JSS MAHA VIDYAPEETHA

JSS College of Arts, Commerce and Science

Ooty Road, Mysuru - 570 025

Department of Master of Computer Applications

OVERALL COURSE GRID OF

Master of Computer Applications

2021-2022

Master of Computer Applications

2 Years / 4 Semesters

1. Introduction:

MCA is Masters of Computer Application is a PG course of two years and has it is a master Course in Computer Application the MCA subjects are related to computer languages computer software and the MCA syllabus is divided into 4 semesters has the MCA subjects consists 5 number but their brief knowledge is given in two years so the MCA syllabus is made in such a way that the students learn MCA subjects in two years in such a pattern that the gain all the knowledge

The MCA course includes classroom teaching, practical assignments, and project work which is a mandate in the MCA course syllabus. MCA course syllabus emphasis the latest programming languages and tools to develop better and faster applications. Some colleges encourage students to spend a full semester working in the industry to explore and understand how IT works.

To train MCA course subjects offered by the universities are Data Structures and files using C, Project Visual C++, Computer Networks and Java programming etc. MCA syllabus varies from university to university and some of them are- Internet & JAVA Programming, Modeling and Simulation, Computer and 'C' Programming, Management Information System, and many others.

The MCA course list also emphasis certain specialization topics like Troubleshooting, System Engineering, Software Development, Hardware Technology, etc.

2. Lecture-Practical/Project-Tutorial (L-P-T)

A course shall have either or all the three components, i.e. a course may have only lecture component, or only practical/project component or a combination of any two/three components

Lecture (L): Classroom sessions delivered by faculty in an interactive mode. It should be conducted as per the scheme of lectures indicated in respective course.

Practical/Project(P): Practical / Project Work consisting of Hands-on experience /Field Studies / Case studies that equip students to acquire the much required skill component. Besides separate Practical/Project course, three course in each semester include few practical assignment and it will be evaluated under internal evaluation

Tutorial (T): Session consisting of participatory discussion/ self-study/ desk work/ brief seminarpresentations by students and such other novel methods that make a student to absorb and assimilatemore effectively the contents delivered in the Lecture sessions

A Mini project is an assignment that the student needs to complete at the end of every semester in order to strengthen the understanding of fundamentals through effective application of thecourses learnt. The details guidelines have been given in the course structure.

The Project Work to be conducted in the FINAL Semester and evaluated at the end of the semester. The detail guidelines have been in the respective course structure.

The teaching / learning as well as evaluation are to be interpreted in a broader perspective asfollows:

i) Teaching – Learning Processes: Classroom sessions, Group Exercises, Seminars, Small Group Projects, Self-study, etc.

ii) Evaluation: Tutorials, Class Tests, Presentations, Field work, Assignments, competency based Activity, etc.

The MCA Programme is a combination of:

a. Four-Credit Courses (100 Marks each): 4 Credits each

b. One-Credit Courses (50 Marks each):

Following are the session details per credit for each of L-P-T model

1) Every ONE-hour session per week of L amounts to 1 credit per Semester,

2) Minimum of TWO hours per week of P amounts to 1 credit per Semester

3) Minimum of ONE hours per week of T amounts to 1 credit per Semester

Semester I					
Course Title	**Course Code**	**Credits**	**Contact hours**	**EXT**	**INT**
Java Programming	IT11	4:0:0	4	70	30
Data Structure and Algorithms	IT12	4:0:0	4	70	30
Computer Organisation and Architecture	IT13	4:0:0	4	70	30
Operating System Concepts	IT14	4:0:0	4	70	30
Computer Networks	IT15	4:0:0	4	70	30
Management Information System	BT11	4:0:0	4	70	30
Mathematical foundations	MT11	4:0:0	4	70	30
Java Programming Lab	IT11L	0:0:1	2	30	20
Data Structure and Algorithms Lab	ITC11	0:0:1	2	30	20
	TOTAL	30	32	550	250

Semester II						
Sl. No.	**Course Title**	**Course Code**	**Credits**	**Contact Hours**	**EXT**	**INT**
1	Python Programming	IT21	4:0:0	4	70	30
2	Software Architecture	IT22	4:0:0	4	70	30
3	Optimization Techniques	MT21	4:0:0	4	70	30
4	Advanced Internet Technologies	IT23	4:0:0	4	70	30
5	Analysis and Design of Algorithms	IT24	4:0:0	4	70	30
6	DBMS	IT 25	4:0:0	4	70	30
7	Elective	ET2X	4:0:0	4	70	30
8	Python Programming Lab	IT21L	0:0:1	2	30	20
9	Advanced Internet Technologies Lab	IT23L	0:0:1	2	30	20
			30	32	550	250

ELECTIVES:

Machine Intelligence Stream		Data Sciences Stream		Applications Stream	
ET21	Artificial Intelligence and Robotics	ET22	NOSQL	ET23	Enterprise Resource Planning

Semester III						
Sl. No.	**Course Title**	**Course Code**	**Credits**	**Contact Hours**	**EXT**	**INT**
1	Mobile Application Development	IT31	4:0:0	4	70	30
2	Data Warehousing and Data Mining	IT32	4:0:0	4	70	30
3	Software Testing and Quality Assurance	IT33	4:0:0	4	70	30
4	.NET Technologies	IT34	4:0:0	4	70	30
5	Cloud Computing	IT35	4:0:0	4	70	30
6	Cryptography and Network Security	IT36	4:0:0	4	70	30
7	Elective	OC32	4:0:0	4	70	30
8	Mobile Application Development Lab	IT31L	0:0:1	2	30	20
9	Data Warehousing and Data Mining Lab	IT32L	0:0:1	2	30	20
			30	32	550	250

ELECTIVES:

Machine Intelligence Stream		Data Sciences Stream		Applications Stream	
ET31	Soft Computing	ET32	Big Data Analytics	ET33	Software Project Management and Practices

Semester IV					
Sl. No.	**Course Title**	**Course Code**	**CP**	**EXT**	**INT**
1	Business Intelligence	BM41	4:0:0	70	30
2	Project	ITC41	0:0:12	150	100
			16	220	130

Semester	**Credit**	**IE**	**UE**
Semester I	30	260	540
Semester II	30	260	540
Semester III	30	260	540
Semester IV	16	130	220
Total	106	910	1840
			2750

IT : Information Technology

BT: Business Technology

MT: Mathematics Technology

Semester I

Course Code: IT-11
Course Name: Java Programming

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30	-	-	70	100

Course Description:

COURSE OUTCOMES:
Upon successful completion of this course, students will be able to: CO1: Demonstrate and implement programs using components and constructs of a Java language CO2: Identify classes, objects, members of a class and use packages and interfaces appropriately. CO3: Demonstrate for Java program for multithread, synchronization and exception handling concepts. CO4: Use the concept of string, event handling, simple data structures like arrays and members of classes of Java API in application development CO5: Design and develop Java based UI and Networking applications using applets, swing components and networking concepts.
TOPICS COVERED:

UNIT 1 – Java Basics 10 Hours

History of Java, Java buzzwords, data types, variables, scope and life time of variables, arrays, operators, expressions, control statements, type conversion and casting, simple java program, concepts of classes, objects, constructors, methods, access control, this keyword, garbage collection, overloading methods and constructors, parameter passing, recursion, nested and inner classes, exploring string class

UNIT 2 – OOP Concepts in Java, Packages and Interfaces 10 Hours

Hierarchical abstractions, Base class object, subclass, subtype, substitutability, forms of inheritance- specialization, specification, construction, extension, limitation, combination, benefits of inheritance, costs of inheritance. Member access rules, super uses, using final with inheritance, polymorphism- method overriding, abstract classes, the Object class.

Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages, differences between classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces. Exploring java.io.

UNIT 3 - Exception Handling and Multi Threading 10 Hours

Concepts of exception handling, benefits of exception handling, Termination or presumptive models, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception sub classes. String handling, Exploring java.util.

Differences between multi threading and multitasking, thread life cycle, creating threads, thread priorities, synchronizing threads; inter thread communication, thread groups, daemon threads. Enumerations, auto boxing, annotations, generics.

UNIT 4 - String and Event Handling 10 Hours

String fundamentals, String Constructors, Three string related language features, The Length() method, Obtaining the characters within the string, String comparison, using index Of() and lastindexOf(), changing the case of the characters within the string, String buffer and String builder.

Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes. The AWT class hierarchy, user interface components- labels, button, canvas, scrollbars, text components, check box, check box groups, choices, lists panels – scroll pane, dialogs, menu bar, graphics, layout manager – layout manager types – border, grid, flow, card and grid bag.

UNIT 5 – Applets, Swings and Networking with Java.Net 12 Hours

Concepts of Applets, differences between applets and applications, life cycle of an applet, types of applets, creating applets, passing parameters to applets.

Swings- Introduction, limitations of AWT, MVC architecture, components, containers, exploring swing- JApplet, JFrame and JComponent, Icons and Labels, text fields, buttons – The JButton class, Check boxes, Radio buttons, Combo boxes, Tabbed Panes, Scroll Panes, Trees, and Tables.

Networking fundamentals, Networking Classes & Interfaces, The InetAddress class, The Socket class, URL class, URL connection class, Http URL connection class, Exploring collection frame work, Collection overview, Collection classes and interfaces, Array class.

TEXT BOOKS / REFERENCES:

1. Herbert Schildt. Java - The Complete Reference, Ninth Edition. Oracle Press, McGraw Hill Education (India) Edition- 2014.

Reference books:

1. Cay S. Horstmann, Gary Cornell. Core Java, Core Java Volume-1 – Fundamentals, 9th edition, Pearson Education, 2014.
2. Timothy Budd, "Understanding Object-oriented programming with Java", Updated Edition, Pearson Education, 2000.

ADDITIONAL LEARNING SOURCES:

1. http://www.oracle.com/technetwork/java/index-jsp-135888.html
2. http://www.javaworld.com/article/2074929/core-java
3. http://www.javaworld.com/
4. http://www.learnjavaonline.org/
5. https://www.codecademy.com/learn/learn-java
6. http://www.tutorialspoint.com/java/
7. http://www.java-examples.com/
8. http://www.homeandlearn.co.uk/java/java.html

Course Code: IT-12
Course Name: Data Structure and Algorithms

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30	-	-	70	100

COURSE OUTCOMES:

Upon successful completion of this course, the student will be able to:

CO1: Design and analyze programming problem statements.
CO2: Choose appropriate data structures and algorithms, understand the ADT/libraries, and use it to design algorithms for a specific problem.
CO3: Apply mathematical abstraction to solve problems.
CO4: Demonstrate various methods of organizing large amounts of data.
CO5: Analyze algorithms and to determine algorithm correctness and time efficiency class.
CO6: demonstrate linear data structures linked list, stack and queue (apply)
CO7: implement tree, graph, hash table and heap data structures (apply)
CO8: apply brute force and backtracking techniques (apply)
CO9: demonstrate greedy and divide-conquer approaches (apply)
CO10: implement dynamic programming technique (apply)

UNIT 1 - Introduction and overview of C Programming 12 Hours

Introduction to C programming, Variables, Data types, Constants, Declarations, Operators, Precedence, Associativity, Order of evaluation. Input and output statements; Control Statements, Arrays – Single dimension, Two dimensional, Multi dimensional Arrays, Strings. Functions, Categories of functions. Examples Pointers, Pointer arithmetic, Call by value, Pointer Expression, Pointer as function arguments, recursion, passing strings to functions, Call by reference, Functions returning pointers, Pointers to functions, Programming Examples. Structures and Unions.

UNIT 2 - Introduction to Data Structures 8 Hours

Information and its meaning: Abstract Data Types, Sequences as Value Definitions, ADT for Varying length character Strings, pointers and review of Pointers, Dynamic Memory Allocation - definition, malloc, calloc, and realloc, free. Data Structures: Array as an ADT, Arrays as Parameters, String as an ADT.

UNIT 3 - The Stack 12 Hours

Definition and examples, Primitive operations, Example, The stack as an ADT, Representing stacks, Implementing the pop, push operations using function overloading, Examples for infix, postfix, and prefix expressions, Basic definition and Examples. Applications of Stacks: Expression Evaluations, Expression conversion, Recursion as application of stack, Properties of recursive definition or algorithm. Binary search, Towers of Hanoi problem.

UNIT 4 - Queues and Linked List 12 Hours

The queue and its sequential representation, the queue as ADT, Basic operations using polymorphism and inheritance, Priority queue, Array implementation of a priority queue. Linked lists, inserting and removing nodes from a list, Linked implementations of stacks, Linked implementation of queues, linked list as a data Structure. Example of list operations.

UNIT 5 - Linked Lists and Trees 8 Hours

Other list structures: Circular lists, Stack as circular lists, doubly linked lists. Application of linked lists: Stacks, Queues, double-ended queues, priority queues. Sorting and Searching: Applications and implementation with function overloading. Tree: Definition and representation, Types of trees, Basic operations on Tree.

TEXT BOOKS/ REFERENCES :

Text Books :

1. Programming in ANSI C, Third Edition, E. Balaguruswamy. 6th Edition (2013).
2. Data Structures Using C and C++ by Aaron.M. Tenenbaum, Yedidyah Langsam and Moshe J. Augustine, PHI, Edition, 2011.

Reference Books :

1. Data structures, Algorithms and Applications in C++, S. Sahani, University Press (India) Pvt Ltd, 2nd Edition.
2. The complete reference C, Herbert Schildt, Fifth Edition, Tata McGraw Hill.

ADDITIONAL LEARNING SOURCES:

1. http://www.tutorialspoint.com/Data-Structures-in-C-Online-Training/classid=13
2. http://nptel.ac.in/datastructures_c
3. www.javatpoint.com
4. www.oracle.com
5. www.geeksforgeeks.org/java

Course Code: IT-13
Course Name: Computer Organisation and Architecture

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30	-	-	70	100

Upon Successful Completion of this Course, Student will know
CO1: Computer Architecture-Hardware, software
CO2: Design of Interfaces
CO3: Addressing Modes

UNIT-1 **12 Hours**

Principles of Computer design - Software, hardware interaction layers in computer architecture. Central processing unit. Machine language instructions, Addressing modes, instruction types, Instruction set selection, Instruction cycle and execution cycle.

UNIT-2 **12 Hours**

Control unit, Data path and control path design, Microprogramming V s hardwired control, RISC Vs CISC, Pipelining in CPU design: Superscalar processors.

UNIT-3 **12 Hours**

Memory system, Storage technologies, Memory array organization, Memory hierarchy, interleaving, cache and virtual memories and architectural aids to implement these.

UNIT-4 **8 Hours**

Input-output devices and characteristics. Input-output processing, bus interface, data transfer techniques, I/O interrupts, channels.

UNIT-5 **8 Hours**

Performance evaluation - SPEC marks, Transaction Processing benchmarks.

TEXT BOOKS/ REFERENCES :

1. Pal Chauduri, P., "Computer Organisation and Design", Prentice Hall of India, New Delhi, 1994.
2. Rajaraman,V., and Radhakrishnan, T., "Introduction to Digital Computer Design" (4thedition). Prentice Hall of India, New Delhi, 1997.
3. Stallings. W, "Computer Organization and Architecture, (2nd edition) Prentice Hall of India, New Delhi

Course Code: IT-14
Course Name: Operating System and Linux

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30	-	-	70	100

COURSE OUTCOMES:

Upon successful completion of this course, the student will be able to:

CO1: Recognize the structure of operating system, interaction of an operating system and application programs.
CO2: Analyze the various programming paradigms viz., multi-process and multi-threaded programming.
CO3: Examine the various resource and memory management techniques.
CO4: Distinguish the different features of real time and mobile operating systems.
CO5: Identify current issues in system security; demonstrate various factors can influence the overall performance of an operating system.

TOPICS COVERED:

UNIT 1- Computer and Operating Systems Structure 11 Hours

Basic Elements, Processor Registers, Instruction Execution, The Memory Hierarchy, Cache Memory, I/O Communication Techniques, Introduction to Operating System, Mainframe Systems, Desktop Systems, Multiprocessor Systems, Distributed Systems, Clustered Systems, Real - Time Systems, Handheld Systems, Feature Migration, Computing Environments.
System Structures: System Components, Operating – System Services, System Calls, System Programs, System Structure, Virtual Machines, System Design and Implementation, System Generation

UNIT 2 - Process Management and Mutual Execution 10 Hours

Process, Process States, Process Description, Process Control, Execution of the Operating System, Security Issues, Processes and Threads, Symmetric Multiprocessing(SMP), Micro kernels, CPU Scheduler and Scheduling. Principles of Concurrency, Mutual Exclusion: Hardware Support, Semaphores, Monitors, Message Passing, Readers/Writes Problem.

UNIT 3 - Deadlock and Memory Management 11 Hours

Principles of Deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, An Integrated Deadlock Strategy, Dining Philosophers Problem Memory Management: Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with Paging, Demand Paging, Process Creation, Page Replacement, Allocation of Frames, Thrashing

UNIT 4 - File System and Secondary Storage 10 Hours

File Concept, Access Methods, Directory Structure, File System Mounting, File Sharing, Protection, File – System Structure, File – System Implementation, Directory Implementation, Allocation Methods, Free–Space Management**,** Disk Structure, Disk Scheduling, Disk Management.

UNIT 5 - Computer Security and Case study of Linux Operating system 10 Hours

The Security Problem, User Authentication, Program Threats, System Threats. Linux System Linux history, Design Principles, Kernel modules, Process, management, scheduling, Memory management, File systems, Input and output, Inter-process communications.

TEXT BOOKS/REFERENCES:

TEXT BOOKS :

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Principles, 8th edition, Wiley India, 2009.
2. William Stallings, “Operating System Internals and Design Principles” Pearson, 6thedition, 2012

REFERENCES:

1. Dhananjay M. Dhamdhere, “Operating Systems – A Concept – Based Approach”, TataMcGraw – Hill, 3rd Edition, 2012.
2. Harvey M Deital: Operating systems, 3rd Edition, Pearson Education, 1990.
3. Chakraborty , “Operating Systems” Jaico Publishing House, 2011

ADDITIONAL RESOURCES:

1. https://www.tutorialspoint.com/operating_system/os_linux
2. https://www.cs.uic.edu/~jbell/CourseNotes/OperatingSystems.

Course Code: IT-15
Course Name: Computer Networks

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30	-	-	70	100

COURSE OUTCOMES:
Upon successful completion of this course, students will be able to: **CO1:** Analyze and distinguish the basic concepts, principles and techniques of data communication along with the layers of OSI and TCP/IP model. CO2: Independently understand and distinguish the concept of links, nodes and data transmission issues in the network. **CO3:** Capability to categorize wired LANs: Ethernet, IPv4 addresses and performance of The network-layer. **CO4:** Design and demonstrate the services of TCP and UDP. **CO5:** Ability to summarize and interpret the basic concepts of Application-Layer paradigms and standard client-server protocols.

TOPICS COVERED:

UNIT 1 - Basics of Data Communications and Physical Layer 10 Hours

Data Communications: Components, Data Representation, Data Flow, Networks; Network Criteria, Physical Structures, Network Types: LAN, WAN, Switching, Network Models: Protocol Layering: Principles of Protocol Layering, Logical Connections, TCP/IP Protocol Suite: Layered Architecture, Layers in the TCP/IP Protocol Suite, Encapsulation and Decapsulation, Addressing, Multiplexing and Demultiplexing, The OSI Model; OSI versus TCP/IP, Lack of OSI Model's Success, Introduction to Physical Layer, Data and Signals, Periodic Analog Signals, Digital Signals, Transmission Impairment, Data Rate Limits, Performance, Switching: Circuit-Switched Networks, Packet Switching, Datagram Networks, Virtual Circuit Networks.

UNIT 2 - Data Link Layer 10 Hours

Introduction to Data-Link Layer, Link-Layer Addressing: Address Resolution Protocol (ARP), Error Detection and Correction: Introduction, Types of Errors, Redundancy, Detection versus Correction, Coding, Block coding: Error Detection, Cyclic Code: Cyclic Redundancy Check,

Polynomials, Cyclic Code Analysis and its Advantages, Checksum, Forward Error Correction: Using Hamming Distance, Using XOR, Chunk Interleaving.

UNIT 3 - LANs and Network Layer 10 Hours

Ethernet Protocol, Standard Ethernet: Characteristics, Addressing, Access Method, Efficiency of Standard Ethernet, Implementation, Changes in the Standard, Fast Ethernet (100 MBPS): Access Method, Physical Layer, 10 Gigabit Ethernet, Introduction to Network Layer, Network- Layer Services: Packetizing, Routing and Forwarding, Packet Switching: Datagram Approach, Virtual-Circuit Approach, Network Layer Performance: delay Throughput, Packet loss, Congestion Control, IPv4 addresses.

UNIT 4 - Transport Layer 10 Hours

Introduction to Transport-Layer: Transport-Layer Services; Transport-Layer Protocols: Port Numbers, User Datagram Protocol: User Datagram, UDP Services, UDP Applications, Transmission Control Protocol: TCP Services, TCP Features, Segment, A TCP Connection, State Transition Diagram, Windows in TCP, Flow Control, Error Control, TCP Congestion Control, TCP Timers.

UNIT 5 - Application Layer and Standard Client-Server Protocols 12 Hours

Introduction to Application Layer, Services, Application-Layer Paradigms, Client-Server Programming: Application Programming Interface, Using Services of the Transport Layer, Iterative Communication using UDP, Iterative Communication using TCP, Concurrent Communication, World Wide Web and HTTP: FTP: Two Connections, Control Connection, Data Connection, Security for FTP, E-Mail: Architecture, Web-Based Mail, TELNET: Local versus Remote Logging, Secure Shell (SSH): Components, Applications, Domain Name System (DNS): Name Space, DNS in the Internet, Resolution, Caching, Resource Records, DNS Messages, Registrars, DDNS, Security of DNS.

TEXT BOOKS / REFERENCES:

Text books:

B. A. Forouzan, Data Communications and Networking, 5th Edition, McGraw Hill Education (India) Private Limited, 2013.

Reference books:

1. William Stallings, Data and Computer Communications, 10th Edition, Pearson, 2013.
2. Larry L. Peterson and Bruce S. David: Computer Networks – A Systems Approach, 5th Edition, Elsevier, 2011.
3. Andrew S. Tanenbaum, Computer Networks, Fourth Edition, PHI, 2008.

4. Fred Halsall, Data Communications, Computer Networks and Open Systems, 4th Edition, Pearson Education, 2005.

1. www.nptel.ac.in/courses
2. http://freevideolectures.com/Course/2276/Computer-Networks

Course Code: BT-11
Course Name: Management Information System

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30			70	100

Course Description:

COURSE OUTCOMES:
Upon successful completion of this course, the student will be able to: CO1: Apply the different strategies for the management of business to formulate business process. CO2: Analyze the need for business process re-engineering, and the process of making. CO3: Analyze and examine business information needs to facilitate evaluation of strategic alternatives. CO4: Apply Management Information Systems knowledge and skills learned to facilitate the acquisition, development, deployment, and management of information systems. CO5: Effectively communicate strategic alternatives to facilitate decision-making.
TOPICS COVERED:

UNIT 1- Systems Engineering, Information and Knowledge 12 Hours

System concepts, system control, types of systems, handling system complexity, Classes of systems, General model of MIS, Need for system analysis, System analysis for existing system & new requirement, system development model, MIS & system analysis. Information concepts, classification of information, methods of data and information collection, value of information, information: A quality product, General model of a human as information processor, Knowledge, Introduction of MIS: MIS: Concept, Definition, Role of the MIS, Impact of MIS, MIS and the user, Management as a control system, MIS support to the management, Management effectiveness and MIS, Organization as system. MIS: organization effectiveness.

UNIT 2- Decision Making and DSS 10 Hours

Decision making concepts; decision making process, decision-making by analytical modeling, and Behavioral concepts in decision making, organizational decision-making, Decision structure, DSS components, and Management reporting alternatives
Technology of Information System : Introduction, Data processing, Transaction processing, Application processing, information system processing, TQM of information systems, Human factors & user interface, Strategic nature of IT decision, MIS choice of information technology.

UNIT 3- Electronic Business systems 10 Hours

Enterprise business system – Introduction, cross-functional enterprise applications, real world case, Functional business system, - Introduction, marketing systems, sales force automation, CIM, HRM, online accounting system, Customer relationship management, ERP, Supply chain management (real world cases for the above)
E-business Technology: Introduction to E-business, model of E-business, internet and World Wide Web, Intranet/Extranet, Electronic, Impact of Web on Strategic management, Web enabled business management, MIS in Web environment.

UNIT 4- Strategic Management of Business & Developing Business/IT Strategies /IT Solutions 10 Hours

Concept of corporate planning, Essentiality of strategic planning, Development of the business strategies, Type of strategies, short-range planning, tools of planning, MIS: strategic business planning. Planning fundamentals (real world cases), Organizational planning, planning for competitive advantage, (SWOT Analysis), Business models and planning. Business/IT planning, identifying business/IT strategies, Implementation Challenges, Change management., Developing business systems, (real world case), SDLC, prototyping, System development process, implementing business system .

UNIT 5: E-Commerce Introduction 10 Hours

Introduction to e-commerce, E-commerce Business Models and Concepts, Ecommerce Infrastructure: The Internet and World Wide Web, Web design, JavaScript Internet Information Server (IIS); Personal Web Server (PWS).
E-Commerce techniques and Issues: Introduction to Active Server Pages (ASP), Building an E-Commerce Web Site, E-Commerce Payment Systems, E-Commerce Marketing Techniques, Building product catalogue, Search product catalogue, Web Spider and search agent, Ethical, Social and Political Issues in E-Commerce.

TEXT BOOKS /REFERENCES:

Text Books :

1. Waman S Jhawadekar: Management Information System, 3rd Edition, Tata McGraw Hill.
2. James A O'Brien and George M Marakas: Management Information System, 7th Edition, Tata McGraw Hill, 2006
3. Turban, Rainer, and Potter, Introduction to E-Commerce, second edition, 2003
4. H. M. Deitel, P. J. Deitel and T. R. Nieto, E-Business and E-Commerce: How to Program, Prentice hall, 2001

Reference Books:

1. Ralph M Stair and George W Reynolds: Principles of Information Systems, 7th Edition, Thomson, 2010.
2. Steven Alter: Information Systems - The Foundation of E-Business, 4th Edition, Pearson Education, 2001
3. Elizabth Chang: E-Commerce Fundamentals and Applications, Wile India Edition.

ADDITIONAL LEARNING RESOURCES:

1. http://mbaexamnotes.com/management-information-system-notes
2. https://www.tutorialspoint.com/management_information_system

Course Code: MT-11
Course Name: Mathematical Foundations

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30			70	100

COURSE OUTCOMES:
Upon successful completion of this course, students will be able to: **CO1:** Implement statistical measures and explore its applications **CO2:** Analysis of computational errors and design of algorithms to solve a set of linear equations. **CO3:** Applying the concepts of vector and linear functions in real time applications. **CO4:** Apply the notion of relations on finite structures, like strings and analyze algorithms using the concept of functions. **CO5:** Explore the properties of Graph theory and its applications in computer science.
TOPICS COVERED:

UNIT 1- Statistics 10 hours

Univariate data – different measures of location, dispersion, relative dispersion, skewness and kurtosis, Moments, Measures based on them – comparison with moment measures, Correlation and Regression Analysis.

UNIT 2 – Number Systems and Vector & Matrix Algebra 10 hours

Errors in Numerical Computations, Types of Errors, Analysis and Estimation of Errors, Vector Algebra: Vector spaces with real field, Basis and dimension of a vector space, Orthogonal vectors, Properties of Matrices and Determinants: Matrix Operations, Elementary Matrices, Inverse Matrix, Diagonal Matrix, Symmetric Matrix, and Determinant Matrix.

UNIT 3 - Linear Algebraic Systems 11 hours

Numerical methods for Linear Systems, Direct Methods for Linear Systems: Cramer's Rule, Gauss Elimination Method, Gauss Jordan Elimination Method, Pivoting Strategies, Gauss- Jordon Method, LU Decomposition Method, Tridiagonal Systems of Linear Equations, Iterative Methods

for Solving Linear Systems, Jacobis Iteration Method, Gauss-Seidel Iterative Method, Convergence Criteria, Eigen Values and Eigen Vectors.

UNIT 4 – Relations and Functions 10 hours

Cartesian products and Relations, Properties of Relations, Functions: Plain and One-to-One, Onto Functions: Stirling Numbers and the Second Kind, Special functions, The Pigeon-hole principle, Function composition and inverse functions.

UNIT 5 - Graph Theory 11 Hours

Definitions and Examples, Subgraphs, Complements, and Graph Isomorphism, Vertex Degree: Euler Trails and Circuits, Planar Graphs, Hamilton Paths and Cycles, Graph Coloring and Chromatic Polynomials.

TEXT BOOKS / REFERENCES:

TEXT BOOKS :

1. Sant Sharan Mishra, “Computer Oriented Numerical and Statistical Methods”, PHI Learning Private Limited, 2013.
2. Rizwan Butt, “Introduction to Numerical Analysis Using Matlab”, Infinity Science Press LLC, 2008
3. Ralph P Grimaldi, B.V.Ramana, “Discrete & Combinatorial Mathematics, An Applied Introduction” 5th Edition, Pearson Education, 2009.

REFERENCES:

1. D.S. Chandrasekharaiah, Discrete Mathematical Structures, 4th Edition, PRISM Pvt. Ltd. 2012.
2. Bondy and U.S.R.Murty: Graph Theory and Applications (Freely downloadable from Bondy's website; Google-Bondy)
3. S. Kumarsean, “Linear Algebra A geometric approach”, Prentice Hall of India Private Limited, 2001
4. Kenneth H Rosen, “Discrete Mathematics & its Applications" 7th edition, McGraw- Hill, 2010.

ADDITIONAL LEARNING SOURCES:

1. http://www.personal.kent.edu/~rmuhamma/GraphTheory/graphTheory.htm
2. http://www.tutorialspoint.com/discrete_mathematics/
3. http://nptel.iitm.ac.in/
4. http://www.maths.lu.se/english/library/e-resources/
5. http://sunzi.lib.hku.hk/ER/detail/hkul/3743848
6. https://www.**math**.ucdavis.edu/~**linear**/**linear**-guest.pd

Course Code: IT11L
Course Name: Java Programming Practicals

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
--	3 Hrs./Week	1		50		50	100

Upon successful completion of this course, students will be able to:

CO1: Demonstrate and implement programs using components and constructs of a Java language
CO2: Identify classes, objects, members of a class and exhibit use packages and interfaces appropriately.
CO3: Demonstrate for Java program for multithread, synchronization and exception handling concepts.
CO4: Use the concept of string, event handling, simple data structures like arrays and members of classes of Java API in application development
CO5: Design and develop Java based UI and Networking applications using applets, swing components and networking concepts.

LIST OF PROGRAMS TO BE COVERED:

1. Display Hello world
2. Check entered number is ODD or EVEN
3. Find factorial of number
4. Find the sum of the digits of a given number
5. Swap two numbers without using a temporary variable
6. Accept a name and display the name with greeting message using Class.
7. Generate a salary for an employee using class, object, constructors, methods and access control. Different parameters to be considered are Emp_No, Emp_Name, Age, Basic, DA, HRA, CA, PT, IT.
8. Generate a sales report for a sales executive using class, object, constructors, methods and access control. Different parameters to be considered are Emp_No, Emp_Name, Sales_Q1, Sales_Q2, Sales_Q3, Sales_Q4.
9. Demonstrate Constructor Overloading and Method Overloading.
10. Implement Inner class and demonstrate its Access protection.
11. Write a program in Java for String handling which performs the following:
    a. Checks the capacity of String Buffer objects.
    b. Reverses the contents of a string given on console and converts the resultant string in upper case.
    c. Reads a string from console and appends it to the resultant string of ii.
12. Demonstrate Inheritance.

13. Simple Program on Java for the implementation of Multiple inheritance using
    a. interfaces to calculate the area of a rectangle and triangle.
14. Write a JAVA program which has
    a. A Class called Account that creates account with 500Rs minimum balance, a deposit() method to deposit amount, a withdraw() method to withdraw amount and also throws Less Balance Exception if an account holder tries to withdraw money which makes the balance become less than 500Rs.
    b. A Class called Less Balance Exception which returns the statement that says withdraw amount (Rs) is not valid.
    c. A Class which creates 2 accounts, both account deposit money and one account tries to withdraw more money which generates a Less Balance Exception take appropriate action for the same.
15. Write a JAVA program using Synchronized Threads, which demonstrates Producer Consumer concept.
16. Write a JAVA program to implement a Queue using user defined Exception Handling (also make use of throw, throws.).
17. Complete the following:
    a. Create a package named shape.
    b. Create some classes in the package representing some common shapes like Square,
    c. Triangle and Circle. Import and compile these classes in other program.
18. Write a JAVA Program
    a. Create an enumeration Day of Week with seven values SUNDAY through SATURDAY. Add a method is Workday( ) to the Day of Week class that returns true if the value on which it is called is MONDAY through FRIDAY. For example, the call Day Of Week SUNDAY is Workday ( ) returns false.
19. Write a JAVA program which has
    a. A Interface class for Stack Operations
    b. A Class that implements the Stack Interface and creates a fixed length Stack.
    c. A Class that implements the Stack Interface and creates a Dynamic length Stack.
    d. A Class that uses both the above Stacks through Interface reference and does the Stack operations that demonstrates the runtime binding.
20. Print a chessboard pattern.
21. Write a JAVA Program which uses File Input Stream / File Output Stream Classes.
22. Demonstrate utilities of Linked List Class.
23. Write a JAVA applet program, which handles keyboard event.
24. Write a JAVA Swing program, to design a form.
25. Create a simple Student Registration application using Swings, JDBC and MySQL.
26. Write a JAVA program which uses Datagram Socket for Client Server Communication.

TEXT BOOKS / REFERENCES:

Text books:

1. Herbert Schildt. Java - The Complete Reference, Ninth Edition. Oracle Press, McGraw Hill Education (India) Edition- 2014.

Reference books:

1. Cay S. Horstmann, Gary Cornell. Core Java, Core Java Volume-1 – Fundamentals, 9th edition, Pearson Education, 2014.
2. Timothy Budd, "Understanding Object-oriented programming with Java", Updated Edition, Pearson Education, 2000.

ADDITIONAL LEARNING SOURCES:

1. http://www.oracle.com/technetwork/java/index-jsp-135888.html
2. http://www.javaworld.com/article/2074929/core-java
3. http://www.javaworld.com/
4. http://www.learnjavaonline.org/
6. https://www.codecademy.com/learn/learn-java
7. http://www.tutorialspoint.com/java/
8. http://www.java-examples.com/
5. http://www.homeandlearn.co.uk/java/java.html

Course Code: IT12L
Course Name: Data Structure and Algorithms Practicals

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
--	3 Hrs./Week	1		50		50	100

COURSE OUTCOMES:

Upon successful completion of this course, the student will be able to:

CO1: Design and analyze programming problem statements.
CO2: Choose appropriate data structures and algorithms, understand the ADT/libraries, and use it to design algorithms for a specific problem.
CO3: Apply mathematical abstraction to solve problems.
CO4: Demonstrate various methods of organizing large amounts of data.
CO5: Analyze algorithms and to determine algorithm correctness and time efficiency class.

LIST OF EXPERIMENTS COVERED:

PROGRAMS ON C.

1. Programs to learn and explore C data types, looping and decision making structures. {mean, median, lcm, gcd, min max}
2. Calculate the salary of an employee given his basic pay, HRA = 10% of basic pay, TA=5% of his basic pay and deductions IT = 2.5% of his basic pay.
3. Solve quadratic equations to find the roots of the equation.
4. Programs to implement arrays and structures.{Ex: Students marks calculation, matrix operations}
5. Calculate the average marks of the student test marks and display the result using structure.
6. Programs to implement dynamic memory allocation: malloc, calloc, realloc and free.

STACK

7. Write a C program to evaluate the validity of an expression
8. Write a C program to evaluate a postfix expression.
9. Write a C program to convert an expression from infix to postfix.
10. Write a C program to implement multiple stack of integers.

QUEUES

11. Write a C program to perform basic operations on queue of integers, the program should provide the appropriate message to handle all concerned conditions
12. Write a C program to perform basic operations on list of students information stored in circular queue.

Let student information include regno, course title, year of study

13. Write a C program to implement dual queue.

LINKED LIST

14. Write a C program to implement stack operations using linked list.
15. Write a C program to implement queue operations using linked list.
16. Write a C program to create the students mark list based on the rank. Let the student record contain student-id, name, total marks.

17. Write a C program to perform operations.

a. Creation of list.
b. Insertion of new element [At Front, from rear, based on the position]
c. Deletion of a node [At Front, from rear, based on the position]
d. Display the list.
e. Replace the content of one element by another element.
f. Swap two nodes

18. Write a C program to perform the following operations on doubly linked list.

a. Creation of list by :

Insertion [At beginning, At end, In between] Deletion [At beginning, At end, In between]

b. Display all the nodes.
c. Swap two nodes based on specific criteria.

TREES

19. Write a C program to perform / implement the binary tree using array and hence perform the following

a. To print the left and right child of specified node
b. To print all the ancestors of a specified node
c. To print all the node in a specific level
d. To print only the leaf node

20. Write a C program to perform / implement the binary tree using linked list and hence perform the following

a. To print the left and right child of specified node
b. To print all the ancestors of a specified node
c. To print all the node in a specific level
d. To print only the leaf node

21. Write a C program with recursive routines to traverse the binary tree in all possible orders

a. Create a tree
b. Pre-Order traversal
c. In-Order traversal
d. Post-Order traversal

22. Write a C program to construct a heap of n integers and hence sort them using heap sort Algorithm

23. Implement the search techniques
   a. Linear Search
   b. Binary Search

Text Books :

1. Programming in ANSI C, Third Edition, E. Balaguruswamy. 6th Edition (2013).
2. Data Structures Using C and C++ by Aaron.M. Tenenbaum, Yedidyah Langsam and Moshe J. Augustine , PHI, Edition, 2011.

Reference Books :

1. Data structures, Algorithms and Applications in C++, S. Sahani, University Press (India) Pvt Ltd, 2nd Edition.
2. The complete reference C, Herbert Schildt, Fifth Edition, Tata McGraw Hill.

1. http://www.tutorialspoint.com/Data-Structures-in-C -Online-Training/classid=13
2.http://nptel.ac.in/datastructures_c

Semester II

Course Code: IT-21
Course Name: Python Programming

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30			70	100

COURSE OUTCOMES:
Upon successful completion of this course, students will be able to: CO1: Design and apply a solution clearly, accurately in a program using python. CO2: Comprehend and Apply knowledge in real time situational problems and think creatively about solutions. CO3: Apply the best features of mathematics, engineering and natural sciences to program using python. CO4: Apply object-oriented programming concepts to develop dynamic interactive Python applications. CO5: Demonstrate how to build and package python modules for reusability.
TOPICS COVERED:

UNIT 1 - Introduction to Python 10 Hours

Python Basics: Data Types, Operators, Input/Output Statements, Creating Python Programs, Python Flow Control statements: Decision making statements, Indentation, Conditionals, loops, break, continue, and pass statements. Strings, lists, Tuples, Dictionaries

UNIT 2 - Python Functions 10 Hours

Defining functions, DOC strings, Function parameters: default, keyword required and variable length arguments, key-word only parameters, local and global variables, pass by reference versus value, Anonymous functions, Recursion. Functional Programming:
Mapping, Filtering and Reduction, Lambda Functions, List Comprehensions.

UNIT 3 - Object Oriented Programming 10 Hours

Definition and defining a class, Constructor, Destructor, self and del keywords, Access to Attributes and Methods, geattr and hasattr attributes, Data Attributes and Class Attributes, Data Hiding, Inheritance, Static Members. Regular Expressions: Defining Regular Expressions and String Processing.

UNIT 4 - File Handling and Python GUI Programming 10 Hours

File object attributes, Read and Write into the file, Rename and Delete a File, Exceptions Handling: Built-in Exceptions and User defined Exceptions GUI Programming, Introduction to Python GUI Programming, Tkinter Programming, Tkinter widgets, Events and Bindings

UNIT 5 - Working with Django 12 Hours

Rendering Templates into HTML and Other Formats, Understanding Models, Views, and Templates, Separating the Layers (MVC) - Models, Views, Templates, Overall Django Architecture, Defining and Using Models, Using Models, Templates and Form Processing, Setting up the Database, Using a Database Server, Using SQLite, Creating the Tables

TEXT BOOKS / REFERENCES:

Text books:

1. Timothy A. Budd: Exploring Python, Tata McGraw-Hill, 2011.

2. Jeff Forcier, Paul Bissex, Wesley Chun: Python Web Development with Django, Addison-Wesley, 2008.

Reference books:

1. Ascher, Lutz: Learning Python, 4th Edition, O'Reilly, 2009.
2. Wesley J Chun: Core Python Applications Programming, Pearson Education, 3rd Edition, 2013.
3. Paul Gries, Jennifer Campbell, Jason Montojo , Practical Programming: An introduction to Computer Science Using Python, second edition, Pragmatic Bookshelf.
4. Allen Downey , Jeffrey Elkner , Learning with Python: How to Think Like a Computer Scientist Paperback –, 2015

ADDITIONAL LEARNING SOURCES:

http://www.network-theory.co.uk/docs/pytut/ http://docs.python.org/tutorial/
http://zetcode.com/tutorials/pythontutorial/ http://www.sthurlow.com/python/
http://www.tutorialspoint.com/python/ http://www.djangoproject.com/
http://www.djangobook.com/

Course Code: IT-22
Course Name: Software Architecture

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30			70	100

COURSE OUTCOMES:

Upon successful completion of this course, the student will be able to:
CO1: Comprehend the need and importance of software architectures.
CO2: Differentiate various architectural styles based on requirement.
CO3: Implement system qualities during architecture development for the application.
CO4: Apply pattern oriented architecture by understanding patterns and their descriptions.
CO5: Design and document the software architecture.

TOPICS COVERED:

UNIT 1 - Introduction, Architectural Styles 12 Hours

The Architecture Business Cycle: Where do architectures come from? Software processes and the architecture business cycle; What makes a "good" architecture? What software architecture is and what it is not; Other points of view; Architectural patterns, reference models and reference architectures; Importance of software architecture; Architectural structures and views.
Architectural styles; Pipes and filters; Data abstraction and object-oriented organization; Event-based, implicit invocation; Layered systems; Repositories; Interpreters; Process control; Other familiar architectures; Heterogeneous architectures.

UNIT 2 - Understanding and Achieving Quality Attributes 10 Hours

Functionality and architecture; Architecture and quality attributes; System quality attributes; Quality attribute scenarios in practice; Other system quality attributes; Business qualities; Architecture qualities.
Achieving Quality: Introducing tactics; Availability tactics; Modifiability tactics; Performance tactics; Security tactics; Testability tactics; Usability tactics; Relationship of tactics to architectural patterns; Architectural patterns and styles.

UNIT 3 - Architectural Patterns – From Mud to Structures, Distributed Systems 12 Hours
Introduction: From mud to structure: Layers, Pipes and Filters, Blackboard. Distributed Systems: Broker; Interactive Systems: MVC, Presentation-Abstraction-Control.

UNIT 4 - Adaptable Systems & Other systems 08 Hours

Adaptable Systems: Microkernel; Reflection. Structural decomposition: Whole – Part; Organization of work: Master – Slave; Access Control: Proxy.

UNIT 5 - Designing and Documenting Software Architecture 10 Hours

Architecture in the life cycle; Designing the architecture; Forming the team structure; Creating a skeletal system. Uses of architectural documentation; Views; Choosing the relevant views; Documenting a view; Documentation across views.

TEXT BOOKS / REFERENCES:

1. Len Bass, Paul Clements, Rick Kazman: Software Architecture in Practice, 3d Edition, Pearson Education, 2013.
2. Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal: Pattern-Oriented Software Architecture, A System of Patterns, Volume 1, John Wiley and Sons, 2012.
3. Mary Shaw and David Garlan: Software Architecture -Perspectives on an Emerging Discipline, Prentice Hall of India, 2010.

Reference books:

1. Richard N. Taylor, Nenad Medvidovic and Eric M. Dashofy: Software Architecture: Foundations, Theory, and Practice, Wiley- India 2012.

ADDITIONAL LEARNING SOURCES:

1. http://www.sei.cmu.edu/architecture/
2. http://handbookofsoftwarearchitecture.com/
3. https://leanpub.com/software-architecture-for-developers/read
4. http://www.hillside.net/patterns/

Course Code: MT-21
Course Name: Optimization Techniques

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30			70	100

Prerequisite: Basic mathematical knowledge is essentials.

Course Objectives:

1. To understand the role and principles of optimization techniques in business world.
2. To understand the process of problem statement formulation of the business scenario.
3. To understand the implementation of various decision-making techniques in the process of decision making.
4. To gain the techniques and skills on how to use optimization techniques to support the decision making in business world.

Course Outcomes:
Student will be able to
CO1: Understand the role and principles of optimization techniques in business world (Understand)
CO2: Demonstrate specific optimization technique for effective decision making (Apply)
CO3: Apply the optimization techniques in business environments (Apply)
CO4: Illustrate and infer for the business scenario (Analyze)
CO5: Analyze the optimization techniques in strategic planning for optimal gain. (Analyze)

UNIT 1 Linear Programming 10 Hours

Various definitions, statements of basic theorems and properties, Advantages and Limitations application areas of Linear programming ,Linear Programming – Concept
Formulation of Linear programming, Solution of LPP using Graphical method
Simplex Method and Problems, Two Phase Simplex Method and problems

UNIT 2 Markov Chains & Simulation Techniques: 12 Hours

Markov chains: Applications related to technical functional areas,
Steady state Probabilities and its implications, Decision making based on the inferences Monte Carlo Simulation. Application of Markov chain in Queuing theory, Simulation techniques used in Machine learning and bioinformatics.

UNIT 3 Sequential model and related Problems 10 Hours

Processing n jobs through 2 machines ,Processing n jobs through 3 machines Processing n jobs through m machine. PERT and CPM: Basic differences between PERT and CPM. Network diagram:Time estimates (Forward Pass Computation, Backward Pass Computation ,Critical Path,Probability of meeting scheduled date of completion, Calculation on CPM network. Various floats for activities, Event Slack: calculation on PERT network. Application of schedule based on cost analysis and crashing Case study-based problems

UNIT 4 Game Theory 12 Hours

Introduction,n X m zero sum game with dominance ,Solution using Algebraic, Arithmetic and Matrix strategy

Decision Analysis

Introduction to Decision Analysis, Types of Decision-making environment Decision making under uncertainty and under risk, Concept of Decision Tree.

Text Books:

1. Operations Research by Pannerselvam
2. Operations Research Theory and Application by J. K. Sharma –Mac-Millan Publication
3. Statistical and Quantitative Methods – Mr. Ranjit Chitale

Reference Books:

1. Statistical Methods – S.P.Gupta, Sultan Chand, New Delhi
2. Operation Research by V. k. Kapoor
3. Operations Research by Kanti Swaroop, P. K. Gupta and Man Mohan
4. Introduction to Operations Research by Hiller & Lieberman, Tata Mc Graw Hill
5. Operations Research by H. A. Taha
6. Operation Research by Hira & Gupta
7. What is Game Theory?, David K. Levine, Economics, UCLA

Practicals to be conducted on the following topics. It is expected that, Applications to be covered using Python and /or R

1. Linear Programming
2. Markov Chain and Simulation Techniques
3. Sequential models and related problems
4. CPM and PERT
5. Game Theory
6. Decision Analysis

Course Code: IT-23
Course Name: Advanced Internet Technologies

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30	-	-	70	100

Course Description:

Course Outcomes:

Student will be able to
CO1: Outline the basic concepts of Advance Internet Technologies (Understand)
CO2: Design appropriate user interfaces and implements webpage based on given problem Statement (Apply)
CO3: Implement concepts and methods of NodeJS (Apply)
CO4: Implement concepts and methods of Angular (Apply)
CO5: Build Dynamic web pages using server-side PHP programming with Database Connectivity (Apply)

Course Structure:

UNIT 1 Introduction to HTML5
Basics of HTML5 – Introduction, features, form new elements, attributes and semantics in HTML5, <canvas>, <video>, <audio>.
Introduction to Scalable Vector Graphics (SVG), Introduction to Version compatibility Installation of Apache Tomcat (Xampp/Lampp/MySQL)

UNIT 2 Introduction to CSS3
Architecture of CSS, CSS Modules, CSS Framework, Selectors and Pseudo Classes, Fonts and Text Effects, Colors, Background Images, and Masks, Transitions, Transforms and Animations Embedding Media, Gradients, Bootstrap

UNIT 3 Node JS
introduction and how it works, installation of node js, REPL, NPM, How modules work, Webserver Creation, Events
Extra Reading: Node.js with MySQL

UNIT 4 Angular (Latest Stable Version)

Introduction (Features and Advantage), Type Script , Modules, Components, Directives, Expression, Filters, Dependency Injection, Services, Routing, SPA (Single Page Application)

UNIT 5 PHP

Installing and Configuring PHP

Introduction, PHP and the Web Server Architecture, PHP Capabilities, PHP and HTTP, Environment Variables, Variables, Constants, Data Types, Operators

Working with Arrays, Decision Making, Flow Control and Loops, Introduction to Laravel, Creating a Dynamic HTML Form with PHP, Database Connectivity with MySQL, Performing basic database operations (CRUD), Using GET, POST, REQUEST, SESSION, and COOKIE Variables

Extra Reading: Sending Emails, PHP with AJAX and XML, Payment Gateway Integration

Text Books:

1. Complete reference HTML, TMH
2. HTML5 & CSS3, Castro Elizabeth 7th Edition
3. Beginning Node.js by Basarat Ali Syed
4. Angular: Up and Running- Learning Angular, Step by Step by Shyam Seshadri
5. Beginning PHP, Apache, MySQL web development Reference Books
6. Introducing HTML5 - Bruce Lawson, Remy Sharp
7. Node.js in Action, 2ed by Alex Young, Bradley Meck
8. Mastering Node.js by Pasquali Sandro
9. Angular Essentials by Kumar Dhananjay Complete Ref. PHP

Course Code: IT-24
Course Name: Advanced DBMS

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30		-	70	100

Course Description:

1. Introduction DBMS – Concepts & Architectures

Database and Need for DBMS, Characteristics of DBMS
Database 3-tier schema (ANSI/SPARC) and system architecture of DBMS
Views of data- Schemas and instances, Data Independence
Centralized, Client-Server system, Transaction servers, Data servers, Cloud based servers
Indexing and Hashing - Basic concepts of indexing, ordered index, B+ tree index, B+ tree extensions, Multiple key access, Hashing concepts, types of hashing, Bitmap indices.

2. Data Modelling and Relational Database Design

Data Modelling using ER Diagram: Representation of Entities, Attributes, Relationships and their Type, Cardinality, Generalization, Specialization, Aggregation.
Relational data model: Structure of Relational Database Model, Types of keys, Referential Integrity Constraints, Codd's rules, Database Design using E-R, E-R to Relational
Normalization – Normal forms based on primary (1 NF, 2 NF, 3NF, BCNF)
Note: Case studies based on E-R diagram & Normalization

Extra Reading: Database languages - Relational Algebra, Relational database languages, Data definition in SQL, Views and Queries in SQL, Joins, specifying constraints and Indexes in SQL, Specifying constraints management systems Postgres/ SQL/MySQL.

3. Transaction and Concurrency control

Concept of transaction, ACID properties, States of transaction
Concurrency control, Problems in concurrency controls
Scheduling of transactions, Serializability and testing of serilaizibity
Lock-based Protocol and Time stamp-based ordering protocols, Deadlock Handling

4. Parallel Databases

Introduction to Parallel Databases, Parallel Database Architectures
I/O parallelism, Inter-query and Intra-query parallelism
Inter-operational and Intra-operational parallelism
Key elements of parallel database processing: Speed-up, Scale-up Synchronization and Locking

5. Distributed Databases

Introduction to Distributed Database System, Homogeneous and Heterogeneous Databases, Distributed data storage (Fragmentation and Replication), Distributed transactions, Concurrency control schemes in DDBMS
Commit protocols 2 phase and 3 Phase Commit Protocol

6. Object Oriented Databases & Applications

Overview of Object- Oriented Database concepts & characteristics
Database design for OODBMS – Objects, OIDs and reference type
Spatial data and Spatial indexing (Any two techniques)
Mobile Database: Need, Structure, Features, Limitations and Applications
Temporal databases, temporal aspects valid time, transaction time or decision time
Multimedia Database: Architecture, Type and Characteristics.

7. Crash Recovery and Backup, Failure classifications, Recovery & Atomicity, Log based recovery, Checkpoint and Shadow Paging in Data recovery, Database backup and types of backups

8. Security and Privacy

Database security issues,Discretionary access control based on grant & revoking privilege,Mandatory access control and role-based access control for multilevel security, Encryption & public key infrastructures

9. NO-SQL Database
Introduction, Types of NOSQL, Need of NoSQL databases, Use Cases

Recommended Books:

1. Introduction to database systems C.J. Date, Pearson.
2. Fundamentals of Database Systems by Elmasri Navathe
3. Principles of Database Management James Martin, PHI
4. Database System Concepts by Abraham Silberschatz, H. Korth, Sudarshan

Reference Books:

Database Management System by Raghu Ramakrishnan / Johannes Gherke
Database Management System (DBMS)A Practical Approach. By Rajiv Chopra
Database system practical approach to design, implementation & management by Connoly & Begg,
NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence Martin Fowler

List of Practicals (if any)
To install and configure database software (ORACLE/MYSQL)
To design a database (logical & physical database)
To Perform all SQL operations and queries on designed physical database
To install and configure NO-SQL database and practice for core operations
To perform experiments on database crash and recovery
To perform experiments on database Backup – restoring operations on database server
To perform some operations on Object oriented databases

Course Code: IT-25
Course Name: Analysis and Design of Algorithms

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30		-	70	100

COURSE OUTCOMES:
Upon successful completion of this course, students will be able to: **CO 1:** Apply object oriented techniques to solve bigger computing problems **CO 2:** Explore the knowledge of computational complexity, approximation and randomized algorithms **CO 3:** Analyze the range of the algorithm and the notion of tractable and intractable problems **CO 4:** Design and analyze a wide range of searching and sorting algorithms **CO 5:** Implementation of graph and matching algorithms
TOPICS COVERED:

UNIT 1 - Introduction and overview of C++ Programming 12 Hours

C++ Class Overview- Class Definition, OOPs concepts ,Objects, Class Members, Access Control, Class Scope, Inheritance and Polymorphism ,Constructors and destructors, parameter passing methods, Inline functions, static class members, this pointer, friend functions, dynamic memory allocation and deallocation (new and delete), Exception handling.

UNIT 2 - Introduction and the fundamentals of the Analysis of Algorithm Efficiency 12 Hours

Notion of Algorithm, Fundamentals of Algorithmic Problem Solving, Important Problem Types, Fundamental data Structures. Analysis Framework, Asymptotic Notations and Basic efficiency classes, Mathematical analysis of Recursive and Non-recursive algorithms, Examples

UNIT 3 - Brute Force and Divide and Conquer 10 Hours

Selection Sort and Bubble Sort, Sequential Search and String Matching, Exhaustive Search, Merge- sort, Quick-sort, Binary Search, Binary tree Traversals and related properties.

UNIT 4 - Decrease-and-Conquer, Transform-and-Conquer 10 Hours

Insertion Sort, Depth First search and Breadth First Search, Topological sorting, Algorithms for Generating Combinatorial Objects. Presorting, Balanced Search Trees, Heaps and Heap sort, Problem Reduction.

UNIT 5 - Space and Time Tradeoffs and Dynamic Programming 10 Hours

Sorting by Counting, Input Enhancement in String Matching, Computing a binomial coefficient, Warshall's and Floyd's Algorithms, The Knapsack Problem and Memory Functions.

Text Book:

1. Anany Levitin: Introduction to the Design and Analysis of Algorithms, Pearson Education, 2003.
2. Herbert Scheldt: The Complete Reference C++, 6th Edition, Tata McGraw Hill 2013.

References:

1. Coremen T.H., Leiserson C.E., and Rivest R.L.: Introduction to Algorithms, PHI, 1998.
2. Horowitz E., Sahani S., Rajasekharan S.: Computer Algorithms, Galgotia Publications, 2001.

ADDITIONAL LEARNING SOURCES:

1. https://www.tutorialspoint.com/data_structures_algorithms/
2. http://nptel.ac.in/courses/106101060/

Course Code: IT-21L
Course Name: Practicals

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
-	10 Hrs./Week	5	-	75	-	50	125

Course Description:

This Practical course contains 2 sections. –
1. List of Practicals – Python Programming
2. List of Practicals – Advanced Internet Technologies

Course Outcomes:
Student will be able to
CO1: implement python programming concepts for solving real life problems. (Apply)
CO2: Implement Advanced Internet Technologies (Apply)

Course Structure:
List of Practicals – Python Programming
Note:

- Recommended IDE for python – IDLE
- Exception handling concepts should be used with file handling programs.

1. Python installation and configuration with windows and Linux
2. Programs for understanding the data types, control flow statements, blocks and loops
3. Programs for understanding functions, use of built in functions, user defined functions
4. Programs to use existing modules, packages and creating modules, packages
5. Programs for implementations of all object-oriented concepts like class, method, inheritance, polymorphism etc. (Real life examples must be covered for the implementation of object- oriented concepts)
6. Programs for parsing of data, validations like Password, email, URL, etc.
7. Programs for Pattern finding should be covered.
8. Programs covering all the aspects of Exception handling, user defined exception, Multithreading should be covered.
9. Programs demonstrating the IO operations like reading from file, writing into file from different file types like data file, binary file, etc.
10. Programs to perform searching, adding, updating the content from the file.
11. Program for performing CRUD operation with MongoDB and Python

12. Basic programs with NumPy as Array, Searching and Sorting, date & time and String handling
13. Programs for series and data frames should be covered.
14. Programs to demonstrate data pre-processing and data handling with data frame
15. Program for data visualization should be covered.

List of Practicals – Advanced Internet Technologies

1. Program to implement Audio and Video features for your web page.
2. Program to design form using HTML5 elements, attributes and Semantics.
3. Programs using Canvas and SVG.
4. Programs to demonstrate external and internal styles in the web page using font, text, background, borders, opacity and other CSS 3 properties.
5. Implement Transformation using Translation, Rotation and Scaling in your web page.
6. Program to show current date and time using user defined module
7. Program using built-in modules to split the query string into readable parts.
8. Program using NPM which will convert entered string into either case
9. Write a program to create a calculator using Node JS. (Install and configure Node JS and Server)
10. Write Program for Form validation in Angular.
11. Program to demonstrate the ngif, ngfor, ngswitch statements.
12. Create angular project which will demonstrate the usage of component directive, structural directive and attribute directives
13. Create angular project which has HTML template and handle the click event on click of the button (Installation of Angular and Bootstrap 4 CSS Framework)
14. Program for basic operations, array and user interface handling.
15. Program to demonstrate session management using various techniques.
16. Program to perform the CRUD Operations using PHP Script.

Course Code: ET-21
Course Name: Artificial Intelligence and Robotics

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30		-	70	100

Upon successful completion of this course, students will be able to:

CO1: Find appropriate idealizations for converting real world problems into AI problems formulated using the appropriate search algorithm.
CO2: Formulate and implement the appropriate search algorithms to find the solutions for real time and heuristics problems.
CO3: Represent and debug knowledge in an appropriate first order logic representation with the understanding of the fundamentals of knowledge representation.
CO4: Choose and Implement the appropriate algorithms for a real world supervised learning problem.
CO5: Inculcate the basic knowledge of Robotics along with the Artificial Intelligence

TOPICS COVERED:

UNIT: 1 – Introduction to AI, Informed Search and Exploration 10 Hours

Intelligent Agents: Agents and environment; Rationality; the nature of environment; the structure of agents. Problem-solving: Problem solving agents; Example problems; Searching for solution; uninformed search strategies.
Informed search strategies; Heuristic functions; On-line search agents and unknown environment.

UNIT: 2 - Constraint Satisfaction, Adversial Search, Logical Agent 10 Hours

Constraint satisfaction problems; Backtracking search for CSPs. Adversial search: Games; Optimal decisions in games; Alpha-Beta pruning.Knowledge-based agents; The wumpus world as an example world; Logic; propositional logic Reasoning patterns in propositional logic; Effective propositional inference; Agents based on propositional logic.

UNIT: 3 - First-Order Logic, Inference in First-Order Logic: 12 Hours

Representation revisited; Syntax and semantics of first-order logic; Using first-order logic; Knowledge engineering in first-order logic. Propositional versus first-order inference; Unification and lifting; Forward chaining; Backward chaining; Resolution.

UNIT: 4 - Knowledge Representation and Learning, AI: Present and Future 10 Hours

Ontological engineering; Categories and objects; Actions, situations, and events; Mental events and mental objects; The Internet shopping world; Reasoning systems for categories; Reasoning with default information; Truth maintenance systems.
Learning: Forms of Learning; Inductive learning; Learning decision trees; Ensemble learning; Computational learning theory. AI: Present and Future: Agent components; Agent architectures; Are we going in the right direction? What if AI does succeed? Game theory.

UNIT: 5 – Introduction to Robotics : 10 Hours

Introduction; Robot Hardware: sensors and Effectors; Robotic Perception: localization, mapping, other types of perception; Planning to Move: configuration space, cell decomposition methods and skeletonization methods; Planning uncertain movements: robust methods; Moving: dynamics and control, potential field control and reactive control; Robotic Software: architectures, subsumption architecture , three-layer architecture and robotic programming languages ; Application domains.

TUTORIALS:

1. Program to design tic-tac-toe game.
2. Program for breadth first and depth first search.
3. Program to N-Queeens Problem.
4. To implement max-min problem.
5. To implement simulated Annealing Algorithm.
6. Write a program to implement A* program.
7. To implement Hill-Climbing Algorithm.

Text Book / References:
Text Book:
1. Stuart Russel, Petr Norvig: Artificial Intelligence A Modern Approach, 2nd Edition, Pearson Education, 2003.

References:
1. Elaine Rich, Kevin Knight: Artificial Intelligence, 2nd Edition, Tata McGraw Hill, 1991.
2. Nils J. Nilsson: Principles of Artificial Intelligence, Elsevier, 1980.

Course Code: ET-22
Course Name: NOSQL

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30		-	70	100

Upon successful completion of this course, students will be able to :

CO1: Demonstrate competency in describing how NoSQL databases differ from relational databases from a theoretical perspective.
CO2: Demonstrate competency in designing NoSQL database management systems
CO3: Use of a number of NoSQL databases to store and retrieve data and perform aggregation functions
CO4: Demonstrate competency in selecting a particular NoSQL database for different applications.
CO5: Execute various CRUD operations with MongoDB.

TOPICS COVERED:

UNIT 1 – An Overview and Characteristics of NoSQL 10 Hours
Introduction to NoSQL : An Overview of NoSQL , Defining NoSQL, History, What NoSQL is and what it is not, Why NoSQL?, List of NoSQL Databases. Characteristics of NoSQL: Application, RDBMS approach, Challenges, NoSQL approach.

UNIT 2 – NoSQL Storage Types 12 Hours
Modifying and managing NOSQL, Data stores, Indexing and ordering datasets (MongoDB/ CouchDB / Cassandra) NoSQL Storage Types : Storage types, Column-oriented databases, Document store, key-value store, graph store, multi-storage type databases, comparing the models.

UNIT 3 – Advantages and Drawbacks 10 Hours
Advantages and Drawbacks : Transactional application, Computational application, Web-scale application. Performing CURD operations : Creating records, accessing data, updating and deleting data.

UNIT 4 - Querying SQL 10 Hours

Querying NoSQL stores : similarities between NoSQL and MongoDB query features. Managing data stores and managing evolutions.

UNIT 5 – Indexing and Ordering 10 Hours

Indexing and ordering data sets: Essential concepts behind database index, indexing and ordering in MongoDB, indexing and ordering in CouchDB, Comparative Study of NoSQL Products Comparison: Technical comparison, Implementation language, Engine types, Speed, Features, Limits, Bulk operations, Bulk read, Bulk insert, Bulk update, Bulk delete, Query options.

TUTORIAL
Case Study

1. Application definition, Requirement analysis, Implementation using MongoDB, Features and constraints.
2. Database design, Database queries, Database modeling, Schema definition, Writing queries.
3. Queries for a single entity, simple result, Queries for a single entity, Aggregate, Queries for a one to one relationship.
4. Queries for a one to many relationship, Queries for a many to many relationship, Miscellaneous queries.
5. Pagination, Limiting items in an array in result set.
6. Plug-in and dynamic data support, Model refinements.
7. Reference using non-ID property, Demoralizations and document embedding.
8. Complete document embedding and Partial document embedding.
9. Bucketing, Cache document approach, Miscellaneous changes.

TEXT BOOKS / REFERENCES:

TEXT BOOKS :

1. Shanshank Tiwari “Professional NOSQL”, WROX Press, 2011
Pramod.J.Sadalage and Martin Fowler, “NoSQL Distilled : A Brief guide to the emerging world of polygot persistence”, Pearson Education corporation, I Edition, 2014.

Reference Books :

1. 1. The definitive guide to MONGODB, The NOSQL Database for cloud and desktop computing, Apress 2010.

ADDITIONAL LEARNING SOURCES:

1. https://www.mongodb.com/nosql-explained
2. http://www.dbta.com/Editorial/Trends-and-Applications/NoSQL-for-the-Enterprise-80198.aspx
3. http://www.oracle.com/technetwork/database/databasetechnologies/nosqldb/overview/in dex.html

Course Code: ET-23
Course Name: Enterprise Resource Planning

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30		-	70	100

COURSE OUTCOMES:
Upon successful completion of this course, students will be able to, CO1: Comprehend the basics and concepts of ERP CO2: Apply different ERP related technologies CO3: Implement ERP system by utilizing various concepts of ERP CO4: Analyze different business models of ERP CO5: Analyze the present and future trends of ERP.
TOPICS COVERED:

UNIT 1 - Introduction 10 Hours

Enterprise—An Overview, Business Processes, Introduction to ERP, Basics ERP Concepts, Justifying ERP Investments, Risks of ERP, Benefits of ERP.

UNIT 2 - ERP and Technology 10 Hours

ERP and Related Technologies, Business Intelligence (BI) and Business Analytics (BA), E-Commerce and E-Business, Business Process Reengineering (BPR), Data Warehousing and Data Mining, On-line Analytical Processing (OLAP).

UNIT 3 - ERP and Technology 10 Hours

Product Life Cycle Management (PLM), Supply Chain Management (SCM), Customer Relationship Management (CRM), Geographic Information System (GIS), Advanced Technology and ERP Security.

UNIT 4 - ERP Implementation 10 Hours

To be or not to be…, Implementation Challenges, ERP Implementation (Transition) Strategies, ERP Implementation Life Cycle, Pre Implementation Tasks: Getting Ready, Requirements Definition, Implementation Methodologies, ERP Development Methods, Process Definition, Contracts with Vendors, Consultants and Employees, Training and

Education, Data Migration, Project Management and Monitoring, Post-Implementation Activities, Success and Failure Factors of an ERP Implementation

UNIT 5 - The Business Modules 12 Hours

Business Modules of an ERP Packages, Financials, Manufacturing (Production), Human Resource Management, Plant Maintenance, Materials Management, Quality Management, Marketing, Sales, Distribution and Services.
TEXT BOOKS / REFERENCES:

Text books:
1. Alexis Leon, “ERP Demystified”, Tata McGraw Hill, 14 Aug 2014.

Reference books:
1. Joseph A. Brady, Ellen F. Monk, Bret J. Wangner, “Concepts in Enterprise Resource Planning”, Thomson Learning, 2001.
2. Vinod Kumar Garg and N.K .Venkata Krishnan, “Enterprise Resource Planning – concepts and Planning”, Prentice Hall, 1998.
3. Jose Antonio Fernandz, “The SAP R /3 Hand book”, Tata McGraw Hill, 2006.

TUTORIALS:
Developing Following Applications. Using any Database Systems.
1. Financial System.
2. Manufacturing System.
3. Human Resource Planning.
4. Plant Maintenance.
5. Materials Management System.
6. Quality Management System.
7. Marketing, Sales, & Distributing System etc..

ADDITIONAL LEARNING SOURCES:
1. http://www.netsuite.com/portal/resource/articles/erp/what-is-erp.shtml
2. https://www.managementstudyguide.com/enterprise-resource-planning-1-articles.htm

Semester III

Course Code: IT-31
Course Name: Mobile Applications

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30		-	70	100

Upon successful completion of this course, students will be to:
CO1: Gain broad understanding of the discipline of Mobile Application Development using J2ME Technology.
CO2: Develop User Interface for a J2ME application
CO3: Manage data on both service-side components and client-side applications and Address Portability and Compatibility issues between PDA'S and Cell phones.
CO4: Implement the design using Android SDK.
CO5: Implement the design using Objective C and Ios

TOPICS COVERED:

Unit 1 - J2ME Overview, Architecture and Development Environment 12 Hours

Java 2 micro edition and the world of java, inside J2ME, J2ME and wireless devices. small computing technology: wireless technology , radio data networks, microwave technology, mobile radio Networks, messaging, personal digital assistants.
J2ME architecture, small computing device requirements, run time environment, midlet programming, java language for J2ME, J2ME software development kits, hello world J2ME style, multiple midlets in a midlet suite, J2ME wireless toolkit.

Unit 2 - J2ME Best Practices and Patterns 10 Hours

The reality of working in a J2ME world, best practices commands, items, and event processing: J2ME user interfaces , display class, the palm OS emulator, C command class, item class, exception handling. high level display screens: screen class, alert class, form class, item class, list class, text box class, ticker class. low-level display canvas:
The Canvas, User Interactions, Graphics, Clipping Regions, Animation.

Unit 3 - Record Management System 10 Hours

Record storage, writing and reading records, record enumeration, sorting records, searching records, record listener. JDBC objects: The concept of JDBC, JDBC driver types, JDBC packages, overview of the JDBC process, database connection, statement objects, result set, transaction processing, metadata, data types, and exception.

Unit 4 - Technology-I Android-12 10 Hours

Introduction – establishing the development environment – android architecture – activities and views
– interacting with UI – persisting data using SQLite – packaging and deployment – Interaction with server side applications – Using Google Maps, GPS and Wifi – Integration with social media applications.

Unit 5 - Technology-II IOS-12 10 Hours

Introduction to objective C – iOS features – UI implementation – Touch frameworks – Data persistence using Core Data and SQLite – Location aware applications using Core Location and Map Kit – Integrating calendar and address book with social media application – Using Wifi - iPhone marketplace.

TEXT BOOKS / REFERENCES:
Text Books:

1. James Keogh , J2ME The Complete Reference , Tata McGrawHill.
2. Charlie Collins, Michael Galpin and Matthias Kappler, “Android in Practice”, DreamTech, 2012.
3. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, “Beginning iOS.

Reference Books:

1. Michael Juntao Yuan, Enterprise J2ME, Developing Mobile Java Applications Pearson Education , 2011.
2. Sing Li, Jonathan B. Knudsen, Beginning J2ME: From Novice to Professional, Third Edition, Apress, 2015.
3. Development: Exploring the iOS SDK”, Apress, 2013.

ADDITIONAL LEARNING SOURCES:
1. http://developer.android.com/develop/index.html.

Course Code: IT-32
Course Name: Software Testing and Practices

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30		-	70	100

Course Description:

Upon successful completion of this course, students will be able to: CO1: Gain knowledge on basics of Software Testing, Test case selection and creation . CO2: Illustrate various perspectives of testing with examples. CO3: Use by differentiating boundary value testing, Equivalence class testing, Decision table based testing. CO4: Implement Path testing and Data flow testing based on the requirements CO5: Comprehend different levels of testing, Integration testing and Fault based testing.
TOPICS COVERED:

UNIT 1- Basics of Software Testing 12 Hours
Humans, Errors and Testing, Software Quality; Requirements, Behavior and Correctness, Correctness Vs Reliability; Testing and Debugging; Test Metrics; Software and Hardware Testing; Testing and Verification; Defect Management; Execution History;Test Generation Strategies; Static Testing; Test Generation from Predicates.
Basic Principles, Test case selection and Adequacy
Sensitivity, Redundancy, Restriction, Partition, Visibility and Feedback, Test Specification and cases, Adequacy Criteria, Comparing Criteria

UNIT 2- A perspective on Testing, Examples 8 Hours
Basic definitions, Test cases, Insights from a Venn diagram, Identifying test cases, Error and fault taxonomies, Level of testing, Examples: Generalized pseudocode, The triangle problem, theNextDate function, The commission problem, The SATM (Simple Automation Teller Machine) problem, The currency converter, Saturn windshield wiper.

UNIT 3 - Boundary value, Equivalence class and Decision table based testing 8 Hours
Boundary value analysis, Robustness testing, Worst-case testing, special value testing, Examples, Random testing, Equivalence classes, Equivalence test cases for triangle problem, Next Date function and commission problem, Guidelines and observations, Decision tables, Test cases for triangle problem.

UNIT 4 - Path Testing, Data flow testing, Levels and Integration Testing 12 Hours
DD Paths, Test coverage metrics, Basis path testing, guidelines and observations, Definition Use testing, Slice based testing, Guidelines and observations. Traditional view of testing

levels, Alternative life cycle models, the SATM systems, separating integration and system testing, Guidelines and observations.

UNIT 5 - Fault Based Testing 12 Hours

Assumptions in fault-based testing, Mutation Analysis, Fault-based Adequacy Criteria; Variations on mutation Analysis; From Test case specification to Test Cases, Scaffolding, Generic vs specific Scaffolding, Test Oracles, Self checks as oracles, Capture and Replay.

Agile Testing

Definition and description, how is it different from traditional testing, ten principals for testers, business-facing the test that support the testing.

TEXT BOOKS / REFERENCES:

TEXT BOOKS :

1. Adithya P. Mathur " Foundations of Software Testing – Fundamental Algorithms and Techniques", Pearson Education India, 2011
2. Mauro Pezze, Michael Young, Software testing and Analysis- Process, Principles and Techniques", Wiley India, 2012
3. Paul C Jourgensen, "Software Testing A Craftmans Approach", Aueredach publications, 3rd edition, 2011
4. Lisa Crisping, Janet Gregory, "Agile Testing : A Practical Guide for Testers and Agile Team", The Addison Wesley Signature Series, 2009.

REFERENCE BOOKS:

1. KshirasagaraNaik, PriyadarshiTripathy: Software Testing and Quality Assurance, Wiley India 2012
2. M.G.Limaye: Software Testing-Principels, Techniques and Tools – McGrawHill, 2009
3. Brain Marick: The Craft of Software Testing, Pearson Education India, 2008
4. Ron Patton: Software Testing, 2nd Edition, Pearson Education, India, 2013

ADDITIONAL LEARNING SOURCES:

1. http://www.softwaretestinghelp.com/agile-scrum-methodology-for-development-and-testing/
2. http://crbtech.in/Testing/agile-model-software-testing/
3. https://www.getzephyr.com/**test**-management/**agile-model**-in-**software-testing**
4. http://www.mountaingoatsoftware.com/
5. http://www.testingexperience.com/
6. http://www.infoq.com/ http://www.qasymphony.com/

Course Code: IT-33
Course Name: Cloud Computing

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30		-	70	100

COURSE OUTCOMES:
Upon successful completion of this course, the student will be able to: CO1: Interpret the basic concepts, principles and techniques of data mining. CO2: Apply knowledge discovery techniques while mining the data; recognize & fixing the issues in data mining. CO3: To apply the techniques of clustering, classification, association finding, feature selection and visualization of real world data. CO4: Demonstrate the real world problem has a data mining solution. CO5: Apply evaluation metrics to select data mining techniques.
Topics Covered:

UNIT 1- Introduction to Cloud Computing 11 Hours

Defining Cloud Computing, Cloud types, The NIST model, The Cloud Cube Model, Deployment models, Service models, Examining the Characteristics of Cloud Computing, paradigm shift, Benefits of cloud computing, Disadvantages of cloud computing, Assessing the role of open standards. Assessing the Value Proposition: Measuring the Cloud's Value, Early adopters and new application, The laws of cloudonomics, Cloud computing obstacles, Behavioral factors relating to cloud adoption, Measuring cloud computing costs, Avoiding Capital Expenditures, Right-sizing, Computing the total cost of ownership, Specifying service level agreements, Defining licensing models. Understanding Cloud Architecture: Exploring the cloud computing stack, Composability, Infrastructure, Platforms. Virtual Appliances, Communication Protocols, Applications, Connecting to the Cloud, The Jolicloud Netbook OS, Chromium OS: The browser as an Operating System.

UNIT 2- Understanding Service and Application by Type 10 Hours

Defining Infrastructure as a service (IaaS), Defining Platform as a Service (PaaS), Defining Software as a Service (SaaS), Defining Identity as a Service (IDaaS), and Defining Compliance as a Service (CaaS). Understanding Abstraction and Virtualization: Using Virtualization technologies, Load Balancing and Virtualization, Understanding Hypervisors,

Understanding Machine Imaging, Porting Applications. Capacity Planning: Capacity Planning, Defining Baseline and Metrics, Network Capacity, Scaling.

UNIT 3 - Exploring Platform as a Service 10 Hours

Defining Services, Using PaaS Application Frameworks Using Google Web Services: Exploring Google Applications, Surveying the Google Application Portfolio, Exploring the Google Toolkit, Working with the Google App Engine. Managing the Cloud: Administrating the Clouds, Cloud Management Products, Emerging Cloud Management Standards.

UNIT 4 - Understanding Cloud Security 10 Hours

Securing the cloud, Securing data, Establishing identity and Presence. Moving Application to the Cloud: Application in the Cloud, Applications and cloud APIs. Working with cloud-based storage: Measuring the digital universe, Provisioning Cloud Storage, Exploring Cloud Backup Solutions, Cloud Storage Interoperability.

UNIT 5: Using Webmail Services 10 Hours

Using Webmail Services: Exploring the cloud Mail Services, Working with syndication services. Communicating with the cloud: Exploring instant messaging, Exploring collaboration technologies, Using social networks. Working with Mobile Devices: Defining the Mobile Market, Using Smart phones with the Cloud.

Text Books/ References:
Text Books:
1. Barrie Sosinsky “Cloud Computing Bible” 2011 by Wiley Publishing, Inc.

Reference Books:
1. Cloud Computing Principles and Paradigms by Rajkumar Buyya 2011, Published by John Wiley & Sons
2. Cloud Computing Theory and Practice by Dan C.Marinescu, 2013, Published by Morgan Kaufmann.

Additional Resource :
1. https://cloudacademy.com/ebooks
2. www.freebookcentre.net › Networking Books

Course Code: IT-34
Course Name: Data Warehousing

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30		-	70	100

COURSE OUTCOMES:
Upon successful completion of this course, students will be able to: **CO1:** Design a data warehouse or data mart to present information needed by management in a form that is usable for management client & Comprehend several data preprocessing methods. **CO2:** Ability to do Conceptual, Logical, and Physical design of Data Warehouse **CO3:** Able to produce and document dimensional models for a data warehouse based on an informal domain description. **CO4:** Utilize the concept of data warehouse and OLAP for data Warehousing and tools. **CO5:** xtrapolate knowledge and skills to design a data warehouse to support and provide business solutions
TOPICS COVERED:

Unit 1 - Introduction 12 Hours
Introduction to Data Warehouse. A Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Data Cube Technology, From Data warehousing to Data Mining. The need for data warehousing, paradigm shift, business problem definition, operational and informational data stores, characteristics.Overview of client/server architecture, server specialization in client/server computing environments, server functions, server hardware architecture, system considerations, risc versus cisc, multiprocessor systems.

Unit 2 - Data Warehousing Components 10 Hours
Overall Architecture, data warehouse database, sourcing, acquisition, cleanup and transformation tools, metadata, access tools, data marts, data warehouse administration and management. Business Considerations, design considerations, technical considerations, implementation considerations, benefits of data warehousing.

Unit 3 - Mapping the data warehouse 10 Hours
Relational database technology for data warehouse, types, database architectures for parallel processing, parallel RDBMS features, alternative technologies, parallel dbms vendors, data layouts for best access, multidimensional data models, bitmapped indexing, complex data types.

Unit 4 - Data Extraction, Cleanup and Transformation Tools 12 Hours

Tool requirements, vendor approaches, access to legacy data, vendor solutions, transformation engines. Meta data: defined, meta data interchange initiative, metadata repository, metadata management, implementation examples, meta data trends. Need for OLAP, OLAP Guidelines, Categorization of OLAP Tools.

Unit 5 - Business Analysis 08 Hours

Tool Categories, Need for applications, cognos impromptu, applications, methodology, business intelligence market definition, situation overview, future outlook, essential guidance.

Tutorials:

Case Studies:

1. Data Warehousing Solution for One of Europe's Largest Financial Services Groups.
2. Data Warehousing for a Health Benefits Company
3. Data warehousing solution for banking system.
4. Data warehousing solutions for tax fraud with advanced analytics.
5. Data warehousing solutions for international satellite TV service provider**.**
6. Data warehousing solutions for Correlating data across the business.
7. Business Reporting & Customer Information Datamart Architecture Setup & Roll-out for a global technology company.
8. Global Planning Data Automation.
9. COTS-Anti Money Laundering.
10. Management Information System for Trade Finance.

TEXT BOOKS / REFERENCES:

Text books:

1. Alex Berson, Stephen J smith : Data Warehousing,Data Mining, & OLAP, Tata Mcgraw- Hill, 2012.
2. Gajendra Sharma: Data Mining, Data Warehousing and OLAP, Katson Books, 2010.
3. Jiawei Han and Micheline Kamber: Data Mining - Concepts and Techniques, 2nd Edition, Morgan Kaufmann Publisher, 2012.

Reference books:

1. Paulraj Ponnaiah : Data Warehousing fundamentals for IT professionals, wiley student publishers, second edition , 2014.
2. Ralph Kimball, Margy Ross : The data warehouse toolkit, third edition , wiley publishers, 2012.

ADDITIONAL LEARNING SOURCES:

1. https://www.coursera.org/specializations/data-warehousing.
2. www.knowledge-management-tools.net/data-warehousing.htm.
3. www.slideshare.net/2cdude/data-warehousing.
4. https://www.edx.org/course/delivering-relational-data-warehouse-microsoft-dat216x.

Course Code: IT-35
Course Name: NET Technologies

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30		-	70	100

COURSE OUTCOMES:
Upon successful completion of this course, the student will be able to: CO1: Develop application using the concept of .NET framework and basics of C# .NET. CO2: Create server side applications using C#.NET. CO3: Develop web applications using the ASP.NET. CO4: Comprehend ASP.NET web form, state management and error handling mechanism. CO5: Access and manipulate data in a database by using Microsoft ADO.NET
TOPICS COVERED:

UNIT 1 –Introduction to .NET and Basics of C#.NET 12 Hours

The .NET Framework: The Evolution of Web Development-HTML and HTML Forms, Server-Side Programming, Client-Side Programming. The .NET Framework - C#, VB, and the .NET Languages, The Common Language Runtime, The .NET Class Library, Visual Studio. The .NET Languages, C# Language Basics, Case Sensitivity, Commenting, Statement Termination, Blocks, Variables and Data Types-Assignment and Initializes, Strings and Escaped Characters, Arrays, Enumerations, Variable Operations- Advanced Math, Type Conversions. Object-Based Manipulation- String, DateTime and TimeSpan Types, The Array Type. Conditional Logic-The if, switch Statement. Loops- The for, foreach, while loop, Methods-Parameters, Method Overloading, Optional and Named Parameters, Delegates.

UNIT 2 – C#.NET Types, Objects, and Namespaces10 Hours

The Basics About Classes-Static Members, A Simple Class, Building a Basic Class-Creating an Object, Adding Properties, Automatic Properties, Adding a Method, Adding a Constructor, Adding an Event, Testing the Product Class. Value Types and Reference Types-Assignment Operations, Equality Testing, Passing Parameters by Reference and by Value, Reviewing .NET Types. Understanding Namespaces and Assemblies- Using Namespaces, Importing Namespaces, Assemblies. Advanced Class Programming-Inheritance, Static Members, Casting Objects, Partial Classes, Generics.

UNIT 3 - Developing ASP.NET Applications 10 Hours

Visual Studio: Creating Websites-Creating an Empty Web Application, Websites and Web Projects, The Hidden Solution Files, The Solution Explorer, Adding Web Forms, Designing a Web Page-Adding Web Controls, The Properties Window, and The Anatomy of a Web Form-The Web Form Markup, The Page Directive, The Doctype, The Essentials of XHTML. Writing Code-The Code-Behind Class, Adding Event Handlers, Outlining, IntelliSense, Code Formatting and Coloring, Visual Studio Debugging-The Visual Studio Web Server, Single-Step Debugging, Variable Watches, The Anatomy of an ASP.NET Application-ASP.NET File Types, ASP.NET Application Directories. Introducing Server Controls-HTML Server Controls, Converting an HTML Page to an ASP.NET Page, View State, The HTML Control Classes, Adding the Currency Converter Code, Event Handling, Error Handling

UNIT 4 – ASP.NET Web Form Basics, State Management & Error Handling 10 Hours

ASP.NET Configuration- The web.config File, Nested Configuration, Storing Custom Settings in the web.config File, The Website Administration Tool (WAT), Web Controls-Basic Web Control Classes, The Web Control Tags, Web Control Classes, List Controls, Table Controls, Web Control Events and AutoPostBack, A Simple Web Page. The Problem of State-View State, Transferring Information Between Pages, Cookies, Session State, Session State Configuration, Application State, An Overview of State Management Choices. Error Handling, Logging, and Tracing-Common Errors, Exception Handling-The Exception Class, The Exception Chain, Handling Exceptions, Throwing Your Own Exceptions, Logging Exceptions, Page Tracing.

UNIT 5 – ADO.NET Fundamentals 10 Hours

Understanding Databases, Configuring Your Database-SQL Server Express, Browsing and Modifying Databases in Visual Studio, The *sqlcmd* Command-Line Tool. SQL Basics - Running Queries in Visual Studio, The Select, Update, Insert, Delete statement. The Data Provider Model: Direct Data Access-Creating a Connection, The Select Command, The DataReader, Putting It All Together, Updating Data. Disconnected Data Access-Selecting Disconnected Data, Selecting Multiple Tables, Defining Relationships. Introducing Data Binding-Types of ASP.NET Data Binding, How Data Binding Works, Single-Value Data Binding, Repeated-Value Data Binding, Data Source Controls.

TEXT BOOKS / REFERENCES:

Text books:

1. Matthew MacDonald. Beginning ASP.NET 4 in C# 2010, APRESS, 2010

Reference books:

1. Joseph Mayo. Visual studio 2010 - A beginners guide – BPB Publications 2010
2. Greg Buczek: ASP.Net Developer's Guide, Tata McGraw Hill Edition 4th Edition, 2005.
3. Pro ASP.NET 4 in C# 2010, MacDonald and Freeman

ADDITIONAL LEARNING SOURCES:

1. https://msdn.microsoft.com/en-us/library/4w3ex9c2.aspx
2. http://www.asp.net/
3. http://www.aspfree.com/
4. http://www.devx.com/dotnet
5. asp.net-tutorials.com/localization/local-and-global-resources/
6. https://www.tutorialspoint.com/asp.net/asp.net_ado_net.htm
7. www.w3schools.com/asp/ado_intro.asp
8. https://www.tutorialspoint.com/soa/index.htm

Course Code: IT-36
Course Name: Cryptography and Network Security

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30		-	70	100

Upon successful completion of this course, students will be able to:

CO 1: Explore the need for computer security concepts.
CO 2: Apply the principles and techniques of symmetric key encryption and public key encryption.
CO 3: Demonstrate the specifics of message authentication codes and hash algorithms.
CO 4: Analyze the facts of e-mail security and IP security evolution.
CO 5: Comprehend Web Security, Secure Electronic Transaction, Intruder detection and Firewalls.

TOPICS COVERED:

UNIT 1 – Introduction and Classical Encryption Technique 9 Hours

Computer Security Concepts, OSI Security Architecture, Security Attacks, Security Services, Security Mechanism, Model for Network Security. Symmetric Cipher Model, Substitution Techniques, Transposition Techniques.

UNIT 2 - Block Ciphers, Public Key Cryptography and Key Management 11 Hours

Traditional Block Cipher Structure, The Data Encryption Standard, A DES Example, The strength of DES, Block Cipher Design Principles, AES Structure, AES Transformation Functions, AES Key Expansion, An AES Example, Principles of Public Key Cryptosystem, The RSA Algorithm, Key Management, Diffie Hellman Key Exchange.

UNIT 3 - Cryptographic Hash Functions, Message Authentication Codes
12 Hours

Applications of Cryptographic Hash Functions, Message Authentication, Digital Signatures, Two Simple Hash Functions, Requirements and Security, Security Requirements for Cryptographic Hash Functions, Brute-Force Attacks, Cryptanalysis, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithm (SHA), SHA-3, Message Authentication Requirements, Message Authentication Functions, Requirements for Message Authentication Codes, Security of MACs.

UNIT 4 – Electronic Mail Security and IP Security 10 Hours

Pretty Good Privacy (PGP), S/MIME, IP Security Overview; IP Security Architecture; Authentication Header; Encapsulating Security Payload; Combining Security Associations.

UNIT 5 - User Authentication Protocols and Entity Authentication 10 Hours

Web Security Considerations; Secure Socket Layer (SSL) and Transport Layer Security (TLS); Secure Electronic Transaction (SET), Intruders, Intrusion Detection, Firewall Design Principles- Characteristics, Types of Firewall and Firewall Configuration.

Text books:

1. William Stallings, "Cryptography and Network Security – Principles and Practices", 6th Edition, Pearson Education, 2014.
2. Behrouz A. Forouzan and Debdeep Mukhopadhyay: "Cryptography and Network Security", 2nd Edition, Tata McGraw-Hill, 2014.

Reference books:

1. Atul Kahate, "Cryptography and Network Security" 2nd Edition, Tata McGraw-Hill Publishing Company, 2010.
2. Network Security Private Communication in a public world, Charlie Kaufman, Radia Perlman & Mike Speciner, Prentice Hall of India Private Ltd., New Delhi, 2011.
3. Network Security Essentials Applications and Standards, William Stallings, Pearson Education, New Delhi, 2010.
4. Network Security Complete Reference by Roberta Bragg, Mark Phodes-Ousley, Keith Strassberg Tata Mcgraw-Hill, 2009.

ADDITIONAL LEARNING SOURCES:

1. https://mrajacse.wordpress.com/2012/01/06/cryptography-network-security-ebooks/
2. www.williamstallings.com/Crypto/Crypto4e.html

Course Code: ET-31
Course Name: Soft Computing

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30		-	70	100

Upon successful completion of this course, students will be able to,
CO1: Identify and describe soft computing techniques and their roles in building intelligent machines.
CO2: Recognize the feasibility of applying a soft computing methodology for a particular problem.
CO3: Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
CO4: Apply genetic algorithms to combinatorial optimization problems.
CO5: Apply neural networks to pattern classification and regression problems .

TOPICS COVERED:

UNIT 1 - Introduction 10 Hours

Artificial neural network: Introduction, characteristics- learning methods – taxonomy – Evolution of neural networks- basic models – important technologies – applications. Fuzzy logic: Introduction – crisp sets- fuzzy sets crisp relations and fuzzy relations: Cartesian product of relation – classical relation, fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets. Genetic algorithm- Introduction – biological background – traditional optimization and search techniques – Genetic basic concepts.

UNIT 2 - Neural Networks 10 Hours

McCulloch-Pitts neuron – linear separability – hebb network – supervised learning network: perceptron networks adaptive linear neuron, multiple adaptive linear neuron, BPN, RBF, TDNN- associative memory network: auto- associative memory network, hetero-associative memory network, BAM, hopfield networks, iterative autoassociative memory network & iterative associative memory network – unsupervised learning networks: Kohonenself organizing feature maps, LVQ – CP networks, ART network.

UNIT 3 - Fuzzy Logic10 Hours
Membership functions: features, fuzzification, methods of membership value assignments-Defuzzification: lambda cuts – methods – fuzzy arithmetic and fuzzy measures: fuzzy arithmetic – extension principle – fuzzy measures – measures of fuzziness -fuzzy integrals –

fuzzy rule base and approximate reasoning : truth values and tables, fuzzy propositions, formation of rules-decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning- fuzzy inference systems-overview of fuzzy expert system-fuzzy decision making.

UNIT 4 – Genetic Algorithm 10 Hours

Genetic algorithm and search space – general genetic algorithm – operators – Generational cycle – stopping condition – constraints – classification genetic programming – multilevel optimization – real life problem- advances in GA.

UNIT 5 – Hybrid Soft computing Techniques and Applications 12 Hours

Neuro-fuzzy hybrid systems – genetic neuro hybrid systems – genetic fuzzy hybrid and fuzzy genetic hybrid systems – simplified fuzzy ARTMAP – Applications: A fusion approach of multispectral images with SAR, optimization of traveling salesman problem using genetic algorithm approach, soft computing based hybrid fuzzy controllers.

TUTORIALS:

Solving simple programs using MATLAB in the following areas:

1. FUZZY Logic techniques.
2. Neural networks techniques.
3. Genetic Algorithm techniques.
4. Hybrid Soft Computing Techniques.

TEXT BOOKS / REFERENCES:

Text books:

1. J.S.R.Jang, C.T. Sun and E.Mizutani, “Neuro-Fuzzy and Soft Computing”, PHI / Pearson Education,2004.
2. S.N.Sivanandam and S.N.Deepa, “Principles of Soft Computing”, Wiley India Pvt Ltd, 2011.

Reference books:

1. S.Rajasekaran and G.A.Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis & Applications”, Prentice-Hall of India Pvt. Ltd., 2006.
2. David E. Goldberg, “Genetic Algorithm in Search Optimization and Machine Learning” Pearson Education India, 2013.

ADDITIONAL LEARNING SOURCES:

1. http://www.myreaders.info/html/soft_computing.html
2. http://www.soft-computing.de/

Course Code: ET-32
Course Name: Big data Analytics

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30		-	70	100

COURSE OUTCOMES:
Upon successful completion of this course, students will be **CO1:** Demonstrate the knowledge, significance structure and sources of Big Data. **CO2:** Ability to think critically in making decisions based on data analytics, specific to Big Data. **CO3:** Apply the technical skills in predicative and perspective modelling to support business decisions. **CO4:** Comprehend decision tools and techniques for data streaming using various algorithms. **CO5:** Demonstrate the Knowledge gained on mining social network data.
TOPICS COVERED:

UNIT 1 - Introduction to Big Data 12Hours

What is big data? Is the "big" part or the "data" art more important? How is big data different? How is big data more of the same? Risks of big data -why you need to tame big data -the structure of big data- exploring big data, most big data doesn't matter- filtering big data effectively -mixing big data with traditional data- the need for standards-today's big data is not tomorrow's big data. Web data: the original big data -web data overview -what web data reveals -web data in action? A cross-section of big data sources and the value they hold.

UNIT 2 : Data Analysis 08 Hours

Evolution of analytic scalability – convergence – parallel processing systems – cloud computing – grid computing – map reduce – enterprise analytic sand box – analytic data sets – analytic methods – analytic tools – cognos – microstrategy - pentaho. Analysis approaches – statistical significance – business approaches – analytic innovation – traditional approaches – iterative

UNIT 3 - Mining Data Streams 10 Hours

Introduction to streams concepts, stream data model and architecture, stream computing, sampling data in a stream, filtering streams, counting distinct elements in a stream, estimating

moments, counting oneness in a window, decaying window, realtime analytics platform(rtap) applications, case studies, real time sentiment analysis, stock market predictions.

UNIT 4 - Frequent Item sets and Clustering 10 Hours

Mining frequent itemsets - market based model – apriori algorithm – handling large data sets in main memory – limited pass algorithm – counting frequent itemsets in a stream – clustering techniques – hierarchical – k- means – clustering high dimensional data – clique and proclus – frequent pattern based clustering methods – clustering in non-euclidean space – clustering for streams and parallelism.

UNIT 5 : Frameworks and Visualization 10 Hours

Mapreduce – hadoop, hive, mapr – sharding – nosql databases - s3 - hadoop distributed file systems –visualizations - visual data analysis techniques, interaction techniques; systems and applications.

TUTORIALS
Case Studies:

1. Medicare and Medicaid Services : Integrity of health care data and secure payment processing.
2. Tesco PLC.
3. American Express Co.
4. Mobile Telecom Harnesses Big Data with Combined Actuate and Hadoop Solution.
5. Re-engineering a Telecom Market Share Analytical Application.
6. Telco Case Study: Vodafone and Argyle Data on using big data to combat fraud.
7. MTS India relies on HP Vertica in a highly competitive telecom market.
8. Mclaren's Formula One racing team : real time car sensor data during car races.

TEXT BOOKS / REFERENCES:

Text books:

1. Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with advanced analytics, John Wiley & sons, 2013.
2. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2014

Reference books:

1. Paul Zikopoulos, Chris Eaton, Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data: Analytics for Enterprise Class Hadoop and Streaming Data, McGraw Hill Professional, 2012.
2. Glenn J. Myatt, Making Sense of Data, John Wiley & Sons, Pete Warden, Big Data Glossary, O‟Reilly.

3. Chuck Lam, “Hadoop in Action”, Dreamtech Press.

ADDITIONAL LEARNING SOURCES:

1. https://www.tutorialspoint.com/big_data_tutorials.html.
2. https://www.lynda.com/Big-Data-training-tutorials/2061-0.html.
3. https://www.tutorialspoint.com/hadoop/hadoop_big_data_overview.html.
4. https://bigdatauniversity.com.

Course Code: ET-33
Course Name: SOFTWARE PROJECT MANAGEMENT

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30		-	70	100

COURSE OUTCOMES:
Upon successful completion of this course, students will be able to: CO1: Comprehend software project management basics and approaches CO2: Analyze different project management initiation techniques CO3: Apply proper project planning and scheduling techniques CO4: Execute software projects with efficient control mechanisms CO5: Decide on closure of projects using standard and agile methodologies
TOPICS COVERED:

UNIT 1 -Software Project Basics 10 Hours

Introduction, Types of Software Projects, Classifications of Software Projects, Based on Software Development Life Cycle, Approach Driven, Maintenance, Web Application, Agile Development, Conclusion
Approaches to Software Project Management:Alignment of Software Engineering Methodology with Project Management Methodology, The Ad Hoc Methods-Based Approach, The Process-Driven Approach, So, What Is the Right Approach?, The Ad Hoc Approach, The Process-Driven Approach, But Is a Process-Driven Approach the Right Choice?, In a Process-Driven Approach: What Process and How Much?
Software Project Acquisition:From an External Client, The Request for Proposal, The Proposal, Negotiation, Contract Acceptance, From an Internal Client, The Feasibility Study, Preparing the Proposal, Finalizing the Proposal, Reference.

UNIT2 -Software Project Initiation 10 Hours

Introduction, Initiation Activities, Project Management Office-Level Activities, Identifying the Software Project Manager, Preparing/Handing Over the Project Dossier to the Software Project Manager, Coordinating Allocation of Project Resources, Assisting the Software Project Manager in Obtaining Necessary Service Level, Agreements from Departments in the Organization, Assisting the Software Project Manager with the Project Kickoff Meeting, Software Project Manager-Level Activities, Ensuring that Project Specifications Are

Complete,Reviewing Estimates and Revisions/Updates of Estimates, Identifying Necessary Resources and Raising Requests, Preparing Project Plans, Setting Up the Development Environment,Arranging for Project- Specific Skill Training, Organizing the Project Team, Training the Project Team on the Project Plans, Conducting a Project Kickoff Meeting, Arranging for a Phase-End Audit, Common Pitfalls in Project Initiation, Identifying the Wrong Software Project Mana, Identifying Inappropriate Resources, Incurring Delays in Software Project Initiation Activities.

UNIT3 -Software Project Planning 10 Hours

Introduction, Planning Defined, Plans Prepared in Software Project Management, The Project Management Plan, Resources, Skill Sets, Computer Systems, Project Management Method,The Configuration Management Plan, Naming Conventions, Change Management, The Quality Assurance Plan, The Schedule Plan, The Induction Training Plan, The Risk Management Plan, The Build Plan, The Deployment Plan, The User Training Plan,The Handover Plan, The Software Maintenance Plan, The Documentation Plan, Roles in Planning.
Scheduling: Introduction, The Initial Work Breakdown Structure, A Work Breakdown Structure with Predecessors Defined, A Work Breakdown Structure with Initial Dates, A Work Breakdown Structure with Resource Allocation, Scheduling in Practice, Graphic Representation of a Schedule

UNIT 4 -Software Project Execution 10 Hours

Introduction, Work Management, Work Registers, De-allocation, Configuration Management, Information Artifacts, Code Artifacts, Configuration Registers, Configuration Management Tools, Quality Management, Verification Techniques, Validation Techniques, Product Testing, Allocation of Quality Assurance Activities, Productivity Management, Stakeholder Expectations Management, Product Integration Management.
Software Project Execution Control: Introduction, Aspects of Control in Project Execution, Scope Control, Cost Control, Schedule/Progress Control, Quality Control, Effort Control, Productivity Monitoring, Control Mechanisms, Progress Assessment: Earned Value Analysis.

UNIT 5 - Software Project Closure 12 Hours

Introduction, Identifying Reusable Code Components, Documenting the Best Practices, Documenting the Lessons Learned, Collecting/Deriving and Depositing the Final Project Metrics in the Organizational, Knowledge Repository, Conducting Knowledge-Sharing Meetings with Peer Software Project Managers, Depositing Project Records with the Project Management Office, Depositing Code Artifacts in the Code Repository, Conducting the Project Postmortem, Releasing the Software Project Manager, Closing the Project, The Role of the Organization in Project Closure, The Project Management Office, The Configuration Control Board, The Systems Administration Department, Reference.

Agile Project Management: Introduction, Project Management Roles, Agile Project Management Characteristics, Metaphor, Teamwork and Collaboration, Guiding Principles, Open Information, Use a Light Touch, Monitoring and Adjustment, The Nuts and Bolts of Agile Project Management, Planning the Work, Controlling the Work, Process Improvement, Reference.

TUTORIALS:

Writing Cases for the following.

1. Writing requirement Proposal.
2. WritingNegotiationProposal.
3. Writing Feasibility Study Proposal.
4. Software Project Planning Proposal.
5. Software Project Execution Control Proposal.
6. WritingSchedules
7. Software Project Closure

TEXT BOOKS / REFERENCES:
Text books:
1. **"**Mastering Software Project Management: Best Practices, Tools and Techniques**"**, MuraliChemuturi, Thomas M. Cagley, J. Ross Publishing, 2010,

Reference books:

1. "IT Project MAnagement – On track from Start to Finish", Book by Joseph Phillips, 2002.
2. "Managing the unmanageable" by Mantle and Lichty, 2012.
3. Making Things Happen: Mastering Project Managementby Scott Berkun, 2008.

ADDITIONAL LEARNING SOURCES:

1. https://www.tutorialspoint.com/software_engineering/software_project_management.htm
2. http://searchsoftwarequality.techtarget.com/tutorials/Software-Project-Management-Process

Course Code: BM-41
Course Name: BUSINESS INTELLIGENCE

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30		-	70	100

COURSE OUTCOMES:
Upon successful completion of this course, students will be able to, CO1: Comprehend the basics and fundamentals of BI with its business and technical needs CO2: Use the requirements and architectural framework of BI CO3: Know and differentiate different components of the BI framework CO4: Design BI concepts by understanding the requirement needs CO5: Analyze and implement advanced BI techniques and analytics
TOPICS COVERED:

UNIT 1-The Business Demand for Data, Information, and Analytics 10 Hours

Just One Word:Data, Welcome to the Data Deluge, Data Volume, Variety, and Velocity, Taming the Analytics Deluge, The Importance of Analytics, Analytics Challenge, Analytics Strategy, Too Much Data, Too Little Information, The Difference Between Data and Information, The Role of BI in Creating Actionable Information, The Information Backbone, Data Capture versus Information Analysis, The Roles of BI and Operational Systems, Operational BI Blurs the Lines, Where Data Warehousing Fits in, The Five Cs of Data, Common Terminology from Our Perspective, References.
Justifying BI: Building the Business and Technical Case:Why Justification is Needed, Building the Business Case, Review Organization's Business Initiatives and Processes, Solicit BI Sponsorship, Enlist BI Stakeholders, Identify Business Processes Affected by BI, Document Business Benefits, Determine Business Value(Tangible Benefits), Business the Technical Case, Technology and Product Short Lists, Convincing Business People, Convincing the Technologists, Assessing Readiness, Data and Data Quality, Expertise and Experience, Organizational and Cultural Change, Financial and Resource Commitment, Creating a BI Road Map, Developing Scope, Preliminary Plan and Budget, Project Scope, Project Plan, Project Budget, Calculating Benefits and ROI, Obtaining Approval, Common Justification Pitfalls, Overzealous Business Sponsor, CIO is Sole Sponsor, Intangible or Too High-Level Benefits, Confusion Between BI Technology and Business Value.

UNIT 2-Defining Requirements-Business, Data and Quality 10 Hours

The Purpose of Defining Requirements, Goals, Deliverables, Roles, BI Team Participants, Business Participants, Other IT Participants, Defining Requirements Workflow, Business Requirements, Data(and Data Quality) Requirements,Functional Requirements, Regulatory/Compliance Requirements, Technical Requirements, Reverse Engineering(When Necessary), Putting It All Together, Prioritizing Requirements, Interviewing, Preparation for Interviews, Conducting the Interviews, Reviewing Interview Content, Interview Follow-ups, Documenting Requirements.
Architecture Framework:The Need for Architectural Blueprints, Architectural Framework, Information Architecture, Data Architecture, The Rise of the Enterprise Data Warehouse, Data Warehousing Replaces the Data Warehouse, Technical Architecture, Business Intelligence, Data Warehouse and BI Data Stores, Data Integration, Source Systems, BI Technology Keeps Evolving, Product Architecture, Metadata, What is It?, What to do About It, Security and Privacy, Getting Started, Implementing the Plan, Avoiding Accidents with Architectural Planning, The Signs of Accidental Architectural Planning, Recovering from an Accidental Architecture, Do Not Obsess over the Architecture.

UNIT 3-Information Architecture 10 Hours

The Purpose of an Information Architecture, Data Integration Framework, DIF Information Architecture, Data Preparation, Data Franchising, BI and Analytics, Data Management, Metadata Management, Operational BI versus Analytical BI, Shift All Reporting to the Application-Specific Environment, Shift All Reporting to the DW- Based BI Environment, Blend Application-Specific and DW BI Environments, Master Data Management, Identify the Data, Find the Problem Areas, Assess a Solution.
Data Architecture: The Purpose of a Data Architecture, History, Prehistory, In the Beginning, Data Warehousing Goes Public, The Data Mart, Multiple Data Marts, Operational Data Store(ODS), Federated DWs, BI Accidental Architecture, Hub-and-Spoke, Data Architectural Choices, Data Categories, Selecting a Data Architecture, The Same But Different, Analytical Data Architecture(ADA),Data Integration Workflow, Data Integration Workflow— Hub-and-Spoke, Data Workflow of the System of Integration(SOI), Data Workflow of the System of Analysis(SOA), Data Workflow—Rise of EDW Again, Operational Data Store, The Relational for an ODS, ODS Reexamined, ODS is Dead, Long Live ODS, References.

UNIT 4-Technology & Product Architectures 10 Hours

Where are the Product and Vendor Names?, Evolution Not Revolution, Technology Platforms, Enterprise Applications, Data Management, Technology Architecture, Business Intelligence and Analytics, Information Access and Data Integration, Databases, Product and Technology Evaluations, BI Product Vendors, Dazed and Confused, Technology and Product Evaluations, Product Migration.
Business Intelligence Applications: BI Content Specifications, Revise BI Applications List, BI Personas, Casual Consumers, Analyst, Power Users, Data Scientists, BI Design Layout—

Best Practices, Focus on the Purpose, Design Layout, Data Design for self-Services BI, The Last Data Preparation Step, When Inconsistency is Reintroduced, OLAP Cubes and In-Memory Columnar Databases, Matching types of analysis to Visualizations, Comparative Analysis, Time-series or Trending Analysis, Contribution Analysis, Correlation Analysis, Geographic Data, Distribution Analysis.

UNIT 5-BI Design and Development 12 Hours

BI Design, BI User Interface(UI) Standards, Create Privacy, Security and Access Standards, Designing Each BI Application, BI Development, Prototyping Lifecycle, BI Application Development Tasks, BI Application Testing.
Advanced Analytics: Advanced Analytics Overview and Background, The Window to the Future, Don't Ignore the Past, Advanced Analytics in Action, Predictive Analytics and Data Mining, Setting Up a Predictive Analytics or Data Mining Program, Tasks for Developing and Using Models, Selecting Tools, Architecture for Predictive Analytics and Data Mining, Techniques for Predictive Analytics and Data Mining, Resources and Skills, Roadblocks to Success, Analytical Sandboxes and Hubs, Analytical Sandboxes, Analytical Hubs, Hub and Sandbox Design Principles, Hub and Sandbox Architecture Options, Advice for Hubs and Sandboxes, Big Data Analytics, Scope, The Program, Hybrid Architecture, The Big Data Team, Big Data Analytics Worst Practices, Data Visualization, Why Data Visualization is Needed, Why Data Visualization is Not, References.

TUTORIALS:

1. Case study on requirement specification.
2. Defining a requirement workflow.
3. Writing technical requirement specification.
4. Prioritizing the requirements.
5. Writing a BIE roadmap.
6. Writing & Defining scope objectives & outcomes.
7. Writing a plan & budget.
8. Writing Data Management techniques.
9. Creating data marts & operational data stores.
10. Creating OLAP Cubes.

TEXT BOOKS / REFERENCES:
Text books:
1. **"**Business Intelligence Guidebook: From Data Integration to Analytics" Book by Rick Sherman, 1st Edition, 2014.

Reference books:

1. Business Intelligence Roadmap: The Complete Project Lifecycle for Decision-Support Applications by Larissa T. Moss and ShakuAtre, February 25th 2003.

2. Successful Business Intelligence, Second Edition: Unlock the Value of BI & Big DataHardcover– Import, 1 Nov 2013.
3. Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die, Revised and UpdatedPaperback– 22 Feb 2016.

ADDITIONAL LEARNING SOURCES:

1. https://thebipalace.com/
2. https://www.analyticsvidhya.com/learning-paths-data-science-business-analytics-business-intelligence- big-data/tableau-learning-path/

MASTER OF SOCIAL WORK

MSW

SYLLABUS

CREDIT BASED, CHOICE BASED CONTINUOUS ASSESSMENT PATTERNED EDUCATION SYSTEM

(Regulations, Scheme of Examination and Course Content)

To be effective from the Academic Year 2020-21 onwards

DEPARTMENT OF STUDIES IN SOCIAL WORK
JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSORE

JSS College of Arts, Commerce and Science

(Autonomous)

Ooty Road, Mysore

Master of Social Work Programme

DISTRIBUTION OF COURSE CONTENT AND CREDITS

MSW- I Semester

Compulsory additional papers for non BSW students

Sl. No.	Code No.	Paper Title	L	T	P	Credits
1	NSW-1	Social Science Perspectives for Social Work Practice	-	-	-	-
2	NSW-2	Term Project	-	-	-	-

1. A bridge course will be conducted for a period of 5 days covering the required course input. There are no credits allotted to this course and no written examination too. However, attendance of 75% is compulsory.

2. Paper code: NSW2 : **Term project**:

The term project is a team-exercise consisting 3 to 5 students. The team is expected to select a theme relevant to current social issues in consultation with the supervisor and make an exhaustive survey of literature on the chosen theme including empirical studies made on the same.

Further, the group shall also collect the experiences or opinions of people on the issues and make a detailed presentation. Flexibility is accorded in planning and executing the term project. Creative and analytical approaches are to be carried out under the direct supervision of a faculty supervisor.

The report of the term project has to be submitted before the end of theory examination of the first semester. The term project is offered only for the non-BSW students. However, students with BSW background are also encouraged to opt for the term project, as an innovative approach in social work, if they desire so.

DISTRIBUTION OF CREDITS

Sl. No.	Course Type	Credits
1	HARD CORE (HC)	52
2	SOFT CORE (SC)	20
3	OPEN ELECTIVE (OE)	04
	TOTAL	76

Semester- wise Distribution of Course Content and Credits

I Semester

Sl. No.	Course Code	Course Title	L:T:P	Credits
1.	SWA HC-1	Social Work - History and Ideologies	2:1:0	3
2.	SWA HC-2	Work with Individuals and Families	2:1:0	3
3.	SWA HC-3	Work with Groups	2:1:0	3
4.	SWA HC-4	Work with Communities	2:1:0	3
5.	SWA HC-5	Human Growth and Development	2:1:0	3
6.	SWA HC-6	Social Work Practicum – I	0:1:2	3
		Total		**18**

II Semester

Sl. No.	Course Code	Course Title	L:T:P	Credits
1.	SWB HC-7	Management of Developmental and Welfare Services	2:1:0	3
2.	SWB HC-8	Social Work Research and Statistics	2:1:0	3
3.	SWB HC-9	Social Work Practicum – II (Social Work Camp and Summer Placement)	0:0:3	3
4.	SWB HC-10	Social Work Practicum - III	0:1:2	3
5.	SWB SC-1	Communication and Counselling / Gandhian Approach to Welfare and Development	3:1:0	4
6.	SWB SC-2	Personal and Professional Growth/ Population and Environment	2:1:0	3
			Total	**19**

III Semester

Sl. No.	Course Code	Course Title	L:T:P	Credits
1.	SWC HC-11	Human Resource Management	2:1:0	3
2.	SWC HC-12	Social Work Practicum – IV	0:1:2	3
3.	SWC SC-3	Social Work with Tribal and Rural communities/Organizational Behavior and Organizational Development	2:1:0	3
4.	SWC SC-4	Preventive and Social Medicine and Medical Social Work /Rehabilitation and After Care Services	2:1:0	3
5.	SWC SC-5	Social Policy, Planning and Development/ Legal System in India	2:1:0	3
6.	SWC OE	Gerentological Social Work / Social Work Practice with Children	4:0:0	4
			Total	**19**

IV Semester

Sl. No.	Course Code	Course Title	L:T:P	Credits
1	SWD HC-13	Employee Relations and Legislation	2:1:0	3
2	SWD HC-14	Mental Health and Psychiatric Social Work	2:1:0	3
3	SWD HC-15	Major Project	0:2:4	6
4	SWD HC-16	Social Work Practicum – V	0:1:2	3
5	SWD HC-17	Social Work Practicum – VI (Block Placement)	0:0:2	2
6	SWD SC-6	Human Resource Development and Employee Wellness/Case Studies	3:1:0	4
			Total	**21**

Note: In a Semester for only one Soft Core Course, there can be two choices.

Objectives of the Course (Master of Social Work):

1. To provide education and training in social work to those desirous of making a career in social work practice.
2. To provide opportunities through intensive field practicum to work with variety of people in their development and provide service to those who are in need of it.
3. To provide inter-disciplinary collaboration for better understanding of human problems, services and issues related to human development.
4. To link theory with practice in every sphere of human service.
5. To develop requisite knowledge, skills and values in working with people.
6. To promote among learners a sense of responsibility and commitment to work with different sections of people and especially of the vulnerable sections of the society
7. To promote opportunities and to create awareness for personal growth
8. To acquire knowledge and skills in undertaking practice-based research and to administer human service organizations

Name of the Course:

The course shall be called **' Master of Social Work' (MSW)**.

Duration of the Course:

The Course of study **for MSW Degree** shall extend over a period of four semesters spreading over two academic years.

Regulations:

ELIGIBILITY FOR ADMISSION TO MSW COURSE
Candidates who have passed BSW/ BA/ B.Sc. / B.Com. / BBM/ B.C.A / LLB of the University of Mysore or any other university recognized as equivalent there to are eligible for admission to MSW course. Candidates will be selected for admission as per the general guidelines issued from the University of Mysore from time to time. The Department/University shall conduct entrance examination for admission to the course. The examination is of two hour duration and the question paper comprises of 100 objective type questions - 20% questions from general knowledge and current social issues, 60% from science & social sciences, and another 20% questions will be from reasoning and numerical ability. Merit will be assessed on the basis of performance in the entrance examination and performance in the undergraduate examination on equal weightage.

PATTERN OF QUESTION PAPER
Pattern 3 (The Question paper comprising of 3 parts: A,B and C as follows) **PART – A** There are 8 questions and a candidate has to answer any 5 questions. Each question carries 2 marks. This part covers all units of the syllabus. **PART – B** There are 8 questions and a candidate has to answer any 5 questions. Each question carries 5 marks. This part covers all units of the syllabus. **PART –C** There is a single question such as case study (may contain sub questions) covering entire syllabus carrying 15 marks. No choice.
ASSESSMENT OF SOCIAL WORK PRACTICUM
A viva-voce examination shall be conducted for each candidate in all semesters. The performance of the candidate shall be assessed by a committee consisting of three members as follows. 1. Chairperson of the Department 2. One Senior Member of the Faculty 3. One External Examiner

SOCIAL WORK PRACTICUM

The practicum with different learning opportunities is designed to provide scope to develop and enhance professional practice skills. Learning is aided through observation, analysis of social realities and experience of participation in designing and providing social work intervention.

The tasks are organized to help the learner acquire beginning skills, practice those already acquired, and master them from simple to complex. The learner is gradually encouraged to become an independent worker during the course of study.

Objectives

The objectives are met by providing a variety of experiences to learners to:

1. i. Develop the ability to observe and analyze social realities. Understand the
   ii. characteristics of social systems and their dynamics. Appreciate society's
   iii. response to people's needs, problems and social issues.
   iv. Develop critical understanding of the application of legislation, legal process, and social policy.

2. i. Develop the ability to examine the process of programme management and participate in the effort at various levels.
   ii. Develop the ability to recognize the need for newer programs, initiate and Participate in them.
   iii. Use Human Rights tools, understanding of gender justice, and need for equity in all intervention.
   iv. Develop an understanding of organizational structure, resource management, and day-to-day administration for human service programmes - developmental and welfare programmes
   v. Develop the capacity to integrate knowledge and practice-theory by participating in intervention.

3. i. Clarify and imbibe values which sustain positive attitude and professional ethics.
   ii. Develop the capacity for self-direction, growth and change through self awareness.

4. i. Enhance writing skills to document practice appropriately. Recordings to be viewed as an expression of interest, motivation and involvement in practice and as evidence of enrichment in the process of professional growth.

To meet these outcomes, several opportunities with specific objectives are designed. The different sets of opportunities with details of content and related tasks are listed separately.

Odd semester (I Semester)

Paper code: NSW -1

Paper Title: SOCIAL SCIENCE PERSPECTIVES FOR SOCIAL WORK PRACTICE

INTRODUCTION

This course provides the learners basic understanding of relevant concepts from social sciences to help the learners to study and understand social phenomenon. Further, it helps the learner develop skills for social analysis and understand developmental processes.

OBJECTIVES

a. Understand the concepts to examine social phenomenon. b. Develop skills to analyse Indian society and change.
c. Understand change and conflict.
d. Understand the system for economic order.
e. Develop skills for social analysis.
f. Understand the development and its impact.

Course Content

UINIT I

Sociology and its relationship to other disciplines: Meaning, scope and significance - Its relationship with other social sciences such as History, Economics, Politics, Psychology, Anthropology and Social work.

Society and Culture: Society as a system of relationship - Social Structure: Meaning, status and roles - Culture: Meaning and contents-Tradition, customs, values, norms, folklore and mores.

Indian Society: Composition of Indian Society: the concept of unity amidst diversity - Social classification in India: Tribal, rural and urban divisions - Social stratification in India: Meaning, caste, class divisions.
Socialization: Meaning, process of socialisation - The development of self - Agencies of socialisation.

UINIT II

Social Groups, Social Institutions and Social Control - Meaning and types: Primary and Secondary groups, in-groups and out-groups, reference groups - Types of social institutions: Marriage, Family, Religion, State and Law.
Meaning and Functions: Social Control exercised through the social institutions
Social Change: Meaning, characteristics and factors inducing change with reference to India.

Social Movements in India: Meaning, factors essential for a Movement - Dominant social movements in India - Social reform movement and contributions of social reforms - Peasant movement - Trade Union movement - Social movements and social change in India.

UINIT III

Development - A Human Right Perspective: Social Ideals of Indian Constitution - Fundamental Rights - Human Rights.

Socio-economic order and comparative economic system: Capitalism, Socialism and Mixed economy, their features, merits and demerits - Marxian political economy.

Social Analysis: Significance of social analysis: A brief analysis of socioeconomic, political and cultural systems - Inter-linkages in the Indian context.

UINIT IV

Under-development and its causes and Contemporary Development Dynamics: A historical overview with reference to developing countries of Asia, Africa and Latin America - North-south relations, world trades, Multinational corporations and their influences on Third World economics - Trends and counter trends (Paradoxes) in the global, political, economic, military, ecological and socio-cultural spheres.

Theories of Economic Development, Globalisation and its impact on Developing Countries: Stages of growth theory - Structural internationalist theory
Privatization, liberalization and structural adjustment programmes - Role of international financial institutions.

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Journals/ Magazines

Sociological Bulletin (Journal of the Indian Sociological Society).

Contribution to Indian Sociology.

Social Change, Issues and Perspectives (Journal of the Council for Social Development).

Economic and Political Weekly, EPW Research Foundations, Mumbai.

Paper code: NSW 2

TERM PROJECT

The term project is a team-exercise consisting 3 to 5 students. The team is expected to select a theme relevant to current social issues in consultation with the supervisor and make an exhaustive survey of literature on the chosen theme including empirical studies made on the same.

Further, the group shall also collect the experiences or opinions of people on the issues and make a detailed presentation.

Flexibility is accorded in planning and executing the term project. Creative and analytical approaches are to be carried out under the direct supervision of a faculty supervisor.

The report of the term project has to be submitted before the end of theory examination of that semester to the Department of Social Work, University of Mysore, Mysore through the supervisor and Chairman/Principal of the college.

The term project is offered only for the non-BSW students. However, students with BSW background are also encouraged to opt for the term project, as an innovative approach in social work, is they desire so.

Evaluation of the term project will be done along with the viva-voce examination by the viva-voce committee, constituted for the assessment of social work practicum or similar committee may be constituted, if required.

Odd semester
Paper code: SWAHC- 1
Paper Title: SOCIAL WORK - HISTORY AND IDEOLOGIES

INTRODUCTION

This course aims at introducing the learners to a critical inquiry into the history and ideologies of social change and professional social work.

OBJECTIVES

a. Understand the history of evolution of social work profession, both in India and the West.
b. Develop insights into the origin and development of ideologies, approaches to social change.
c. Understand rationale, goals, ideals and ethics for social change.
d. Understand the perceptions of people and social problems, the status of benefactors and their motives.
e. Develop skills to understand contemporary reality in its historical context.
f. Understand self as a part of own environment and explore own assumptions, ideals, values to develop sensitivity to marginalization of vulnerable groups.

Course Content:

UNIT I

Indian History of Social Work Profession: Introduction - Beginning of social work education - Welfare versus developmental orientation in social work - Professionalization of social work values, education, knowledge and professional associations - Goals, values, functions/roles and process of social work - Interface between professional and voluntary social work, social work ethics.

UNIT II

Indian History of Ideologies for Social Change -Ancient period: Vedic, Vedantic and non-Vedic Ideologies, Spirituality - Medieval period: Zoroastrianism and Islam in India - Mysticism of Bhakti and Sufi movements and Sikhism.

Modern period: Christianity in India - Hindu reform movements - Dalit movements - Gandhian ideology and Sarvodaya movement – Nationalism - Ideology of the Indian Constitution - Ideology of voluntary organisations and voluntary action.

UNIT III

Contemporary Ideologies for Social Change: Neoliberalism and Globalisation - Post modernism - Multiculturalism - Ideology of action groups and social movements - Ideology of non-governmental organisations.
Role of state in providing social welfare services.

UNIT IV

Western History of Ideologies for Social Change: Organized and scientific charity - Beginning of social work education - Clinical social work - Ecological social work - Attributes of a profession.

Western History of Social Work Profession - Medieval period: Judeo-Christian-ideologies - Secular humanism and Protestantism - Modem period: Rationalism and Welfarism - Liberalism and democracy - Utilitarianism and Social Darwinism - Socialism and human rights - Emerging ideologies of professional social work.

REFERENCES

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Journals/ Magazines

Economic and Political Weekly, The Indian Journal of Social Work, Lokayan Bulletin and Vikalp.

Odd semester
Paper code: SWAHC- 2
Paper Title: WORK WITH INDIVIDUALS AND FAMILIES

INTRODUCTION

This course aims to develop simple to complex skills of working with individuals and families in various situations like crisis, preventive, facilitative and developmental.

OBJECTIVES

a. Understand casework as a method of social work, and appreciate its place in social work practice.
b. Understand the values and principles of working with individuals and families.
c. Develop the ability to critically analyse problems of individuals and families and factors affecting them.
d. Enhance understanding of the basic concepts, tools and techniques in working with individuals and families, in problem-solving and in developmental work.
e. Develop appropriate skills and attitudes to work with individuals and families.

Course Content

UNIT I

Social case work: Definitions, scope, historical development - Influence of psychoanalysis on casework - Introduction of casework as a method of social work - Concepts of adjustment and maladjustment - Philosophical assumptions and casework values.

Principles of casework: Individualization, acceptance, non-judgmental attitude, participation, relationship, effective communication of feeling, client self-determination, and confidentiality.

Components of social casework: The person, the problem, the place and the process.
Process in casework: Study, assessment, intervention, evaluation, follow-up, and termination.

UNIT II

Types of problems faced by Individuals and families; individual differences and needs - Family assessment in casework practice.

Theories and approaches: Psycho-social approach, Functional approach, Problem-solving approach, Crisis Theory, Family intervention, Behavioural modification, Transactional analysis and Holistic approach.

UNIT III

Tools for Help: Case work tools: Interview, home visit, observation, listening, communication skills, rapport building.
Records: Nature, purpose and principles of recording.

Techniques of casework: Supportive, resource enhancement and counseling.
Self as a professional: Professional self - Conflicts and dilemmas in working with individuals and families.

UNIT IV

Application of Method: Primary and secondary settings - Application of methods in family, women, and child welfare settings, marriage counselling centres, schools settings, medical and psychiatric settings, correctional institutions, and industry.

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Odd semester
Paper code: SWAHC -3
Paper Title: WORK WITH GROUPS

INTRODUCTION

This course aims at developing the understanding of Group Work as a method, developing skills for intervention, and gaining knowledge of the scope of this method in various settings.

OBJECTIVES

a. Develop awareness about the specific characteristics of Group Work and its contributions as a method of social work intervention,
b. Gain knowledge about group formation and the use of a variety of group approaches.
c. Develop understanding of concepts, dynamics and small group theory in relation to all types of groups, e.g. family, staff, committee, long-term client groups.
d. Identify the various situations and settings where the method could be used in the context of social realities of the country.

Course Content

UNIT I

Introduction and history of Group Work: Understanding of groups - Characteristics and significance of group - Definition of Social Group Work - Characteristics of Social Group Work - Purpose of Social Group Work; Historical evolution of group work with special emphasis on the Indian Context.

Type of Groups: Types and approaches based on objectives and purpose - Type of

membership - Time duration - Social group work in different settings and analysis of group processes.

Values and Principles in group work and Characteristics of Group formation: Values in social group work- Principles in group work - Assumptions underlying social group work - Factors of group formation - Formulation of goals - Identification of problems for work.

Pre-group and Initial Phase: Planning model - Characteristics of pre group phase - Group structures - Facilitation skills and role of worker in pre-group and initial phase.

UNIT II

Group Processes and Group Dynamics: Importance of group processes - Typical patterns - Processes in different type of groups - Worker's skills in identifying and understanding processes - Bond, sub-groups, role.
Leadership - Isolation - Decision making - Conflict – Communication - Relationships.

UNIT III

Middle Phase and Use of Program: Characteristics of middle phase - Group structures - Group dynamics - Facilitation skills - Role of group workers - - Comparison across phases - Concept and principles - Program planning - Skills in program planning

Facilitation: Knowledge of skills and techniques for effective work with groups/problem solving.
Recordings in Group work: Importance of recording in social group work - Principles of recording - Recording structure - Types of recording.

UNIT IV

Evaluation in Groups and Termination Phase : Importance of evaluation - Types of evaluation - Methods of evaluation - Need for termination - Types of termination - Characteristics of termination phase - Worker's skills.

Application of Group Work: Application in health settings, school settings, family welfare settings, industrial settings, women and child welfare settings.

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Odd semester
Paper code:SWAHC-4
Paper Title: WORK WITH COMMUNITIES

INTRODUCTION

Community organization / development, as a method of social work practice, is seen as a means to facilitate communities towards self-directed change. It takes as its basis the inequalities in society manifested through processes of marginalization, discrimination or disempowerment of groups, which have resulted in the loss of control over resources, be they tangible or intangible. The strategies of Community Organisation practice being addressed as part of the course cover a range spanning different ideologies, from those being people-initiated, and those that are initiated by the elite. Community organization is seen as a means as well as an end, where collective processes are to sustain the community's capacity to bring about change.

OBJECTIVES

a. Understand the critical elements of community organisation practice.
b. Enhance critical understanding of the models and strategies for community organisation practice.
c. Make the micro-macro connections between the range of complex issues in practice.
d. Develop attitudes conducive to participatory activities for civil society.

Course Content

UNIT I

Community: Concept, characteristics, types and functions.
Understanding of community organisation practice: Definition of community organisation, values and principles of Community Organisations, ethics of community organisation practice.

Community Organisation Practice: Community work within social work, Understanding Human Rights in community organisation practice.
Historical development of community organisation practice.

Power: Concept of power - The range of perspectives - Dimensions of power relevant to community organization.

Empowerment: Concept of Empowerment - Barriers to, process and cycle of empowerment.

Gender and Empowerment: Gender sensitive community organization practice

UNIT II

Models and Strategies of Community Organization - Locality Development Model - Social Planning Model - Social Action Model - Select methods of public interest mobilization, litigation, protests and demonstrations, Dealing with authorities, Public Relations, Planning, Monitoring and Evaluation - Roles in different models attributes and attitude.

UNIT III

Community Organization as a Method: Relevance of community organisation as a method across different spheres of social work intervention and relook at own attitudes.

Skills of Community Organization Practitioner: Problem analysis, resource mobilization, conflict resolution, organizing meetings, writing and documentation, networking, training.

UNIT IV

Strategy and Roles: Unionization as a strategy - Advocacy in community organization.

Current debates in Community Organisation Practice: Emerging issues - Impact of macro policies.

REFERENCES

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Journals

Community Development Journal: An International Forum, UK, Oxford University Press.

Development and Change, Hague Blackwell Publisher.

Paper code: SWAHC-5
Paper Title: HUMAN GROWTH AND DEVELOPMENT

INTRODUCTION

The course aims to introduce the learners to the development of the individual across the life span, in a system and an ecological perspective. It also provides an understanding of human development and behaviour, in contextual influences, including individuals in disadvantaged or special contexts. The theoretical inputs are to enhance the understanding of people's growth, health, and development at various stages as bio-psycho-socio-spiritual being over the life span.

OBJECTIVES

a. Develop an overall understanding of the principles of growth; their relevance and application to behaviour at various phases in the life span.
b. Understand the twin roles of individual's heritage and environmental influences in growth and development.
c. Understand interactional nature of growth and behaviour at various stages in the life span: infancy, childhood, adolescence, youth, adulthood and old age, and impact of cultural aspects.
d. Develop sensitivity towards needs, developmental tasks and health status along with need for developmental programmes for the same.
e. Apply the information of growth, development and health in social work practice in general and individuals, groups and communities in particular.

Course Content

UNIT I

Life Span: Beginning of life - Human reproductive system; Fertilization and Foetal development - Delivery and pre-natal and post-natal care and their importance in development.
Principles of growth and development - Methods of studying human behaviour, - Role of heredity and environment - Social customs traditions, values in parenting and child rearing practices, deprivation and development during stages of life span. Understanding of the Indian concept of life span stages.

UNIT II

Developmental periods: Infancy, babyhood, childhood, puberty, adolescence -. Growth, hazards, lifestyle effects
Adulthood - Growth, personal and social adjustment, health, sexuality, vocational and marital adjustment.
Aging - Characteristics, hobbies, adjustment, physical and mental health, death, dying and bereavement.
Special focus is on psychosocial development, moral development, and personality development vis-a-vis the influence of the contexts of development., (The contexts here refers to gender, family, significant others, neighbourhood: peers, school, community, work place and other larger contexts like the society and culture. Emphasis is placed on the Indian context of development, variations from the

normal patterns of development and views on the stages)

UNIT III

Theories of Human Development: A critical look at the theories of human development - Freud's psychosexual theory, Erikson's psychosocial theory, learning theories.

UNIT IV

Basic human needs: Physical, psychological and intellectual needs, stress - Coping and social support.
Motivation, frustration and conflicts - Emotions and emotional behaviour.
Personality: Definition, nature, types and assessment of personality.
Intelligence: Concept, levels of intelligence, influence of heredity and environment, assessment of intelligence.
Relevance of Psychology to social work practice across the stages of development, period specific needs, tasks and challenges.

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Odd semester
Code: SWAHC-6

Title: SOCIAL WORK PRACTICUM - I

Orientation provides information regarding.

i. the importance and place of the practicum in the educational programme.
ii. the purpose, functions and ethics in professional practice.

In the first four weeks, the learners may make a local directory to include emergency numbers of Hospitals/ PHCs/ Police/ Panchayath Office and Network Agencies along with references to other developmental and welfare services in the location.

Visits - provide an exposure to and understanding of the services provided in responses to people's needs. (Agencies in health setting, education, community, institutional services, criminal justice system, civic administration, rehabi1itation etc.)

Structured experience laboratory - is a classroom activity, which provides opportunities through the games/activities, to form the involvement of self in various practice skills. These laboratory experiences are designed in small groups to encourage participation, sharing of the experience and aid in examining learning and applications of skil1s. These sessions have a specific objective of experiencing self, and applying /using self in practice. (Relationship skills, Communication skills etc., will be focused)

Concurrent practice learning of two-days a week - on going learning of practice is an opportunity to develop intervention skills in reality situations. This entails learning social work practice for two, or two and a half days or its equivalent, each week of the semester.

The learners may be placed in agencies or in communities to initiate and participate in direct service delivery. Practice learning is a vital component of the educational opportunity to be provided to the learner. The teaching-learning process must be designed to help the learner to move on the mastering strategies, skills and techniques to practice social work.

Even semester (II Semester)

Code: SWBHC -7

Paper Title: MANAGEMENT OF DEVELOPMENTAL AND WELFARE SERVICES

INTRODUCTION

The course aims to develop management competencies to function in organizations, participate as a team member and understand the role of a social work programmes manager.

OBJECTIVES

a. Understand the overall environment and its impact on the nature, structure and development of organizations in corporate, public and voluntary sectors in the context of social work profession.
b. Understand policies and procedures involved in establishing and maintaining human service organizations.
c. Acquire skills to network and participate in the management of resources - human, material and environmental.
d. Develop skills to participate in management of programmes, as a part of the inter-disciplinary team and initiate as well as develop new programmes.
e. Develop ability to analyse the practices applied in specific settings.

Course Content

UNIT I

Social Services: Need for welfare and developmental organisations, Factors determining social welfare programmes, Development and Welfare organizations' response to societal needs; role of state, voluntary and corporate sector.

Management services: Types of settings, organizational characteristics like origin, nature, size, structure, and design, organizational climate and impact of socio-political environment - Management process: Vision, Planning, Organizing, Directing, Staffing, Coordination, Reporting, Budgeting.

Establishment: Registration, different types of legislations, legal status, constitution, rules and procedure, goals - Financial resources: Organizational Budget, Sources of finance, Fund Raising, Records, Audit.

UNIT II

Physical: All activities related to acquiring, hiring and maintaining importable structure and infrastructure, maintenance of premises and daily upkeep.

Enhancing the involvement and the potential of people in organization's executive boards, committees; professionals and other staff-relationship, communication, team work, and facilitating team building, supervision, and participation in training.

UNIT III

Programme Development: Programme management: long term, short term, and Documentation.

Project proposals based on felt-needs, nature of resources, eligibility criteria, records, evaluation and research.

Impact analysis - Qualitative and quantitative.

UNIT IV

Public Relations: Public relations need and its promotion by all in the organisation. Representing the organization, networking, public, corporate and voluntary sector, resource building, accountability, transparency, use of media for publicity.

Change and its Management: Understand and manage change, innovation in a rapidly changing social environment: for policy programmes and structure.

Organizational understanding: Conflict, conflict resolution, creating positive climate.

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Paper Code: SWBHC-8
Paper Title: SOCIAL WORK RESEARCH AND STATISTICS

INTRODUCTION

This course is to equip learners to utilize, and conduct research as service managers to improve services, evaluate, and develop new services and intervention methods: strategies and techniques and also, be an effective consumer of other researches.

OBJECTIVES

a. Develop an understanding of scientific approach to human inquiry in comparison to the native or common sense approach in various aspects, and its process.
b. Understand major research strategies, meaning, scope and importance of social work research.
c. Develop an ability to see the linkages between practice, research, theory and their role in enriching one another.
d. Develop ability to conceptualize, formulate and conduct simple research projects/exercises (This would include a broad range of basic research skills such as conceptualization of a research strategy and problem; writing a research proposal; developing tools for col1ecting data; use of sampling, strategies; data collection, processing, presentation, analysis and interpretation; and writing research report etc).
e. Make informed assessment and judicious use of research studies and findings.
f. Develop skills for use of library and documentation services for research.

Course Content

UNIT I

Science - Meaning and assumptions, scientific approach in comparison to the native or common sense approach.

Scientific attitude; Scientific method; application of scientific method for the study of social phenomena.

Research: Definition and objectives, Social Work Research: Meaning, objectives, functions and limitations; Scope of social work research in India; Agencies sponsoring and conducting social work research, ethics in research.

Problem identification: Criteria for the selection of research problem; Problem formulation.
Concepts, constructs, variables, conceptual and operational definitions. Hypothesis: Meaning, importance, uses and requirements.

UNIT II

Design of research: Definition and importance; types of research design; exploratory,

descriptive, experimental, evaluative design, participatory research and action research.

Source and Types of Data: Primary and secondary, objective and subjective, qualitative and quantitative.

Sampling: Sample and population: Rationale and Characteristics of sampling; methods of sampling, general considerations in the determination of sample size.

Methods of collection of primary data:
Observation: Structured and unstructured; participant and non-participant. Questionnaire, interview schedule and interview guide. Pilot study and Pre-testing.

Scales: Need for scales, some prominent scaling procedures.
Case study: Meaning, uses, steps.

Secondary data: Official data, personal documents, problem in the use of secondary data

UNIT III

Processing of data: Content, editing, coding data classification, manual and mechanical tabulation of data; frequency distribution, diagrammatic and graphic presentation - use of computers.

Issues related to Social Work Research: Interpretation of data, research reporting: contents of research report: foot-note, references, bibliography, preparation of abstract; the art of making book review.

UNIT IV

Statistics: Definition, functions and importance
Measures of Central Tendency; Measures of Dispersion.
Chi-square, Correlation Coefficient, 't' distribution; Analysis of Variance and 'F' distribution.

SPSS package.

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Code : SWBHC-9

Title: SOCIAL WORK PRACTICUM - II:

SOCIAL WORK CAMP:

Rural/ Tribal camps with a duration of 7 - 10 days - provide opportunities to experience rural life, analyze rural dynamics, and observe the functioning of local self government and voluntary organisations. This experience aids peer participation in planning for activities for own group and those for local people. It also helps develop skills to carry out, evaluate, and report the experience.

SUMMER PLACEMENT:

Summer Placement - provides an opportunity to experience day-to-day work in a setting. The learner gets involved with direct practice with the client system and with the ongoing management operations of the setting. The time frame recommended for this experience is about three weeks, after the first year of the post-graduate programme. The learner may use the same setting for data collection of research project, if such an arrangement is part of the plan.

Code: SWBHC -10
Title : SOCIAL WORK PRACTICUM - III

Concurrent practice learning of two-days a week - on going learning of practice is an opportunity to develop intervention skills in reality situations. This entails learning social work practice for two, or two and a half days or its equivalent, each week of the semester. The learners may be placed in agencies or in communities to initiate and participate in direct service delivery. Practice learning is a vital component of the educational opportunity to be provided to the learner. The teaching-learning process must be designed to help the learner to move on the mastering strategies, skills and techniques to practice social work.

Even semester
Paper Code: SWBSC-1
Paper title: COMMUNICATION AND COUNSELING

INTRODUCTION

This paper relates the relevance of components of communication and counseling in social work practice.

OBJECTIVES

a. Understand the meaning and importance of communication in day-to-day life.
b. Focus on interpersonal communication of interviewing and allied aspects.
c. Develop holistic understanding of counseling as a tool for help.
d. Acquire knowledge of various approaches: their theoretical under-pinnings for goals, values, processes and techniques,
e. Develop skills of application to real life situations.

Course Content

UNIT I

Communication: Meaning and importance of communication.
Process of communication: Key elements in the communication process - Communication, message, audience; channel of communication. Verbal and non-verbal communication.

Basics of Communication.
Education and communication for national development.

Interpersonal communication: Interviewing - Objectives, principles of interviewing; listening, qualities of effective communicator.
Seminars, conferences, lectures, group discussion, panel discussion, symposium, workshop, role playing, simulation exercises, written communication, report writing, letter writing, article/essay writing, games, brain storming, street play, field work exposure.

UNIT II

Visual aids in communication: Poster making, use of notice boards, flip charts, charts, flash cards, photographs, pamphlets, slide shows.

Mass Communication: Television, exhibition, newspapers and magazines, advertisements, radio, film, VCD/ DVD, e-mail, internet.

Impact of mass communication on society, family, marriage and child development.

Communication Analysis and Planning: Planning and executing a communication campaign on an issue using various methods of communication.

UNIT III

Counseling: Definition, nature and goals, areas of counseling; Historical background and origins of counseling, ethical nature of counseling, qualities of an effective counselor.

Counseling Situations: Developmental, preventive, facilitative, and crisis.

Counseling and Psychotherapy - Skills in counseling - Establishing the relationship.

Process of Counseling.

Approaches to Counseling: Approaches; Theoretical base, thrust, goals, key concepts, techniques - Approaches like person-centered, rational-emotive, behavioural approaches, gestalt, existential approaches, Egans three stage model, eclectic model.

Indigenous Approach: Indigenous approaches of help and self-help like yoga, reflection. Act of Prayashchit.

UNIT IV

Couple and Family Counseling: Issues in such counseling, its process and stages.

Crisis Counseling

Group Counseling: Counseling for groups - Process, advantages and disadvantages of group counseling.

Practice of counseling in family counseling centres, family courts, counseling bureau - Premarital and marital counseling, vocational counseling centres, mental health centres, child guidance clinics, correctional institutions, deaddiction and rehabilitation centres, educational institutions.

REFERENCES

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Paper code: SWBSC -1

Paper Title: GANDHIAN APPROACH TO WELFARE AND DEVELOPMENT

INTRODUCTION

The course aims at sensitizing the learner to the Gandhian approach and to utilize some of the skills in practice.

OBJECTIVES

a. Develop an understanding of Gandhi's concept of society and his approach to social transformation.
b. Develop knowledge of the specific programmes formulated by Gandhi for rural reconstruction and the development of the weaker sections of society, with the focus on strategies and skills.
c. Develop the ability to identify similarities and differences between the Gandhian and professional social work approaches to social change, welfare and development.

Course Content

Unit I

Gandhian thought: Salient features of Gandhian thought; Gandhian values; Concepts and methods; Concept of a healthy society; Sarvodaya.

Unit II

Gandhian Approach: Economic and its organization: Ownership of property; Concept of trusteeship, distribution and economic equality; System of production, problems of mechanization, decentralization of production, rural- urban relationship

Unit III

Social Organisation: Marriage and family, position of women, social stratification, caste and untouchability, education and its role; Basic education.

Unit IV

Constructive programmes: Contents training of constructive workers, skills involved, nature of programmes; Boodan, Gramdan.
Gandhian and Vinbobha's movements with special reference to Bhoodan and Gramdan

Gandhian and Professional Social Work Approach: Similarities and differences between Gandhian and professional approach to social development and welfare

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Even semester
Paper Code: SWSC-2
Paper title: PERSONAL AND PROFESSIONAL GROWTH.

INTRODUCTION

The course aims at enhancing personal and professional effectiveness by developing a continuous awareness and deeper insight into one's being. It encourages value clarification, upholding of professional ethics, and ability to make effective choices for integration. It provides opportunities to understand stress, stressors and methods to handle stress experienced.

OBJECTIVES

a. Understand self as a being, as one in the process of becoming and experience self-awareness.
b. Examine own values and attitudes and explore choices made to express self in own environment.
c. Develop positive life skills and practice self-help methods for integration and for stress reduction.
d. Understand and uphold professional values and ethics.

Course Content:

UNIT I

Self and Self Awareness: Understand self through a cognitive construct/paradigm (two/three models from among those available may be offered as workshops). Suggested approaches are: Rational Emotive Therapy, Gestalt Approach, Transactional Analysis, Reality Therapy, Yoga for Therapy, Meditation Techniques.

Explore self as being, and understand the process of becoming. (through observation)
Practice consciously measures to sustain and experience continuous awareness.
Observation and Reflection: Theory and techniques.
Communication Choices: Communication mode and patterns and effectiveness, Interpersonal communication, nature of choices made.

UNIT II

Emotions and their Expression: Emotions, nature of expression.
Understand own pattern of communication, choices made to express emotions, modes used, examine need for change.

Communication: Informal and knowledge and skills of rapid reading, writing, creative writing, report writing and public speaking.

UNIT III

Creativity and Self: Understand brain functions: Creativity, need and development
Life Style: Conscious life style - enhanced life skills: Communication, decision making, empathy, critical thinking, use of time and money, building and sustaining bonds-relational, colleagial and personal.
Self defeating behaviour - nature and impact. Choices for change.

UNIT IV

Values, Attitude and Professional Ethics: Values and attitudes - their role in life, Value conflict - its impact, value clarification.

Integration: Through Eastern and Western approaches experience the processes of integration. Approaches recommended are: Yoga as a science, meditation (tool for meditation - own choice).

Stress / Burn out - Self help Methods: Stress, Stressors, nature and impact of stress, its expression, and burnout.

Spirituality and Growth.

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Paper code: SWBSC-2

Paper Title: POPULATION AND ENVIRONMENT

INTRODUCTION

The content has two aspects to it. Population dynamics and its relatedness to the environment, natural resources, utilization and their preservation.

OBJECTIVES:

a. Understand characteristics, determinants of population growth.
b. Examine population policy, plan and initiatives.
c. Understand inter-relatedness of human life, living organisms and environment.
d. Examine utilization and management of resources.
e. Develop skills to participate in activities related to the two areas.

Course Content

UNIT I

Characteristics of population: Population, determinants of growth. global concerns - Characteristics of Indian Population – Distribution by age, sex, literacy and occupation – Fertility trends - Birth and death ratio.

Population Policy, World Action Plan, Population Policy of India- Implementation; Initiatives – Government and NGO.

UNIT II

Family Planning: Objectives, scope, methods, implementation, mechanisms and progress.

Concept and Scope of Population education, family life education, sex education, and family planning education.

Population and Environment: Interrelatedness of human life, living organisms; Environment and natural resource – Environment, lifestyle, degradation. Environment management, maintaining, improving, enhancing – Current issues of Environment.

UNIT III

Natural Resources and Diversity: Utilisation and management – Forest, land, water, air, energy sources - Pollution - Sources, treatment, prevention - Soil, water, air, noise - Waste matter - disposal, recycling, renewal, problems, issues - Programmes for forest, land and water management.

UNIT IV

Environment Protection Laws and Role of Social Worker: Acts related to environmental protection – Forest conservation- Water pollution – Standards and tolerance levels – Unplanned urbanization- Environmental movements in India - Role of NGOs in Environmental issues – Government agencies in environmental protection – Social work initiatives at different levels.

REFERENCES

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odd semester (III Semester)

Odd Semester

Paper code: SWCHC-11

Paper Title: **HUMAN RESOURCE MANAGEMENT**

INTRODUCTION

The main objective of this course is to prepare young graduates for management and administrative positions in various industrial, business, governmental/non-governmental organisations and service sector organisations.

OBJECTIVES

a. Develop managerial skills in different functional areas of management with practical focus on HRM.
b. Develop the competence to evolve the problem-solving approaches by applying conceptual and behavioural skills.
c. Develop interpersonal skills/ competence and leadership qualities to work in a group with team building approach.
d. Develop sound theoretical base in various concepts and theories to enable the student to develop a broad perspective of the management field.
e. Distinguish the strategic approach to Human Resources from the traditional functional approach.
f. Understand the relationship of HR strategy with overall corporate strategy.

Course Content

UNIT I

Human Resource Management: Concept, scope, philosophy and objectives; Evolution; Approaches, Structure and Functions; Line and staff relations of HRM; HRM Model. Hierarchy, formal and informal structure, Organization chart/reporting structure.

Human Resource Planning: Concept and objectives; Human resource inventory; Human resource planning process; job analysis; job description; job specification; job design; career planning and career paths; job rotation.

UNIT II

Talent Acquisition: Goals; polices, sources and methods. Selection: Concept, process. Talent Acquisition Tests, Theories and issues in psychological testing, Intelligence testing – theoretical background, Aptitude Testing, Personality Assessment, MBTI. Placement, Induction and socializing the new employee. Talent retention: Concept, importance and methods.

UNIT III

Compensation Management: Factors influencing compensation plans and policies; Job evaluation - Fixation of salary, components of salary. Pay for performance – Incentive Schemes, principles and types, Employee Stock Option Plan, compensation survey / review

UNIT IV

Strategic Human Resource Management (SHRM): Business strategy and organizational capability, SHRM: aligning HR with Corporate strategy, Strategic HR planning and Development, Change Management and restructuring and SHRM, Corporate Ethics, Values and SHRM, Competencies of HR professional in a SHRM scenario.

REFERENCES

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Odd semester
Code: SWCHC-12
Title: SOCIAL WORK PRACTICUM - IV

Workshops: Skills Development - help learners acquire specific skills for situations encountered during practice and acquire skills for intervention. These may be for problems/ concerns, issues or situations like work with alcoholics, HIV/AIDS affected persons, adolescents for life ski11s development, youth for leadership development and couples for marital relationship and enrichment work with elderly. These workshops are to enhance skills/ develop new skills for practice in specific situation, specific problems and issues.

Concurrent practice learning of two-days a week -on going learning of practice is an opportunity to develop intervention skills in reality situations. This entails learning social work practice for two, or two and a half days or its equivalent, each week of the semester. The learners may be placed in agencies or in communities to initiate and participate in direct service delivery. Practice learning is a vital component of

the educational opportunity to be provided to the learner. The teaching-learning process must be designed to help the learner to move on the mastering strategies, skills and techniques to practice social work

Odd semester
Paper code : SWCSC-3
Paper Title : SOCIAL WORK WITH TRIBAL AND RURAL COMMUNITIES.

INTRODUCTION

This course aims at introducing the learner the programmes of tribal and rural development, and the importance of social work practice with tribal and rural communities.

OBJECTIVES

a. Develop an understanding of tribal and rural communities.
b. Understand the characteristics and problems of tribal and rural communities.
c. Acquire knowledge about the contribution of Governmental and Non-governmental Organisations to tribal and rural development.
d. Develop an understanding of the functions of Panchayath Raj Institutions with particular reference to Karnataka.
e. Gain knowledge about the application of social work in tribal and rural development programmes.

Course Content

UNIT I

Tribe in relation to caste and nation - Nature and Characteristics of Primitive Cultures- Tribes in India and their ecological distribution.
Emerging Trends in Tribal Social Institutions - Family and Kinship Systems, Jati Structure, Economic Structure, Political organisations.

Characteristics of Tribal Society - Economic, Social, Political and Cultural Problems of Tribal Life.

UNIT II

Government Programmes since Independence and their Impact on Tribal Societies - Programmes of Voluntary Agencies and their Impact on Tribal Societies.

Analysis and Assessment of Tribal Community Problems - Special Problems of the Tribals in a particular area.

Social Work Practice in Tribal Development: Community organisation as a method of intervention, Participatory Rural Appraisal (PRA), Logical Framework Approach/Analysis (LFA), techniques of intervention and its scope in tribal community development.

UNIT III

Rural Society and Poverty - Historical perspective - Dynamics in the village society – Caste/class relationships - Control and Power, Conflict and Integration. Poverty in the rural context - Its nature and manifestations. Analysis of Basic Problems - Issues faced by the rural poor such as indebtedness, Bonded labour, Low wages, Unemployment, Underemployment, and other forms of exploitations.

UNIT IV

Current Rural Development Programmes in India: Council for the Advancement of People's Action and Rural Technology (CAPART) and other Rural Development Statutory Bodies.

Panchayath Raj System in Karnataka and its role in rural and tribal development.

Role of social worker in tribal and rural development progrmmes. **REFERENCES:**

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Paper code SWCSC-3

Paper Title: ORGANIZATIONAL BEHAVIOUR AND ORGANIZATIONAL DEVELPOMENT

INTRODUCTION

The course aims to provide an understanding of human behavior at work so that the learner may acquire the skills required to analyze problems and develop a problem-solving approach.

OBJECTIVES:

a. To impart knowledge about individual, group and organizational dynamics and their consequences,
b. To make clear the concepts and approaches that help in developing models or systems that support human ingenuity.
c. To acquaint the students with the knowledge of theories and practices that govern human behavior at work,
d. To help the learner understand the value and worth of human resources in an organization.
e. To enable the students to become aware of their communication skills and sensitize them to their potential to become successful managers.
f. To gain self-confidence and healthy self-respect while retaining respect for other's rights.
g. To understand the application of Transactional Analysis in several areas of employee management.

Course content

UNIT I

Conceptual Framework: Organization Behavior: Definition, concept, approaches and scope, historical background of Organization Behavior.

Introduction to Enneagram, personality types according to Enneagram. Emotional Intelligence; Attitude, Values, Personality; Job satisfaction, Employee Morale : Meaning, influences and outcomes - Measuring job satisfaction.
Assertiveness Training: Benefits of assertiveness – components of assertive behavior, measuring assertiveness, handling fear, handling anger, handling depression, developing assertive behavior skills, assertiveness on the job, assertiveness in interpersonal relations.

UNIT II

Transactional Analysis (TA), TA and self awareness, Winners and Losers, Structural analysis, Life positions, transactions, games and strokes, Life scripts, TA applications in motivation, Leadership and Teamwork, TA in counseling.

Motivation: Concept and theories, techniques of motivation, role of reinforcement and punishment, motivation and organization reward system, awards, employee empowerment and engagement.

UNIT III

Leadership: Meaning, roles, skills, and styles, leadership theories, types of leadership, powerful persuasion strategies.

Group dynamics: Concept, types of groups, dynamics of group formation, decision making in groups.

Organization Development: Concept, emerging approaches and techniques, Foundations of OD, Organizational Diagnosis, OD interventions – An overview, individual and interpersonal interventions, team/group interventions, comprehensive interventions, organizational transformation, success and failure of OD, Planned Organizational change, feedback and OD.

UNIT IV

Organizational Conflict: Concepts, causes and types, conflict-resolution strategies.

Organizational change: Concept, forces of change and resistance to change, managing organizational change and diversity, facilitating creative and divergent thinking, planned organizational change.

Stress and Burn Out: Concepts, causes, consequences and coping strategies.
Managerial Ethics: Individual ethics, ethical dilemmas in management, Ethical practices of Indian Managers, Corporate ethics.

REFERENCES

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Odd semester

Paper code: SWCSC-4

Paper Title: PREVENTIVE AND SOCIAL MEDICINE AND MEDICAL SOCIAL WORK

INTRODUCTION

This course introduces the basic health issues and the application of social work in health setting both in hospital and community.

OBJECTIVES

a. Understand the concept and dimensions of health.
b. Understand the issues related to the prevention, clinical features and treatment of major communicable and non-communicable diseases.
c. Trace the historical development of medical social work in India and abroad.
d. Understand the nature of medical social work services.
e. Understand the tenets of National Health Policy of India and modernization of community based health care services. .
f. Understand the health care services at different levels.

COURSE CONTENT

UNIT I

Concept of health : Physical, social, mental and spiritual dimensions of health - Positive health - Determinants of health - Health and development - Indicators of health. Concept of Prevention: Levels of prevention - Hygiene, public health, preventive medicine, community health, social medicine, community medicine.
Health Care of the Community; Concept of health care - Levels and principles of health care.

UNIT II

Communicable and Non-communicable Diseases: Leprosy, Tuberculosis, Sexually Transmitted Diseases (STDs), HIV/AIDS. Cancer, Hypertension, Accidents, Diabetes, Blindness, Neurological problems, Mental illnesses.
Maternal and Child Health Services - Immunization – Integrated Child Development Services (ICDS) Scheme - School health programmes.

UNIT III

Medical Social Work: Meaning, Definition and Scope - Historical background and nature: Medical Social Work in India and Abroad - Team work and Multidisciplinary approach in health care; Organization and administration of medical social work departments in hospitals.
Patient as a person and Role of Social Worker: Understanding the patient as a person; Illness behaviour and treatment behaviour of the patient - Impact of illness on the patient and family.
Role of social worker with patients and their families - Rehabilitation.

UNIT IV

National Health Policy of India, Directorate General of Health Services, Indian Council of Medical Research (ICMR), Health as a concurrent subject.

Health System in India - at the Centre, at the State level, at the district level, and village level. Health Education and Communication.
Voluntary Health Agencies in India - International health - World Health Organisation (WHO), UNICEF, UNDP, FAO, ILO, World Bank.

Non - governmental and other Agencies - Ford Foundation, CARE, International Red Cross, Indian Red Cross.

REFERENCES:

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Paper code: SWCSC-4
Paper Title: **REHABILITATION AND AFTER CARE SERVICES**

INTRODUCTION

Rehabilitation of differently abled people is a noble and worthy endeavor, requiring the combined knowledge of the psycho-social theory and practical skills and techniques of social work. The current paper facilitates social work students to work with the specific group of clientele suffering from various types of disabilities and impart application of specific professional social work methods to cater to the needs of this population.

OBJECTIVES:

a. To understand the concept of handicap, rehabilitation and the scope for practice.
b. To identify the specific client categories requiring the rehabilitation services, problem specificity and rehabilitation service interventions.
c. To acquaint oneself with different rehabilitation settings, different therapeutic approaches to rehabilitation process.
d. To acquire the social work skills adapted to facilitate the process of rehabilitation,the rights and legal provisions provided for differently abled people and assimilate the knowledge of social work practice to disability specific client service.

Course Content

UNIT I

Rehabilitation: Definition and scope for social work interventions; definition of Impairment, Disability, Handicap; causes of Handicap - heredity, acquired, Major illnesses - physical, neurological and psychiatric Stress, vulnerability, coping and competence to deal with handicaps; Need for comprehensive rehabilitation – psycho-social rehabilitation

UNIT II

History, philosophy and principles of psycho-social rehabilitation; specific problem areas – physical handicap - vision, hearing, orthopedic, speech and language difficulties, mental retardation and others; neurological, psychiatric problems, disasters, alcohol and drug usage, terminal illnesses and any other.
Intervention in rehabilitation: Assessment, planning, intervention, evaluation, tools for assessment, follow-up services.

UNTI III

Rehabilitation Settings: Hospital based, day-care, night-care, quarter-way home, half- way-home, group home, hostels, long-stay homes, vocational guidance centre,

sheltered workshop, occupational therapy centre, community based rehabilitation centre, home care, inclusive education and others
Approaches: Therapeutic community, behavior modifications, transactional analysis and eclectic approach

UNIT IV

Practice of Social work methods in the process of rehabilitation: Case work, group work, community organisation, research, administration and social action.
Legal provisions for differently abled people – The Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participation) Act 1995, Rehabilitation Council of India: Formation, scope and functions, governmental policies and programmes, initiatives from the non- governmental sectors.

International trends and national initiatives in the rehabilitation scenario.

REFERENCES

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Paper code: SWCSC-5
Paper Title: SOCIAL POLICY, PLANNING AND DEVELOPMENT

INTRODUCTION

The course introduces the learner as to how policy is a link between Constitutional Principles, Development Plans, Legislative and Executive Actions. The analysis of these processes is to enable utilization of the knowledge to improve social work practice.

Further, it provides a critical and analytical framework to understand key concepts, development processes and current issues, pertaining to different parts of the world, with specific reference to India. This course is expected to provide the social work students with a context for micro-level interventions.

OBJECTIVES

a. Gain knowledge of policy analysis and the policy formulation process.
b. Acquire skills in critical analysis of social policies and development plans.
c. Develop an understanding of social policy in the perspective of national goals as stated in the Constitution, particularly with reference to Fundamental Rights and the Directive Principles of State Policy.
d. Critically understand the concept, content and process of social development.
e. Develop the capacity to identify linkages among social needs, problems, development issues and policies.
f. Locate strategies and skills necessary for social development and reinforce
values of social justice, gender justice and equality.

Course Content

UNIT I

Social Policy and Constitution: Concept of social policy, sectoral policies and social services - Relationship between social policy and social development--Values underlying social policy and planning based on the Constitutional provisions (i.e. the Directive Principles of State Policy and Fundamental Rights) and the Human Rights - Different models of social policy and their applicability to the Indian situation.

UNIT II

Sectoral Social Policies in India: Evolution of social policy in India in a historical perspective-Different sectoral policies and their implementation, e.g. Policies concerning education, health, social welfare, women, children, welfare of backward classes, social security, housing, youth, population and family welfare, environment and ecology, urban and rural development, tribal development and poverty alleviation.

UNIT III

Social Planning: Concept of social planning - Scope of social planning - the popular restricted view as planning for social services and the wider view as inclusive of all sectoral planning to achieve the goals of social development - Indian planning in a historical perspective - The Constitutional position of planning in India. Niti Ayog - Coordination between Centre and State, need for decentralization - Panchayath Raj - people participation.

UNIT IV

Social Development: Concept of social development - Current debates of development - Approaches to development - Development indicators.

Social Development in India: The historical and social context of development in India - Demographic transitions - Rural development: Agrarian and land reforms; Green Revolution - Industrialization and urban development - Labour relations-Gender issues - Environmental issues (land, water, forest) - Education - Health.

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Recommended Journals / Periodicals

Alternatives; Development and Change; Economic and Political Weekly.

Paper code : SWCSC-5
Paper Title : LEGAL SYSTEM IN INDIA

INTRODUCTION

The course is to help learners understand the legal system and procedures in India. It supports understanding the processes in public interest litigation and develops skills for the same.

OBJECTIVES

a. Acquire information on the legal rights of people.
b. Develop an understanding of the legal system and get acquainted with the process of the legal system with emphasis on functioning in India.
c. Understand the role of the police, prosecution, judiciary and correction. d. Gain insight into the problems faced by the people belonging to different strata of society, in interacting with this system.
e. Develop an understanding of the processes and problems of public interest litigation and legal aid to marginalized.

Course Content

UNIT I

Social Justice: Meaning and Concept; Social legislation: Meaning, definitions and concept. Social justice as an essential basis of social legislations; Social legislations in a welfare state with special reference to India.

Rights: Concept and definitions of Rights; types of Rights; Rights of women and children; Rights of Scheduled Castes and Scheduled Tribes; Rights of accused and offender under Constitution of India, Indian Penal Code and Criminal Procedure Code.

UNIT II

Division of Law: Substantive Law and Procedural Law.

Legislations pertaining to Social Institutions: Marriage, divorce, maintenance of spouse, adoption.

Legislations for prevention of Crime and Deviance: Indian Penal Code (relevant chapters like of Offences against Public Tranquility, of Offences affecting the Public Health, Safety, Convenience, of Decency and Morals, of Offences relating to Religion, of Offences affecting the Human Body, of Offences relating to Marriage, of Cruelty by Husband or Relatives of Husband)

Legislations pertaining to women.

UNIT III

Criminal Justice System in India:

Police: Structure, powers and functions and their role in maintaining peace and order in the society.

Prosecution: Meaning, structure, its role in criminal justice, trial participation.

Judiciary: Supreme Court, High Court - Constitution of Supreme Court and High Court: Powers and functions.
Sub-ordinate Courts - District Sessions Court, Magistrate Courts, and other subordinate courts.

UNIT IV

Correction and Correctional Laws: Corrective measures as per Criminal Procedure Code, Probation of Offenders Act, Juvenile Justice (Care and Protection of Children) Act.

Legal Aid: Concept of legal-aid, history of legal-aid, persons needing legal-aid, legal-aid schemes.

Public Interest Litigation: Meaning, Concept, Process and Problems.

Right to Information Act- Provisions and implementation.

Role of Social Worker: Social Work intervention, need, methods.

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11. Kelkar R. V. 2006. Lectures on Criminal Procedure, Lucknow, Eastern Book Company.

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15. Newman, G. 1999 Global Report on Crime and Justice, New York: Oxford University Press.

16. Nirmal Anjali. 1992 Role and Functioning of Central Police Organisations, New Delhi: Uppal.

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Open Elective
Paper Code: SWOE
Paper Title: GERONTOLOGICAL SOCIAL WORK

INTRODUCTION

Changing demographic profile in India has led to rise in the number of elderly as never before. Along with the enhanced longevity, a number of issues related to care and management of elderly have come into focus. Social work as a profession concerned with providing professional service to the needy, has recognized the need to address the concerns of the senior citizens. The paper envisages training the learners in professional social work practice with the elderly.

The paper focuses on senior citizens as target client group for social work intervention; the paper deals with the issues, concerns, problems and social work methods in facilitating healthy adaptation of the client group in the current Indian context.

OBJECTIVES:

a. To get an overview of the perspectives on aging and scope for practice.
b. To understand the various challenges related to aging, healthy aging and problems of the elderly in difficult situations.
c. To identify agencies working with elderly, the different care settings and issues in working with elderly in different settings. To gain an insight into process of working with elderly.
d. To train the learners in applying specific social work intervention measures in working with senior citizens, care givers and to have an understanding of
e. National Policy on Older Persons, and the role of International and NGOs in improving the quality of life of the elderly.

Course Content

UNIT I

Gerontology – Definition and scope. Understanding the elderly – demographic, developmental, psychological, socio cultural, economic, and health perspectives. The issues pertaining to elderly- health, occupation, income, retirement planning, family support, gender issues, property Rights and any other

UNIT II

Developmental tasks in elderly: Issues in health care, changes in family structure, coping with aging process, challenges due to changing physiological, economic, safety, status in the family and other issues, Healthy aging, quality of life, coping with demise of the life partner, bereavement, resolving one's own death, and any other.

UNIT III

Care settings for elderly: General hospitals, geriatric wards/ hospitals, home-based care, homes for the aged, nursing homes, day-care-centers, hobby centers, and facilities for homeless elderly, elder helpline, and senior citizen forum.
Tools for assessment of the problems of elderly, intervention and follow up services and evaluation.

UNIT IV

Social work intervention measures for senior citizens through methods of social work: Case work, group work, community organisation, welfare administration, social work research, social action
Care giver issues - Needs, burden, coping and training; training for caregivers of institutions for the elderly

National Policy on Older Persons, Legal and governmental welfare benefits for senior citizens, Role of HelpAge India and other prominent Organisations working for elderly.
International scenario

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3. Dandekar, Kumudini. 1996 — The Elderly In India, New Delhi, Sage Publications.

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JOURNALS.

1. Indian Journal of Gerontology, C-207, Manu Marg, Tilak Nagar, Jaipur 302 004

2. R & D Journal of Helpage India . C-14, Qutab Institutional Area, New Delhi, 110016.

Open Elective
Paper code SWOE
Paper Title: SOCIAL WORK PRACTICE WITH CHILDREN

INTRODUCTION

Children are the future of human society. Profession of social work has to work with children in difficult circumstances while rendering services in varied settings. There is a need for social workers specially trained in working with the children and adolescents. Such trained social workers can render valuable services to children in need of professional help.

The current paper focuses on children as a special group for focused social work intervention through facilitating acquisition of knowledge about children from different perspectives, types of settings where the children can be helped and application of social work methods to render social work intervention to children.

OBJECTIVES

a. To understand children facing difficult circumstances and the impact of difficult circumstances on children's development.
b. To gain an overview of agencies where children form the major client group, and appropriate evaluation of children's problems.
c. To impart to the trainee, specific social work intervention methods in dealing with children as a client group; to understand the Rights of children in the legal, national and international context.

Course Content

UNIT I

Human reproductive system - beginning of life till beginning of adulthood. Understanding the children and adolescents from different perspectives - developmental, demographic, economic, psychological, sociological, environmental, familial, educational dimensions of child development. Issues in adolescence - self image, peer group, career choice, sexuality, education, vocation and other issues
Healthy child development, importance of supportive environment in upbringing of the children.

UNIT II

Children in difficult circumstances - developmental delay, physical and intellectual handicaps; chronic illnesses, nutritional deficiencies, accidents, poverty, child labour, abandoned and orphaned children, adoption issues, children in institutions, psychological problems in children, self harm and suicides in children, addiction related problems in children, children brought up by single parent due to death, divorce and other related issues, problems in formal schooling, children living in difficult situations - children in streets, slums, war zones, migration, children in conflict with law, truancy, drug abuse, running away from homes, neglected children, child abuse, child trafficking, child marriage and any other. Special focus on adolescent issues as applicable.

UNIT III

Children in difficulties – Helping agencies, Settings and issues - paediatric hospitals, nursing homes, child care centres, child guidance clinics, residential care services for children - residential schools, orphanages, homes for children in conflict with law, agencies dealing with differently abled children, any other.
Assessment, intervention, follow up and evaluation of children and adolescents facing difficulties.

UNIT IV

Social Work Intervention Programmes - Case work, group work, community organisation methods in helping children, school mental health programmes, home visits, school visits, life skills training, family life education for adolescents, creative use of play therapy, art, dance, drama and other mediums for helping children, child

help lines, child care centres, adoption services, special rehabilitation services for rescued children and any other.

Legislations pertaining to children, legal protection, International, National and non-governmental organisations working with children, Rights of the children.

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7. Kantha Amod and Varma, R.M, 1993 — Neglected Child – Changing Perspective, New Delhi, Prayas Juvenile Aid Centre,.

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9. NIPCCD.1992. — National Evaluation of Integrated Child Development Services, New Delhi.

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14. Venkatesan. S. 2004 — Children with Developmental Disabilities, New Delhi, Sage Publications,.

Even semester (IV Semester)

Paper code SWDHC-13

Paper Title: EMPLOYEE RELATIONS AND LEGISLATION

INTRODUCTION

The purpose is to provide an in-depth knowledge about the relationship between employer, employee and the state, to bring out the importance of cordial employee relations for organizational productivity and gain an understanding of the mechanism of inter-personal relations, collective bargaining and productivity improvement functions in the organisation through involvement of all groups.

OBJECTIVES

a. Develop the skills of interpersonal relationship as per organisational requirement.
b. Understand the trends and dynamics between the partners in the organisation.
c. Enhance the knowledge on organisational performance, role and responsibility.
d. Develop the knowledge on various statutory / legal aspects influencing the organizations.
e. To stimulate thinking on rationale behind the Laws and their enforcement.

Course Content

UNIT I

Employee relations, History of industria1ization in India - Issues related to employees in organized and unorganized sector.

Concept, Definition, Philosophy and Principles of employee relations. Employee relations with special reference to Occupation - Safety - Health and Environment (OSHE) Education.

Analysis of the terms 'industry' and 'industrial dispute', industrial discipline – misconduct, disciplinary proceedings.

Domestic Enquiry: Contents and Process, Principles of Natural Justice, Tribunal; Discharge/Dismissal.

UNIT II

Trade Unions: Trade Unionism in India, emergence, history and growth, Trade Union as an organization – Various Trade Unions in India, Trade Union policies, Role of Trade Unions in India, Employers'' Associations – Objectives, structure and activities. Contemporary issues in employee relations.

UNIT III

Employee Legislations: - The Payment of Bonus Act, 1965, Employees Provident Fund (and Misc. Previsions) Act 1952, Workmen's Compensation Act 1923, Employees State Insurance Act 1948, Payment of Gratuity Act, 1972,Child Labour (Prohibition and Regulation) Act, 1986.
Fundamentals of Labour laws, The Constitution of India: Preamble, Fundamental Rights including writs, Directive Principles of State Policy, The Factories Act 1948, The Contract Labour (Regulation and Abolition) Act 1970,The Minimum Wages Act 1948 and The Payment of Wages Act 1936; The Apprentices Act, 1961,The Maternity Benefit Act 1961.

UNIT IV

The Trade Union Act 1926, The Industrial Employment (Standing Orders) Act 1946, The Industrial Dispute Act 1947, The Employment Exchanges (Compulsory Notification of Vacancies) Act 1958. Introduction to Right to Information Act, Intellectual Property Rights, Patent Law, Copyrights, Trademark Law.

Collective Bargaining: Definitions, characteristics, critical issues in collective bargaining, theories of collective bargaining, Hick's Analysis of Wages setting under collective bargaining, conflict-choice model of negotiation, Behavioral Theory of Labor Negotiation, Collective Bargaining in India, Collective bargaining in practice, levels of bargaining, coverage and duration of agreements, administration of agreements, negotiating a contract, the negotiation process, effective negotiation, negotiation and collective bargaining, post negotiation – Administration of the agreement.

Employee relations in knowledge based industry - Concepts of self-managed teams (SMT) - Changing employee/ employer and trade union relationship. Current rules of Taxation of Salaries.

Labor Welfare Officer - Duties and functions; Social Work in Industry.

REFERENCES

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3. Dasgupta, S. K. — Industrial Law, Sterling Publishers Pvt. Ltd.
4. Devar, R. S. 1967 — Personnel Management and Industrial Relations, New Delhi, Vikas Publishing House.
5. Joseph, T.M. 2009 — Industrial Law, Mumbai, Himalaya Publications Pvt., Ltd.
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12. Moorthy, M. V. 1968 — Principles of, Labour Welfare, Vishakapatnam, Gupta Brothers.

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24. Tripati, P. C. 1989 — Personnel Management and Industrial Relations, New Delhi, S. Chand and Sons,.

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Paper code: SWDHC-14
Paper Title: **MENTAL HEALTH AND PSYCHIATRIC SOCIAL WORK**

INTRODUCTION

This course is to provide awareness about mental health and mental health problems and also application of social work in mental health settings.

OBJECTIVES

a. Understand the concepts 'mental health' and 'mental illness'.
b. Understand the signs and symptoms, etiology, diagnosis and treatment of
   mental health problems.
c. Understand different services for the care of mentally ill.
d. Understand historical background of psychiatric social work in India and
   abroad.Understand the nature of psychiatric social work services and relevance of team work.
e. Understand the nature of collaboration with voluntary organisations for the
   welfare of mentally ill.
f. Identify the issues related to psychiatric social work department in hospitals
   and community mental health settings.

Course Content

UNIT I

Concept of mental health and mental illness - Mental health as a part of general health - Misconceptions about mental illnesses. General approaches to the mentally ill - International Classification of Mental Disorders.
Signs, symptoms, etiology, diagnosis, prognosis and management of the following:

- Neuroses
- Psychoses
- Psycho physiologic disorders
- Personality disorders
- Psychiatric disturbances in children and adolescents
- Organic psychotic conditions
- Mental retardation.

UNIT II

Introduction to Psychiatric Social Work: Meaning and Scope - Historical background of psychiatric social work in India and abroad - Reasons for its development as a specialty. Application of social work methods and other related techniques used in the field - Multi-disciplinary approach and team work in mental health care - Problems of hospitalization - Impact of mental illness on the patient, family and community.

Practice of Social Work: Importance of home visit and visit to the place of work - Role of family in the treatment of mentally ill - Preparing the family and community for the return of the affected individual, follow-up.

UNIT III

Care of mentally ill: Day-care centre, night-care centre, half-way-home, sheltered workshop, Occupational therapy units - Role of social worker and role of voluntary organisations.
Role of voluntary organisations, governmental-agencies and paraprofessionals in the welfare of mentally ill.

Role of social worker in mental health centers, departments of psychiatry in general hospitals, child guidance clinics, community mental health units, correctional institutions, industries, and family welfare centres.

Role of social worker with head injured, paraplegics and epileptics.

Role of social worker in the management of substance abuse – Educational avenues in psychiatric social work - Research avenue in the field of mental health for social workers.

UNIT IV

Organisation of psychiatric social work department - Functions; and collaboration with other departments.

Community mental health and social work, NMHP, Innovations like Satellite clinics, district mental health programme etc.

Rehabilitation and Acts: Occupational therapy - Principles and practice - Psychosocial rehabilitation.

Mental Health Act, 1987.

The Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participation) Act, 1995.

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19. Page, J. D. 1983 — Abnormal Psychology, New York, McGraw-Hill.

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Illinois: University of Chicago Press.

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26. National Mental Health Programme for India

Code SWDHC -15
Title: **MAJOR PROJECT**

Students are given broad guidelines for undertaking empirical evidence-based project in the fourth semester. In case of group project work, the group will be formed by the college or the university department by adopting random method of selection. The project shall comprise of selection of the topic, methodological details, analysis, interpretation and deductions made. The department will prepare a set of guidelines for presenting the report.

Evaluation of the Project will be done along with the viva-voce examination by the viva-voce committee constituted for the assessment of social work practicum.

Even semester

Code: **SW DHC-6**
Title : **SOCIAL WORK PRACTICUM - V**

Concurrent practice learning of two-days a week - on going learning of practice is an opportunity to develop intervention skills in reality situations. This entails learning social work practice for two, or two and a half days or its equivalent, each week of the semester. The learners may be placed in agencies or in communities to initiate and participate in direct service delivery. Practice learning is a vital component of the educational opportunity to be provided to the learner. The teaching-learning process must be designed to help the learner to move on the mastering strategies, skills and techniques to practice social work.

Even semester

Code: **SWDHC-17**

Title: **SOCIAL WORK PRACTICUM – VI**: (BLOCK PLACEMENT)

Block Placement - enables learners to integrate learning and generate newer learning by participating in the intervention process over a period of 6 weeks continuously, in a specific agency. Usually, block field work is provided at the end of the two-year programme. There shall be a professionally qualified worker in the setting willing to plan orientation and provide consultation, when needed.

Paper code: SWDSC-6

Paper Title: **HUMAN RESOURCE DEVELOPMENT AND EMPLOYEE WELLNESS**

INTRODUCTION

The purpose of this course is to provide practical exposure and knowledge in behavioural science to develop skills not only to understand and analyse problems but also to develop a problem-solving approach to issues.

OBJECTIVES

a. To develop multi facets of the personality and to build self confidence.
b. To develop a spirit of continuous learning and innovation.
c. To strengthen the competency base of individuals, teams and organization and also femilar with the organizational culture.
d. Understand and further the organization culture.
e. To appreciate the importance of bottom-line focus to the Human Resource
function and trend toward HR Accountability.
f. To understand the various approaches to and techniques of measuring HR issues.
g. To create awareness of different types of information systems in an organization so as to enable the use of computer resources efficiently, for effective decision- making.

Course Content

UNIT I

Human Resource Development (HRD): Concept, origin and needs for HRD; Overview of HRD as a Total system; Approaches to HRD; human capital approach; social psychology approach and poverty alleviation approach; HRD and its dimensions, Competency Mapping.

UNIT II

HRD Interventions: Performance Measurement Systems – Fundamental issues. Feedback sessions. Organizational goal setting process, Key Result Area (KRA) and Key Performance Indicator (KPI),Coaching, Mentoring, career planning, career development, reward system, quality of work life. HRIS: - Computers and computer based Information Systems. Measuring HR : Changing role of HR, HR as a strategic partner, the need for measuring HR. Approaches to measuring HR: - Competitive Benchmarking, HR Accounting, HR Auditing, HR Effectiveness Index, HR Key Indicators, HR MBO (Management by Objectives).

Instructional Technology: Learning and HRD; Building Learning Organization: measuring learning – the intellectual capital, architecting a learning organization, Organizational Learning, models and curriculum; factors and principles of learning; group and individual learning; HRD trends; behavioural sciences; transactional analysis; Concepts of continuous learning, behavior modeling and self-directed learning; evaluating the HRD effort; data gathering; analysis and feedback; HRD experience in Indian organizations; future of HRD - Organization culture and development.

UNIT III

Talent Development: Concept and importance; Training Need Analysis, process of training, designing and evaluating training and development programs. Use of information technology, Types and Methods of Training: Training within industry (TWI), External; on the job and off the job; Training methods; lecture, incident process, role play, structured and unstructured discussion, in-basket exercise, simulation, vestibule, training, management games, case study, programmed instruction, team development, and sensitivity training; review of training programs.

UNIT IV

Employee Wellness: Concept, philosophy, principles and scope; Importance and relevance of wellness programs, Role of Welfare Officer as per the Factories Act 1948. Relevance - with reference to Accidents, Absenteeism, Alcoholism, Domestic Violence: Preventive and remedial measures.

Employee Counseling. Role of Counselor in Organizations. Corporate Social Responsibility (CSR): CSR as a business strategy.

Environmental management systems ISO 14001, ISO 26000: Social responsibility guidance standard, environmental impact assessment.

REFERENCES

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2. Business Today Managing People: The Business Today, ExperientialGuide to Managing Workforce 2000, January 7-21, 1996.

3. Cowling, Alan and James Philip The Essence of Personnel Management and Industrial Relations, New Delhi, Pentice-Hall of India Pvt., Ltd.

4. Davis, Keith. 1983 Human Behaviour at Work, New Delhi: Tata McGraw-Hill

5. Fisher, Cynthia; Schoenfeldt, Lyle F. and Shaw, James, B. 1997 Human Resource Management, Third Edition, Boston, Houghton Mifflin Company.

6. Jayagopal, R. 1990 Human Resource Development: Conceptual Analysis and Strategies, New Delhi: Sterling Publishers Pvt. Ltd.

7. Moorthy, M. V. 1982 Priciples of Labour Welfare, New Delhi, Oxford & IBH.

8. Moorthy, M. V. 1992 Human Resource Management Psycho-Sociological Social Work Approach, Bangalore, R & M Associates.

9. Norman, M. 1960 Psychology in Industry, London, Harrap & Company.

10. Prasad, L. M. 1996 Organisational Behaviour, New Delhi, S.Chand & Co.

11. Rao, T. V. 1990 HRD Missionary, New Delhi. Oxford & IBH.

12. Rao, T. V. 1991 Reading in Human Resource

Development, New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd

13. Rudrabasavaraj, M. N. 1984 — Human Factors in Administration, Bombay: Himalaya Publishing House.

14. Sahni, P. and Sharma, K. K. 1988 — Organisational Behaviour, New Delhi: Deep and Deep Publications.

15. Singh M. K. and Bhattacharya (Eds.) 1990 — Personnel Management, New Delhi : Discovery Publishing House.

16. Vroom, V. H. and Grant, L. 1969 — Organisational Behaviour and Human Performance, New York. Wiley.

Code: SWDSC-6
Title: CASE STUDIES

Every Candidate is expected to take up five cases, study them in depth and present the intervention, if any. Case refers to a unit of study – an individual, an institution, a community or an incident. The candidate has to work under the guidance of faculty member and submit the report on or before the date prescribed.

The university or the college concerned can develop guidelines for undertaking case studies. However, the students are encouraged to start his/her work on case studies from the beginning of the course.

Evaluation of the case study will be done along with the viva-voce examination by the viva-voce committee constituted for the assessment of social work practicum or similar committee may be constituted, if required.

JSS COLLEGE OF ARTS, COMMERCE & SCIENCE

(An Autonomous College of University of Mysore)

Re-accredited by NAAC with 'A' grade

OOTY ROAD, MYSORE-570 025, KARNATAKA

ESTD-1964

SYLLABUS

M.VOC. (FOOD PROCESSING & ENGINEERING)

2021-2022

DEPARTMENT OF FOOD PROCESSING AND ENGINEERING

Scheme of Instruction For M. Voc. (Food Processing & Engineering) year 2021-22								
General Education Component								
(L-Lecture; T-Tutorial; P-Practical/Practice) (1 Credit = 15 Hrs)								
Semesters	**Paper No.**	**Title**	**L:T:P**	**Theory Hours**	**Tutorial Hours**	**Practical Hours**	**Total Hours**	**Total Credits**
Sem I	G .1	Food Chemistry	2:0:1	30	0	15	45	3
	G - 2	Food and Nutrition	2:0:1	30	0	15	45	3
								06
Sem II	G-3	Food Microbiology	2:0:1	30	0	15	45	3
	G-4	Biostatistics	2:0:1	30	0	15	45	3
								06
Sem III	G-5	Information Communication Technology	2:0:1	30	0	15	45	3
	G-6	Product development and Entrepreneurship	2:0:1	30	0	15	45	3
								06
Sem IV	G-7	Food marketing	2:0:1	30	0	15	45	3
	G-8	Food standards, Regulatory Affairs and IPR Issues	2:0:1	30	0	15	45	3
								06

General Component

Semester - I **MFA 510**

Sl. No.	Paper I : Food Chemistry	Hrs
1.	Introduction to food chemistry, its role in processing and food formulations,	1
2.	Moisture in foods: Role and type of water in foods, Functional properties of water, role of water in food spoilage, Water activity and sorption isotherm, Molecular mobility and food stability.	2
3.	Dispersed systems of foods: Physicochemical aspects of food dispersion system: a) Sol b) gel c) foam d) emulsions.	1
4.	Carbohydrates: Functional characteristics of different carbohydrates. Maillard reaction, caramelization, methods to control non enzymatic reactions. Starch and Dietary fibres, Functional properties of polysaccharides, natural vegetable gums, carbohydrate composition of various natural foods.	5
5.	Proteins in foods: Protein content and composition in various foods- cereal grains, legumes and oilseed proteins, proteins of meat, milk, egg and fish. Functional properties of proteins in foods – water and oil binding, foaming, gelation, emulsification. Effect of processing on functional properties of proteins-heat processing alkali treatments, chilling, freezing, dehydration and radiations. Unconventional sources of proteins- SCP fish protein concentrates, leaf proteins	5
6.	Lipids in foods: Role and use of lipids /fat, occurrence, fat group classification, Physicochemical aspects of fatty acids in natural foods, hydrolysis, reversion,. Chemical aspects of lipolysis, auto-oxidation, antioxidants, Technology of fat and oil processing: Refining, Hydrogenations, Inter etherification, Safety use of oils and fats in food formulation.	5
7.	Vitamins and minerals, Dietary sources, requirements, Allowances, Enrichment, Restorations, Fortifications, Losses of vitamins and minerals, Optimization and retention of vitamins and minerals	2

8.	Enzymes in food industry, Carbohydrases (Amylases, cellulases, pectinases,) Proteases, Lipases and oxidases in food processing.	2
8.	Chemistry of food flavour: definitions of flavour, Flavourmatics / flavouring compounds, Sensory assessment of flavour, Technology for flavour retention.	2
9.	Food additives: Buffer systems/ salts / Acids, Chelating agents and sequestrants, Antioxidants, Antimicrobial agents, Non- nutritive and low calorie sweetners, Stabilizer and thickeners,	2
10.	Food colours, natural and synthetic, Regulatory aspects –Natural and synthetic permitted food colours.	1
11.	Food toxicants – anti nutritional factors and their occurrence, effects and methods of elimination or inactivation- protease inhibitors, lectins, lathyrogens, phytates and flatulence factors.	2
12.	Food Contaminants, Pesticidal residues – permitted limits. Toxicology and public health.	2

Sl. No.	**Practical**	**Hrs**
1.	Determination of moisture content of foods using different methods	3
2.	Determination of crude proteins by microkjeldahl method	3
3.	Determination of crude fat by soxlet method	3
4.	Determination of acid value, saponification value and iodine number of fat/ oil	3
5.	Determination of minerals and acid insoluble ash and estimation of Calcium and phosphorus	3
6.	Assay of amylases, papain and lipases	3
7.	Detection of common food adulterants	3
8.	Determination of food colors	3

MODEL QUESTION PAPER

CODE NO: MFA 510

Semester - I

Food Chemistry

TIME: 3 hrs **Max marks: 70**

Instructions: Draw neat and labeled diagram wherever necessary.

1. Answer all the questions in one sentence or a word 10 X 1 = 10

   a. ----------
   b. ----------
   c. ----------
   d. ----------
   e. ----------

2. Answer any four of the following questions 4 X 5 = 20

   a. ----------
   b. ----------
   c. ----------
   d. ----------
   e. ----------

3. Answer any four questions of the following 4 X 10 = 40

   a. ----------
   b. ----------
   c. ----------
   d. ----------
   e. ----------

(Note- 10 Marks may be divided in to 6+4 or 5+5)

I SEMESTER PRACTICAL EXAMINATION

Food Chemistry

PRACTICAL

SCHEME OF EXAMINATION

DURATION: 3 Hours

Maximum Marks: 70

Practical proper: 60

Record marks: 10

NOTE :- Candidates are required to submit the records duly signed by the teacher-in charge and certified by the Head of the Department

1. Determination of moisture content of foods using different methods
2. Determination of crude proteins by microkjeldahl method
3. Determination of crude fat by soxlet method
4. Determination of acid value, saponification value and iodine number of fat/ oil
5. Determination of minerals and acid insoluble ash and estimation of Calcium and phosperus
6. Assay of amylases, papain and lipases
7. Detection of common food adulterants
8. Determination of food colors

General Component

Semester – I **MFA 520**

Sl. no.	Paper II :Food and Nutrition	Hrs
1.	Introduction to Food: Definition, classification and constituents of food : Carbohydrates, Fats , Proteins ,Fat soluble vitamins-A, D, E and K , Water soluble vitamins – Thiamin, Riboflavin, Niacin, Pyridoxine, Folate, Vitamin B12 and Vitamin C, Minerals – Calcium, Iron, Zinc, Iodine and Flourine.	4
2.	Functions of food, Effect of deficiency & overconsumption of dietary sources on health, Basic Food Groups, Recommended dietary Allowance (RDA), Food guide pyramid, Dietary fibers, Functions of water in body. Balanced Diet: Concept of Balanced Diet: Definition, food groups used in planning balanced diets.	5
3.	Traditional and contemporary methods of food processing and quality evaluation of food products	3
4.	Nutrition: Basic terms used in Nutrition, relationship between food, health and nutrition, Bioavailability of nutrients. Basal Metabolic Rate (BMR). Protein quality, Dietary allowances and standards for different age groups: Adult man/woman, Preschool children, Adolescent children, pregnant woman. Geriatric nutrition, Nutrition for athletes	10
5.	Digestion and absorption of carbohydrates, proteins and fats. Factors influencing the sensory acceptability and digestion of foods	2
6.	Food Design: Nutritive values of cereals, pulses, oil seeds, fruits, vegetables, fish, meat and eggs. Nutrient composition of foods and Energy calculations	3
7.	Antinutritional factors: Sources and harmful effects of anti vitamins (e.g.: avidin, dicoumarol), Natural toxicants, (e.g.: Lathyrus sativa).Food adultrants- structure and harmfull effects of - Butter yellow, lead chromate and malachite green.	3

Sl. no.	Practical	Hrs
1.	Sensory acceptability of food products: Physical Attributes (Appearance, color, texture, taste and overall acceptansibility). Texture measurement of food products by instrumental methods. Preparation of food labelling. Formulation for foods for target groups (weaning, pre-school children, geriatric, therapeutic foods etc.). Processing of spices for traditional products. Storage and shelf determination.	9h
2.	Estimation of iron in drumsticks	3h
3.	Estimation of Calcium in ragi	3h

MODEL QUESTION PAPER

CODE NO: MFA 520

Semester - I

Food and Nutrition

TIME: 3 hrs **Max marks: 70**

Instructions: Draw neat and labeled diagram wherever necessary.

1. Answer all the questions in one sentence or a word 10 X 1 = 10

f. ----------
g. ----------
h. ----------
i. ----------
j. ----------

2. Answer any four of the following questions 4 X 5 = 20

f. ----------
g. ----------
h. ----------
i. ----------
j. ----------

3. Answer any four questions of the following 4 X 10 = 40

f. ----------
g. ----------
h. ----------
i. ----------
j. ----------

(Note- 10 Marks may be divided in to 6+4 or 5+5)

I SEMESTER PRACTICAL EXAMINATION

Food and Nutrition

PRACTICAL

SCHEME OF EXAMINATION

DURATION: 3 Hours

Maximum Marks: 70

Practical proper: 60

Record marks: 10

NOTE :- Candidates are required to submit the records duly signed by the teacher-in charge and certified by the Head of the Department

1. Sensory acceptability of food products: Physical Attributes (Appearance, color, texture, taste and overall acceptansibility).
2. Texture measurement of food products by instrumental methods.
3. Preparation of food labelling.
4. Formulation for foods for target groups (weaning, pre-school children, geriatric, therapeutic foods etc.).
5. Processing of spices for traditional products.
6. Storage and shelf determination.
7. Estimation of iron in drumsticks
8. Estimation of Calcium in Ragi

General Component

Semester – II **MFB 510**

Sl. no.	Food Microbiology	Hrs
1.	**Microbiology:** Introduction, historical developments in food microbiology; prokaryotes and eukaryotes. **Microscopy**: Different types of microscopes, their construction and working principles. Simple microscope (dissection microscope), Compound microscope - bright field, dark field, phase contrast, stereomicroscope and fluorescence microscope. Principle, construction and applications of Scanning and Transmission electron microscopes. **Classification of microbes:** Haeckel's three- kingdom, Whittaker's five-kingdom classification and Cavalier-Smith's eight kingdom classification. Morphology of microbes. **Pure culture techniques-** Serial dilution, Pour plate, Spread plate, Streak plate and Micromanipulator technique Microbial growth, growth curve. Sources of microorganism in foods . Factors affecting heat resistance; Pasteurization and sterilization. Factors affecting growth-intrinsic and extrinsic factors controlling growth of microorganisms.	9
2.	**Disinfection & disinfectants:** Definition of terms - Disinfectants, antiseptics, sanitizers, Microbicides: virucide, algicide, fungicide and sporicide. Microbistatic: bacteriostatic and fungistatic. Use and mode of action - Alcohols, Aldehydes, Halogens, Phenols, Heavy metals, Quaternary Ammonium compounds and Sterilizing gases (ethylene oxide).	2
3.	**Food preservatives-** heating process, irradiation, low temperature storage, chemical preservatives and high-pressure processing of foods; control of water activity.	2
4.	**Foods microbiology and public health:** Food poisoning, types of food poisonings, important features etc; bacterial agents of food borne illness, food poisoning by *Clostridium- C. Botulinum, Salmonella-salmonellosis, Bacillus cereus*, and non bacterial agents of food borne illness: poisonous algae-types of illness, Study of Neurotoxic Shellfish Poisoning (NSP) and Diarrheic Shellfish Poisoning (DSP), and fungi-Aflatoxin (a brief account)**.**	5
5.	**Food spoilage:** Fruits and vegetables, spoilage of canned foods; methods of isolation and detection of microorganisms or their products in food; conventional methods; rapid methods, retention of microbes, (newer techniques)-immunological methods; fluorescent anti body, radioimmunoassay, principles of ELISA, PCR (Polymerase chain reactions**)**	4

6.	Indicators microorganisms; microbiological criteria of foods and their significance; the HACCP system and food safety used in controlling microbiological hazards, applications of hurdle technology for controlling microbial growth.	2
7.	**Microbiology of Fermented foods:** Cereals, Vinegar, Oriental foods, Alcoholic beverages.	2
8.	**Microbiology of milk & milk products:** cheese, butter, ice cream, and milk powder etc	2
9.	**Microbiology of cereal & cereal products:** bread, biscuits, confectionary etc	2

Sl. no.	**Practical**	**Hrs**
1.	Equipments used in microbiology laboratory,	15
2.	Study of microscope and observation of microbial slides,	
3.	Methods of sterilization and preparation of media, ,	
4.	Staining techniques- Simple, Negative and Gram's staining	
5.	Effects of environmental factors on growth of microorganisms,	
	Assignment-microbiological analysis of market samples- milk & milk products, fresh & processed fruits and vegetables, Cereal & bakery products	

MODEL QUESTION PAPER

CODE NO: **Semester - II**

Food Microbiology

TIME: 3 hrs **Max marks: 70**

Instructions: Draw neat and labeled diagram wherever necessary.

PART-A

I. Write short notes for the following(any 5): **(5x2=10)**

1. ----------
2. ----------
3. ----------
4. ----------
5. ----------
6. ----------

PART-B

II. Answer any 4 of the following: **(4x5=20)**

1. ----------
2. ----------
3. ----------
4. ----------
5. ----------

PART –C

III. Answer any 4 of the following: **(4x10=40)**
IV.

1. ----------
2. ----------
3. ----------
4. ----------
5. ----------

II SEMESTER PRACTICAL EXAMINATION

Food Microbiology

PRACTICAL

SCHEME OF EXAMINATION

DURATION: 3 Hours

Maximum Marks: 70

Practical proper: 60

Record marks: 10

NOTE :- Candidates are required to submit the records duly signed by the teacher-in charge and certified by the Head of the Department

Equipments used in microbiology laboratory, study of microscope, observation of microbial slides, preparation and sterilization of media, methods of sterilization, staining techniques, effects of environmental factors on growth of microorganisms,

Assignment-microbiological analysis of market samples- milk & milk products, fresh & processed fruits and vegetables, Cereal & bakery products

General Component

Semester - II **MFB 520**

Sl. no.	Biostatistics	Hrs
1.	Statistical concepts: Data structure, sampling methods, collection, classification and tabulation of data, graphical and diagrammatic representation, histogram, frequency polygon, frequency curve, bar graph, pie chart etc.	4
2.	Measure of Central Frequency: Mean, median, mode.	2
3.	Measure of dispersion of data: Range, semi-interquartile range, mean deviation, standard deviation, standard error, coefficient of variation, confidence limits.	5
4.	Types of distribution of data: Normal, Binomial, Poisson.	7
5.	Z-test, t-test, ANOVA, multiple comparisons, LSD and DMRT, Chi-square test.	4
6.	Regression estimate, correlation coefficient.	4
7.	Experimental designs, data transformation.	4

Sl. no.	Practical	Hrs
1.	Analytical Problems / calculations	15

MODEL QUESTION PAPER

CODE NO: Semester - II

Biostatistics

TIME: 3 hrs **Max marks: 70**

Instructions: Draw neat and labeled diagram wherever necessary.

PART-A

V. Write short notes for the following(any 5): (5x2=10)

7. ----------
8. ----------
9. ----------
10. ----------
11. ----------
12. ----------

PART-B

VI. Answer any 4 of the following: (4x5=20)

6. ----------
7. ----------
8. ----------
9. ----------
10. ----------

PART –C

VII. Answer any 4 of the following: (4x10=40)
VIII.

6. ----------
7. ----------
8. ----------
9. ----------
10. ----------

II SEMESTER PRACTICAL EXAMINATION

Biostatistics

PRACTICAL

SCHEME OF EXAMINATION

DURATION: 3 Hours

Maximum Marks: 70

Practical proper: 60

Record marks: 10

NOTE :- Candidates are required to submit the records duly signed by the teacher-in charge and certified by the Head of the Department

1.Analytical Problems / calculations

Semester – III **MFC 510**

Sl no.	Information Communication Technology	Hrs
1.	The humanitarian supply chain - Definition, system of organizations, people, technology, activities, information and resources involved in moving a product or service from supplier to customer.	5
2.	Beneficiary Identification – Challenge in food assistance to ensure that assistance goes to the right beneficiaries. Charitable organisations and NGO's involved in disaster management world over.	5
3.	Role of Mobile Technologies, handheld devices, RFID, scanners in HLRC as well as in SCM of food industry from farm to fork. Building blocks of ICT and role of Big Data, IOT, Data mining, Mapping technology, smart systems.	5
4.	Explain the Role of SCM system and all its components in food manufacturing organisations. How can ICT help to maintain the quality of Raw materials in food supply chain?	5
5.	Role of ICT in systems such as LIFO/FIFO/JIT/QR/VMI and **cost optimisation** in SCM system of a food manufacturing setup.	5
6.	Role of ICT in QSR industry. Importance of cold chain maintenance to maintain quality of Raw materials from farm to fork. Role of ICT in monitoring cold chain maintenance.	5
7.	Explain communication and types. Role of communication through modern media/technologies. Discipline and courtesies to be followed in official communication to maintain decorum.	5

SL.no.	Practical	Hrs
1.	Software use in mapping Technology, Tracking, web portals in crisis management in case of a disaster.	2
2.	Requirement development for food processing unit SCM software.	3
3.	Application of software for SCM system and ERP.	5

MODEL QUESTION PAPER

CODE NO: Semester – II

Information Communication Technology

TIME: 3 hrs **Max marks: 70**

Instructions: Draw neat and labeled diagram wherever necessary.

PART-A

IX. Write short notes for the following(any 5): **(5x2=10)**

13. ----------
14. ----------
15. ----------
16. ----------
17. ----------
18. ----------

PART-B

X. Answer any 4 of the following: **(4x5=20)**

11. ----------
12. ----------
13. ----------
14. ----------
15. ----------

PART –C

XI. Answer any 4 of the following: **(4x10=40)**
XII.

11. ----------
12. ----------
13. ----------
14. ----------
15. ----------

II SEMESTER PRACTICAL EXAMINATION

Information Communication Technology

PRACTICAL

SCHEME OF EXAMINATION

DURATION: 3 Hours

Maximum Marks: 70

Practical proper: 60

Record marks: 10

NOTE :- Candidates are required to submit the records duly signed by the teacher-in charge and certified by the Head of the Department

I. Software use in mapping Technology, Tracking, web portals in crisis management in case of a disaster.
II. Requirement development for food processing unit SCM software.
III. Application of software for SCM system and ERP.

General Component

Semester - III **MFC 520**

Sl. no.	PRODUCT DEVELOPMENT AND ENTRPREUNERSHIP	Hrs
1	Sensory evaluation of foods - Importance, need and application for product formulation, Basic tastes, threshold tests for basic tastes, Sensory panel, type, selection and training. Types of sensory tests- Subjective and objective sensory evaluation. Instrumental tests for sensory attributes – color, texture and odor.	8
2	Product Development - Designing new product – types and drawing forces, Need for product development. Stages of product development, Consumer research. Role of sensory evaluation in consumer product acceptance.	5
3	Entrepreneurship - Starting and managing an enterprise - Steps in preparing a business plan, Components of management, Developing managerial skills, Managing a food industry. Factors influencing entrepreneurship groups Qualities of an entrepreneur	6
4	Consumer Behaviour & Marketing - Factors influencing food purchases, product acceptance, purchasing trends. Changing food trends.	3
5	Special food processing technologies and novel food ingredients – Membrane technology (reverse osmosis and ultra-filtration), agglomeration, agitation, air classification, extrusion, automation in food industries.	8

Sl. no.	Practical	Hrs
1	Sensory analysis: Different types of sensory tests for basic tastes and sensory attributes of products.	5
2	Project on different sensory techniques and responses utilizing prepared food products, analysis and presentation of sensory data.	3
3	Stepwise development of a new food product, standardization, acceptability studies and submission of project report.	4
4	Survey on types of convenience foods / consumer behaviour / analysis of food labelling.	3

MODEL QUESTION PAPER

CODE NO: MFC 520 Semester – III

PRODUCT DEVELOPMENT AND ENTRPREUNERSHIP

TIME: 3 hrs **Max marks: 70**

Instructions: Draw neat and labeled diagram wherever necessary.

PART-A

XIII. Write short notes for the following(any 5): (5x2=10)

19. ----------
20. ----------
21. ----------
22. ----------
23. ----------
24. ----------

PART-B

XIV. Answer any 4 of the following: (4x5=20)

16. ----------
17. ----------
18. ----------
19. ----------
20. ----------

PART –C

XV. Answer any 4 of the following: (4x10=40)

XVI.

16. ----------
17. ----------
18. ----------
19. ----------
20. ----------

III SEMESTER PRACTICAL EXAMINATION

PRODUCT DEVELOPMENT AND ENTRPREUNERSHIP PRACTICAL

SCHEME OF EXAMINATION

DURATION: 3 Hours

Maximum Marks: 70

Practical proper: 60

Record marks: 10

NOTE: - Candidates are required to submit the records duly signed by the teacher-in charge and certified by the Head of the Department

I. Different types of sensory tests
II. Methods of Sensory analysis for basic tastes and sensory attributes of products.
III. Stepwise development of a new food product, standardization and acceptability studies.
IV. Survey on types of convenience foods.
V. Market survey and identification of consumer behaviour.
VI. Survey on types of analysis of food labelling.
VII. Preparation of project reports on different sensory techniques and responses utilizing prepared food products
VIII. Presentation of the project proposed and analysis of sensory data.

General Component

Semester – IV **MFD 510**

Sl. No.	Food Marketing	Hrs
1.	Food Marketing: Definition, meaning, characteristics of rural and urban marketing	3
2.	Opportunities and challenges marketing food products by small scale entrepreneurs	2
3.	Rural marketing segmentation, rural consumer behavior, changing trends in rural consumer selection and decision, marketing process and influential factors, marketing needs for export products.	5
4.	Urban marketing segmentation, urban consumer behavior, changing trends in urban consumer selection and decision, marketing process and influential factors	5
5.	Product design, innovativeness presentation, services, prices, method of pricing, network for sourcing raw materials and distribution of products in both rural and urban area.	4
6.	Designing advertisement, campaign, sales promotion, choice of media, techniques, personal selling and publicity	4
7.	Online Marketing: Target population, product packing, distribution through courier and other mode of transportation.	3
8.	Food packaging, labelling for consumer acceptability	2
9.	Relevant of marketing information system, market research in accessing consumer behavior	2

Sl. No.	Practical	Hrs
1.	Regulatory aspects and food hygiene and safety for packing and marketing of food products. Costing of food products. Visit to marketing federation, cooperatives APMCs and other marketing organization and institution for familiarization of	15

	marketing strategy, handling and transportation of fresh package products, perishable goods and self stable and transport table. Financial management, securing financial support, advancing the products for marketing, bulk and retail sales, recalling the products recovery of advances.	

MODEL QUESTION PAPER

CODE NO: Semester – IV

Food Marketing

TIME: 3 hrs **Max marks: 70**

Instructions: Draw neat and labeled diagram wherever necessary.

PART-A

XVII. Write short notes for the following(any 5): **(5x2=10)**

25. ----------
26. ----------
27. ----------
28. ----------
29. ----------
30. ----------

PART-B

XVIII. Answer any 4 of the following: **(4x5=20)**

21. ----------
22. ----------
23. ----------
24. ----------
25. ----------

PART –C

XIX. Answer any 4 of the following: **(4x10=40)**

21. ----------
22. ----------
23. ----------
24. ----------
25. ----------

IV SEMESTER PRACTICAL EXAMINATION

PRACTICAL

Food Marketing

SCHEME OF EXAMINATION

DURATION: 3 Hours

Maximum Marks: 70

Practical proper: 60

Record marks: 10

NOTE :- Candidates are required to submit the records duly signed by the teacher-in charge and certified by the Head of the Department

1.Regulatory aspects and food hygiene and safety for packing and marketing of food products. Costing of food products

2.Visit to marketing federation, cooperatives APMCs and other marketing organization and institution for familiarization ofmarketing strategy, handling and transportation of fresh package products, perishable goods and self stable and transport table.

3.Financial management, securing financial support, advancing the products for marketing, bulk and retail sales, recalling the products recovery of advances.

General Component

Semester – IV **MFD 520**

Sl. No.	Food Standards, Regulatory Affairs and IPR Issues	Hrs
1.	Introduction to concepts of food quality, food safety, food quality assurance and food quality management; objectives, importance and functions of quality control, Current challenges to food safety	3
2.	Principles of food quality assurance, total quality management (TQM)–good manufacturing/management practices, good hygienic practices, good lab practices, general awareness and role of management practices in quality control	3
3.	Microbial quality control: determination of microorganisms in foods by cultural, microscopic, physical, chemical methods. Statistical quality control in food industry Food adulteration, nature of adulterants, methods of evaluation of food adulterants and toxic constituents	3
4.	Food safety management, applications of HACCP in food safety, concept of food trace ability for food safety, Food safety and Standards Act 2006: salient provision and prospects	3
5.	Role of national and international regulatory agencies, Bureau of Indian Standards (BIS), AGMARK, Food Safety and Standards Authority of India (FSSAI)	3
6.	Introduction to WTO agreements: SPS and TBT agreements, Codex Alimentarious Commission ,, International organization for standards (ISO) and its standards for food quality and safety (ISO 9000 series, ISO 22000, ISO 15161,ISO 14000)	5
7.	Food safety in USA, USFDA, Legislation in Europe: Directives of the official journal of the EU, council regulations, food legislation in UK. Regulating methods for food analysis, case studies. Enforcers of Food Laws Approval Process for Food Additives ,Nutritional Labeling	5
8.	Concept of property, rights, duties and their correlation; History and evaluation of IPR; Copyrights and related rights. Distinction among Various forms of IPR. Patent rights/protection and	5

	procedure; Infringement or violation; Remedies against infringement; Indian Patent Act 1970 and TRIPS; Geographical indication and Industrial design	
Sl. No.	**Practical**	**Hrs**
1.	Study of food regulations in various countries ; study of nutritional labeling of packaged food items by visiting food market, Visit the websites of FSSAI, BIS, AGMARK, ISO, Codex Alimentarius Commission , USFDA Study of patent law in India and the procedure for grant of patent in India	15

MODEL QUESTION PAPER

CODE NO: Semester – IV

Food Standards, Regulatory Affairs and IPR Issues

TIME: 3 hrs **Max marks: 70**

Instructions: Draw neat and labeled diagram wherever necessary.

PART-A

XX. Write short notes for the following(any 5): (5x2=10)

31. ----------
32. ----------
33. ----------
34. ----------
35. ----------
36. ----------

PART-B

XXI. Answer any 4 of the following: (4x5=20)

26. ----------
27. ----------
28. ----------
29. ----------
30. ----------

PART –C

XXII. Answer any 4 of the following: (4x10=40)

26. ----------
27. ----------
28. ----------
29. ----------
30. ----------

IV SEMESTER PRACTICAL EXAMINATION

PRACTICAL

Food Standards, Regulatory Affairs and IPR Issues

SCHEME OF EXAMINATION

DURATION: 3 Hours

Maximum Marks: 70

Practical proper: 60

Record marks: 10

NOTE :- Candidates are required to submit the records duly signed by the teacher-in charge and certified by the Head of the Department

1. Study of food regulations in various countries ;

2.study of nutritional labeling of packaged food items by visiting food market, Visit the websites of FSSAI, BIS, AGMARK, ISO, Codex Alimentarius Commission , USFDA

3.Study of patent law in India and the procedure for grant of patent in India

JSS COLLEGE OF ARTS, COMMERCE & SCIENCE

(An Autonomous College of University of Mysore)

Re-accredited by NAAC with 'A' grade

OOTY ROAD, MYSORE-570 025, KARNATAKA

ESTD-1964

SYLLABUS

M. Voc. (Software Development)

2021 -2022

DEPARTMENT OF SOFTWARE DEVELOPMENT

Scheme of Instruction For M. Voc. (Software Development) year 2021-22									
General Education Component									
(L-Lecture; T-Tutorial; P-Practical/Practice) (1 Credit = 15 Hrs)									
Years/Semesters		**Paper No.**	**--Title**	**L:T:P**	**L**	**T**	**P**	**Total Hours**	**Total Credits**
General Education									
Year 1	Sem I	MSA510	Business English	2:0:1	30	0	15	45	3
		MSA520	Data Analysis	3:0:0	45	0	0	45	3
	Sem II								**06**
		MSB510	Presentation and time management Skills	2:0:1	30	0	15	45	3
		MSB510	Concept of Data Mining	2:0:1	30	0	15	45	3
									06
		Skill Components							
			Design Developer	240 hours					**48**
				Total					**60**
		General Education							
Year 2	Sem III	MSC510	Teamwork and Communication skills	2:0:1	30	0	15	45	3
		MSC520	Advanced Computer networks	3:0:0	45	0	0	45	3
									06
	Sem IV	MSD510	Project Estimation Skills	2:0:1	30	0	15	45	3
		MSD520	Meeting Management Skills	2:0:1	30	0	15	45	3
									06
		Skill Components							
			Software Developer	240 hours					**48**
				Total					**60**

Scheme of Assessment:

Semester-I:

Sl. no	Course Code	Course Name	Credits		Marks				
			L:T:P	Total	Th	C1	C2	Pr	Total
1	MSA510	Business English	2:0:1	03	70	15	15	70	170
2	MSA520	Data Analytics	3:0:0	03	70	15	15	100	100

Semester-II:

Sl. no	Course Code	Course Name	Credits		Marks				
			L:T:P	Total	Th	C1	C2	Pr	Total
1	MSB510	Presentation and time management Skill	2:0:1	03	70	15	15	70	170
2	MSB520	Concept of Data Mining	2:0:1	03	70	15	15	70	170

Semester-III:

Sl. no	Course Code	Course Name	Credits		Marks				
			L:T:P	Total	Th	C1	C2	P	Total
1	MSC510	Teamwork and Communication skills	2:0:1	03	70	15	15	70	170
2	MSC520	Advanced Computer networks	2:0:1	03	70	15	15	70	170

Semester-IV:

Sl. no	Course Code	Course Name	Credits		Marks				
			L:T:P	Total	Th	C1	C2	P	Total
1	MSD510	Project Estimation Skills	2:0:1	03	70	15	15	70	170
2	MSD520	Meeting Management Skills	2:0:1	03	70	15	15	70	170

General Education Component

Semester-I:

Subject Name : Business English	
Course Code : MSA510	
No. of Teaching Hours – 45	Credits : 2:0:1 L-T-P

Theory		
Unit .No	**Title**	**Hrs**
1	Understanding company structures, Developing Relationships in the workplace, Correspondence-Emailing, Written reports and telephoning	15
2	Public speaking and presentations, Meetings : Chairing, setting the ageda, controlling the conversation , Participating, turn taking, listening and taking notes, Being diplomatic, agreeing and disagreeing. Negotiations: Key negotiating language, framing your argument, Negotiating with suppliers, Negotiating with customers	10
3	Reports : Skim reading reports and news feeds, How to report information and ideas , Writing reports – style, register, conventions	5
	Total	**30**

Practical		
Sl.No	**Title**	**Hrs**
1	Understanding company structures	2
2	Developing Relationships in the workplace	3
3	Correspondence-Emailing, Written reports and telephoning	3
4	Public speaking and presentations	3
5	Meetings and negotiations	2
		2
	Total	**15**

Subject Name : Data Analysis	
Course Code : MSA520	
No. of Teaching Hours – 45	Credits : 3:0:0 L-T-P

Unit.No	**Title**	**Hrs**
1	DATA ANALYSIS : Regression modeling, Multivariate analysis, Bayesian modeling, inference and Bayesian networks, Support vector and kernel methods, Analysis of time series: linear systems analysis, nonlinear dynamics – Rule induction – Neural networks: learning and generalization, competitive learning, principal component analysis and neural networks; Fuzzy logic: extracting fuzzy models from data, fuzzy decision trees, Stochastic search methods.	15
2	MINING DATA STREAMS : Introduction to Streams Concepts – Stream data model and architecture – Stream Computing, Sampling data in a stream – Filtering streams – Counting distinct elements in a stream – Estimating moments – Counting oneness in a window – Decaying window – Realtime Analytics Platform(RTAP) applications – case studies – real time sentiment analysis, stock market predictions.	10
3	FREQUENT ITEM SETS AND CLUSTERING: Mining Frequent item sets – Market based model – Apriori Algorithm – Handling large data sets in Main memory – Limited Pass algorithm – Counting frequent itemsets in a stream – Clustering Techniques – Hierarchical – K- Means – Clustering high dimensional data – CLIQUE and PROCLUS – Frequent pattern-based clustering methods – Clustering in non-euclidean space – Clustering for streams and Parallelism.	10
4	FRAMEWORKS AND VISUALIZATION : MapReduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases – S3 – Hadoop Distributed file systems – Visualizations – Visual data analysis techniques, interaction techniques; Systems and applications:	10
	Total	**45**

TEXT BOOKS:

1. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.

2. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2012.

Semester- II:

Subject Name : **Presentation and time management Skill**	
Course Code : MSC510	
No. of Teaching Hours – 45	Credits : 2:0:1 L-T-P

Theory		
Unit .No	**Title**	**Hrs**
1	Understand basic patterns of an effective presentation, Create and deliver an effective presentation, Asking questions, Answering questions, Evaluate presentation, Case study; Entrepreneurship development	10
2	Values and beliefs of time management, Goals and benchmarks- The ladders of success, Managing projects and commitments, Prioritizing your to do's	10
3	Designing the projects that matter, Inspired action; Getting the results you need, Tracking projects, Managing for accomplishment, Tools for time management	10
	Total	**30**

Practical		
Sl.No	**Title**	**Hrs**
1	Understand basic patterns of an effective presentation	1
2	Create and deliver an effective presentation	1
3	Asking questions	1
4	Answering questions	2
5	Evaluate presentation	2
6	Case study; Entrepreneurship development	2
	Total	**15**

Subject Name : **Concepts of Data Mining**	
Course Code : MSC520	
No. of Teaching Hours – 45	Credits : 2:0:1 L-T-P

Theory		
Unit .No	**Title**	**Hrs**
1	Data Mining Introduction : Introduction to Data Mining, Need of Mine Data, Evolution of Data Mining, Data Mining Tasks, Classification, Clustering, Association Mining, Challenges of Data Mining	
2	Preprocessing : Data, Attribute Values, Measurement of Length, Types and Properties of Attributes & data , Data Preprocessing Data Exploration: Data Exploration Techniques, Summary Statistics, Frequency and Mode, Percentiles, Mean and Median, Visualization, Histograms, Box Plots	10
3	Classification : OLAP, OLAP Operations, Data Mining Classification, Decision Trees, Naive Bayes Data Mining Association: Data Mining Association Analysis, Association Rule Mining, Frequent Item set Generation, FP-growth Tree Algorithm, Cluster Analysis.	**15**
		30

Practical		
Sl.No	**Title**	**Hrs**
1	Data Mining Tools: WEKA (Waikato Environment for Knowledge Analysis): is a well-known suite of machine learning software that supports several typical data mining tasks, particularly data pre-processing, clustering, classification, regression, visualization, and feature selection.	7
2	RapidMiner: Formerly called YALE (Yet another Learning Environment), is an environment for machine learning and data mining experiments that is utilized for both research and real-world data mining tasks.	8
	Total	**15**

Reference book:

1. Tan, Steinbach, Kumar Introduction to Data Mining Pearson Addison Wesley, 2006
2. Jiawei Han, Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann Publishers

Semester- III:

Subject Name : **Teamwork and Communication skills**	
Course Code : MSA510	
No. of Teaching Hours – 45	Credits : 2:0:1 L-T-P

Theory		
Sl.No	**Title**	**Hrs.**
1	Team structure, Stages of team, Traditional teams vs. Collaborative teams, Taking team action & problem solving, Team communication, Conflict resolution, Meditation, Role-Specific issues and Project presentations	2
2		
3	Communication in English, Listening skills, Reading skills, Writing skills, Speaking skills	
	Total	30

Practical		
Sl.No	**Title**	**Hrs.**
1	Team structure	1
2	Stages of team	1
3	Traditional teams vs. Collaborative teams	1
4	Taking team action & problem solving	2
5	Team communication	2
6	Conflict resolution	3
7	Meditation	1
8	Role-Specific issues	2
9	Project presentations	2
	Total	15

Subject Name : **Advanced Communication Networks**	
Course Code : MSC520	
No. of Teaching Hours – 45	Credits : 3:0:0 L-T-P

Theory		
Sl.No	**Title**	**Hrs.**
1	Review of fundamental concepts in networking and communication. Packet switching techniques and types, Foundations of networking protocols, Internet protocols and addressing. Basics of wireless Networks and Mobile IP. Routers, Routing and internetworking, network layer routing, Least cost path algorithms, Non least cost algorithms, Intra domain routing protocols, inter domain routing protocols, Congestion control in network layer	15
2	Transport and end to end protocols: Transport layer, TCP, UDP, Mobile transport protocols, TCP congestion control, Applications and network management	10
3	Packet Queues and delay analysis, Queuing disciplines, Markovian systems, Non Markovian systems, Networks in Queues, Basics of QoS and resource allocation	10
4	VPNs, Tunneling and Overlay networks, VPN, MPLS, P2P networks, Basics of VOIP, mobile ad hoc networks and wireless sensor networks. Recent trends in networking	10
	Total	45

References:

1. Nader Mir : Computer and communication networks , Pearson Education 2007

2. Leon Garcia and IndraWidjaja: CommuincationNetworks,TMH Second Edition

Semester-IV:

Subject Name : **Project Estimation skills**	
Course Code : MSD510	
No. of Teaching Hours – 45	Credits : 2:0:1 L-T-P

Theory		
Sl.No	**Title**	**Hrs.**
1	Understand project estimation	3
2	How to estimate time accurately	4
3	Methods for estimating time	13
4	Preparing your schedule	10
	Total	30

Practical		
Sl.No	**Title**	**Hrs.**
1	Understand project estimation	2
2	How to estimate time accurately	3
3	Methods for estimating time	5
4	Preparing your schedule	5
	Total	15

Subject Name : **Meeting management skills**	
Course Code : MSD520	
No. of Teaching Hours – 45	Credits : 2:0:1 L-T-P

Theory		
Sl.No	**Title**	**Hrs.**
1	Understanding meeting management	3
2	Types of meetings	4
3	Setting meeting objectives	5
4	Greetings	2
5	Conduct of meeting	5
6	Meeting closure	1
7	Minutes of meeting	5
8	Meeting followup	5
	Total	30

Theory		
Sl.No	**Title**	**Hrs.**
1	Understanding meeting management	2
2	Types of meetings	1
3	Setting meeting objectives	2
4	Greetings	1
5	Conduct of meeting	3
6	Meeting closure	1
7	Minutes of meeting	2
8	Meeting followup	3
	Total	15

JSS MAHAVIDYAPEETHA

JSS College of Arts, Commerce & Science (Autonomous)
Ooty Road, Mysuru-25

PG Department of Physics
(Autonomous under University of Mysore, Re-accredited by NAAC with 'A' Grade
Recognised by UGC as "College with Potential for Excellence")

M.Sc. Physics

Course Structure and Syllabus

Under
Choice Based Credit Scheme (CBCS)
&
Continuous Assessment Grading Pattern (CAGP)
2021-22

JSS MAHAVIDYAPEETHA

JSS College of Arts, Commerce & Science (Autonomous),

Ooty Road, Mysuru-25

PG Department of Physics

Details of Courses offered and associated credits

Paper Code	Paper	HC/SC/ EL/OE	Credits			
			L	T	P	Total
I Semester						
PHY101	Classical Mechanics	HC 1	3	-	-	03
PHY102	Mathematical Methods of Physics 1	HC 2	3	-	-	03
PHY103	Mathematical Methods of Physics 2	HC 3	3	-	-	03
PHY104	Classical Electrodynamics & Plasma Physics	HC 4	3	-	-	03
PHY105	Computer Lab CL-A	HC 5	-	-	2	02
PHY106/107	Electronics Lab/Optics Lab	SC 1	-	-	4	04
						18
II Semester						
PHY201	Continuum Mechanics and Relativity	HC 6	3	-	-	03
PHY202	Thermal Physics	HC 7	3	-	-	03
PHY203	Quantum Mechanics 1	HC 8	3	-	-	03
PHY204	Spectroscopy and Fourier Optics	HC 9	3	-	-	03
PHY205	Computer Lab CL-B	HC 10	-	-	2	02
PHY206/207	Optics Lab / Electronics Lab	SC 2	-	-	4	04
						18
III Semester						
PHY301	Quantum Mechanics 2	HC 11	3	-	-	03
PHY302	Condensed Matter Physics	HC 12	3	-	-	03
PHY303	Nuclear and Particle Physics	HC 13	3	-	-	03
PHY311/312	Condensed Matter Physics Lab / Nuclear and Particle Physics Lab	HC 14	-	-	4	04
Students are permitted to choose any one of the following (special paper) and corresponding practical coupled to the special paper						
PHY304	Solid State Physics 1	SC 3	3	-	-	03
PHY313	Solid State Physics Lab 1	SC 4	-	-	2	02
PHY305	Nuclear Physics 1	SC 3	3	-	-	03
PHY314	Nuclear Physics Lab 1	SC 4	-	-	2	02
PHY306	Theoretical Physics 1	SC 3	3	-	-	03
PHY315	Theoretical Physics Lab 1	SC 4	-	-	2	02
Students from other departments can register for any one of the following						
PHY321/322	Modern Physics/Energy Science	OE	3	1	-	04
						22

IV Semester						
PHY421/422	Nuclear and Particle Physics Lab/ Condensed Matter Physics Lab	HC 15	-	-	4	04
A student has to register for one particular discipline in confirmation with the corresponding SC (special paper) opted in III semester						
PHY401	Solid State Physics 2	SC 5	3	-	-	03
PHY402	Solid State Physics 3	SC 6	3	-	-	03
PHY423	Solid State Physics Lab 2	SC 7	-	-	2	02
PHY403	Nuclear Physics 2	SC 5	3	-	-	03
PHY404	Nuclear Physics 3	SC 6	3	-	-	03
PHY424	Nuclear Physics Lab 2	SC 7	-	-	2	02
PHY405	Theoretical Physics 2	SC 5	3	-	-	03
PHY406	Theoretical Physics 3	SC 6	3	-	-	03
PHY425	Theoretical Physics Lab 2	SC 7	-	-	2	02
Students are permitted to choose any one of the following (Elective papers 1)						
PHY407	Accelerator Physics	SC 8	2	-	-	02
PHY408	Liquid Crystals		2	-	-	02
PHY409	Atmospheric Physics		2	-	-	02
PHY410	Numerical Methods		2	-	-	02
Students are permitted to choose any one of the following (Elective papers 2)						
PHY411	Nuclear Spectroscopy Methods	SC 9	3	1	-	04
PHY412	Modern Optics					
PHY413	Electronics					
PHY414	Minor Project					04
						18

Semester	HC	SC	OE	Total
I Semester	14	4		18
II Semester	14	4		18
III Semester	13	5	04	22
IV Semester	04	14		18
Total	45	27	04	76

HC: Hard Core; **SC:** Soft Core; **OE:** Open Elective; **EL:** Elective; **EC:** Extra Credit;

Syllabus for the 4-Semester M.Sc., (Physics)
Choice Based Credit Scheme (CBCS)

PHY-101: Classical Mechanics

Mechanics of a system of particles: Conservation of linear and angular momenta in the absence of (net) external forces and torques using centre of mass. The energy equation and the total potential energy of a system of particles using scalar potential (**Goldstein H).**
The Lagrangean method: Constraints and their classifications. Generalized coordinates. Virtual displacement, D'Alembert's principle and Lagrangean equations of the second kind. Examples of (1) single particle in Cartesian, spherical polar and cylindrical polar coordinate systems, (2) Atwood's machine, (3) a bead sliding on a rotating wire in a force-free space and (4) Simple pendulum. Derivation of Lagrange equations from Hamilton principle **(Goldstein H).**
Central forces: Reduction of two particle equations of motion to the equivalent one-body problem, reduced mass of the system. Conservation theorems (First integrals of the motion). Equations of motion for the orbit, classification of orbits, conditions for closed orbits. The Kepler problem (inverse-square law of force) (**Aruldas G, Goldstein H, Srinivasa Rao K.N**). **[16 hours]**

Hamilton's equations: Generalised momenta. Hamilton's equations. Examples - simple harmonic oscillator, charged particle moving in an electromagnetic field. Hamiltonian for a free particle in different coordinates. Cyclic coordinates. Physical significance of the Hamiltonian function. Derivation of Hamilton's equations from a variational principle **(Goldstein H)**.
Canonical transformations: Definition, Generating functions (Four basic types). Examples of Canonical transformations. The harmonic Oscillator. Infinitesimal contact transformation. Poisson brackets; properties of Poisson brackets, angular momentum and Poisson bracket relations. Equation of motion in the Poisson bracket notation. The Hamilton-Jacobi equation; the example of the harmonic oscillator treated by the Hamilton-Jacobi method **(Goldstein H).** **[16 hours]**

Mechanics of rigid bodies: Degrees of freedom of a free rigid body. Angular momentum and kinetic energy of rigid body. Moment of inertia tensor, principal moments of inertia, products of inertia, the inertia tensor. Euler equations of motion for a rigid body. Torque free motion of a rigid body. Precession of earth's axis of rotation, Euler angles, angular velocity of a rigid body **(Goldstein H).**
Small oscillations of mechanical system: Introduction, types of equilibria, Quadratic forms of kinetic and potential energies of a system in equilibrium. General theory of small oscillations, secular equation and eigenvalue equation. Small oscillations in normal coordinates and normal modes, examples of two coupled oscillators. Vibrations of a linear triatomic molecule **(Goldstein H).** **[16 hours]**

Total work load **48 hours**

References:

1. Goldstein H., Poole C. and Safko J., Classical mechanics, 3rd Edn., Pearson Education, New Delhi. 2002
2. Upadhaya J.C., Classical mechanics, Himalaya Publishing House, Mumbai. 2006.
3. Srinivasa Rao K.N., Classical mechanics, Universities Press, Hyderabad. 2003.
4. Takwale R.G. and Puranik S., Introduction to classical mechanics, Tata McGraw, New Delhi, 1991.
5. Landau L.D. and Lifshitz E.M., Classical mechanics, 4th Edn., Pergamon Press, 1985.
6. Aruldas G., Classical Mechanics, PHI Learning Private Limited, New Delhi

PHY-102: Mathematical Methods of Physics 1

Curvilinear coordinates and Tensors: Curvilinear coordinates in the Euclidean 3-space, Orthogonal curvilinear coordinates. Differential vector operators; Grad, divergence, curl and Laplacian in arbitrary curvilinear coordinates. Circular cylindrical coordinates, spherical polar coordinates **(Arfken &Weber).**

Tensors: Tensors of rank r as a r-linear form in base vectors. Transformation rules for base vectors and tensor components. Tensor algebra, contraction, Raising and lowering of indices, Associated tensors, quotient rule. Mention of pseudo tensor, dual tensor and non-cartesian tensor. Metric tensor, Covariant and contravariant components of the metric tensor, Christoffel symbols. Tensor derivative operators, Covariant differentiation. The contracted Christoffel symbol **(Arfken &Weber). [16 hours]**

Differential equations, Hermite function and Laguerre functions: Partial differential equation Separation of variables - Helmholtz equations in Cartesian, circular cylindrical coordinates Spherical polar coordinates. Regular and irregular singular points of a second order ordinary differential equation. Series solution-Frobenius power series method, Examples of Harmonic oscillator and Bessel's equation. Linear dependence and independence of solutions-Wronskian. Non-homogeneous equations-Green's function, examples **(Arfken &Weber).**
Hermite functions: Hermite`s differential equation and its Solution, Hermite polynomials, Generating functions, Recurrence relations, Rodrigues representation, Orthogonality **(Arfken &Weber).**
Laguerre functions: Laguerre differential equation and its solution, Laguerre polynomials, Generating function, Recurrence relations, Rodrigues representation, Orthogonality. Associated Laguerre functions: Definition, Generating function, Recurrence relations and Orthogonalit **(Arfken &Weber). [16 hours]**

Special functions: Sturm - Liouville theory - Self adjoint ODE's, Hermitian operators, completeness of eigenfunction, Green's function—eigenfunction expansion (**Arfken &Weber).**

Bessel functions: Bessel functions of the first kind J_v (x), Bessel differential equation, generating function for J_v (x), Integrals for J_o (x) and J_v (x), recurrence formulae for J_v (x), orthogonal properties of Bessel polynomials **(Arfken &Weber).**

Legendre functions: Legendre differential equation, Legendre polynomials, generating functions, recurrence formulae, Rodrigues representation, Orthogonality. Associated Legendre polynomials; The differential equation, Orthogonality relation **(Arfken &Weber).**

Spherical harmonics: Definition and Orthogonality **(Arfken &Weber). [16 hours]**

Total work load 48 hours

References:

1. Arfken G.B. and Weber H.J., Mathematical methods for physicists, 6th Edn., Academic Press, New York (Prism Books, Bangalore, India), 1995.
2. Harris E.G., Introduction to modern theoretical physics, Vol. 1, John Wiley, New York, 1975.
3. Srinivasa Rao K.N,, The rotation and Lorentz groups and their representations for physicists, Wiley Eastern, New Delhi, 2003.
4. Gupta B.D., Mathematical physics, 4th Edn, 2011.
5. Bali N. P., Engineering Mathematics, Laxmi Publications, New Delhi
6. Dass H. K., Higher Engineering Mathematics, S. Chand, New Delhi
7. Chattopadhay P. K., Mathematical Physics, New Age International.

PHY-103: Mathematical Methods of Physics 2

Linear vector space: Linear vector space **-** Definition. Linear dependence and independence of vectors. Dimension. Basis. Change of basis. Subspace. Isomorphism of vector spaces. Linear operators. Matrix representative of a linear operator in a given basis. Effect of change of basis. Invariant subspace. Eigenvalues and eigenvectors. Characteristic equation. The Schur canonical form. Diagonalization of a normal matrix. Schur's theorm **(Arfken &Weber).** **[16 hours]**

Linear representations of groups: Groups of regular matrices; the general linear groups *GL (n, C)* and *GL (n, R)*. The special linear groups *SL (n, C)* and *SL(n, R).* The unitary groups *U (n)* and *SU(n).* The orthogonal groups *O(n, C), O (n, R), SO(n, C)* and *SO(n, R).* Homogeneous Lorentz group (**Arfken &Weber).**
Rotation group: The matrix exponential function-Definition and properties. Rotation matrix in terms of axis and angle. Eigenvalues of a rotation matrix. Euler resolution of a rotation. Definition of a representation. Equivalence. Reducible and irreducible representations. Schur's lemma. Construction of the $D^{1/2}$ and D^{1} representation of *SO (3)* by exponentiation. Mention of the D^{j} irreps *SO (3).*
(Srinivasa Rao K.N). **[16 hours]**

Fourier transforms and Integral equations: General properties, completeness, use of Fourier series. Applications of Fourier series **(Arfken &Weber).**

Integral transforms; Development of Fourier Integral, Fourier transform - inversion theorem, Fourier transform of derivatives, convolution theorem. Momentum representation (**Arfken &Weber).**

Integral equations: Definitions, transformation of a differential equation into an integral equation, Integral transforms, generating functions, Abel's equation, Neumann series, separable kernels, Numerical solution, non-homogeneous integral equations **(Arfken &Weber).** **[16 hours]**

Total work load **48 hours**

References:

1. Shankar R., Principles of quantum mechanics, 2nd Edn., Plenum Press, New York, 1984.
2. Srinivasa Rao K.N., The rotation and Lorentz groups and their representations for Physicists, Wiley Eastern, New Delhi, 1988.
3. Arfken G.B. and Weber H.J., Mathematical methods for Physicists, 5th. Edn., Academic Press, New York, 2001.
4. Gupta B.D., Mathematical Physics, 4th Edn. (Page no. 8.48–8.83, 8.16-8.48) 2011
5. Bali N. P., Engineering Mathematics, Laxmi Publications, New Delhi
6. Dass H. K., Higher Engineering Mathematics, S. Chand Publications, New Delhi
7. Charlie Harper, Introduction to Mathematical Physics, PHI Publications, 2008.

PHY-104: Classical Electrodynamics, Plasma Physics and Optics

Electric multipole moments: The electric dipole and multipole moments of a system of charges. Multipole expansion of the scalar potential of an arbitrary charge distribution **(Griffiths D.J).**

Potential formulation: Maxwell equations in terms of electromagnetic potentials. Gauge transformations. The Lorentz, Coulomb and radiation gauges **(Griffiths D.J).**

Fields of moving charges and radiation: The retarded potentials. The Lienard-Wiechert potentials. Fields due to an arbitrarily moving point charge; the special case of a charge moving with constant velocity **(Griffiths D.J).**

Radiating systems: Radiation from an oscillating dipole. Power radiated by a point charges - Larmor formula. Lienard's generalisation of Larmor formula. Energy loss in bremsstrahlung and linear accelerators. Radiation reaction - Abraham-Lorentz formula **(Griffiths D.J) [16 hours].**

Relativistic electrodynamics: Charge and fields as observed in different frames. Covariant formulation of electrodynamics; Electromagnetic field tensor, Transformation of fields, Field due to a point charge in uniform motion. Lagrangian formulation of the motion of charged particle in an electromagnetic field **(Griffiths D.J).**

Plasma Physics: Quasineutrality of a plasma, plasma behaviour in magnetic fields, Plasma as a conducting fluid. Magnetohydrodynamics; magnetic confinement, Pinch effect, instabilities, Plasma waves.
(Laud B. B.). [16 hours]

Electromagnetic waves: Monochromatic plane waves - velocity, phase and polarization. Propagation of plane electromagnetic waves in (1) conducting media and (2) ionised gases. Reflection and refraction of electromagnetic waves; Fresnel formulae for parallel and perpendicular components. Brewster`s law. Normal and anomalous dispersion; Clausius-Mossotti relation **(Born M. and Wolf E).**

Interference: General theory of interference of two monochromatic waves. Two beam and Multiple beam interference with a plane-parallel plate. Fabry-Perot interferometer; etalon construction, resolving power and its application. Interference filters **(Born M. and Wolf E).**

Diffraction: Integral theorem of Helmholtz and Kirchhoff. Fresnel-Kirchhoff diffraction formula; conditions for Fraunhofer and Fresnel diffraction. Fraunhofer diffraction due to a circular aperture.
(Born M. and Wolf E) [16 hours]

Total work load 48 hours

References:

1. Griffiths D.J., Introduction to Electrodynamics, 5th Edn., Prentice-Hall of India, New Delhi, 2006.
2. Jackson J.D., Classical Electrodynamics, 2nd Edn., Wiley-Eastern Ltd, India, 1998.
3. Born M. and Wolf E., Principles of Optics, 6th Edn., Pergamon Press, Oxford, 1980.
4. Matveev A.N., Optics, Mir Publishers, Moscow, 1988.
5. Laud B.B., Electromagnetics, Wiley Eastern Limited, India, 2000.
6. Hecht E., Optics, Addison-Wesley, 2002.
7. Lipson S.G., Lipson H. & Tannhauser D.S., Optical physics, Cambridge University Press, USA, 1995.
8. Ajoy Ghatak, Optics, Tata McGraw – Hill, New Delhi
9. Gupta A. B. Modern Optics, Books and Allied (P) Ltd, Kolkata
10. Sen S .N., Plasma Physics, Pragathi Prakasan

PHY-105: Computer Lab CL-A

- Linux operating system basics (4 sessions) :
  Login procedure; creating, deleting directories; copy, delete, renaming files; absolute and relative paths; Permissions—setting, changing; Using text editor.
- Scientific text processing with LATEX.
  Typeset text using text effects, special symbols, lists, table, mathematics and including figures in documents.
- Using the plotting program GNUPLOT (2 sessions) :
  Plotting commands; To plot data from an experiment and applying least-squares fit to the data points. Including a plot in a LATEX file.
- Using the mathematics package OCTAVE (2 sessions), To compute functions, matrices, eigenvalues, inverse, roots.

Total work load: 1 day(s) per week × 4 hours × 16 weeks = **64 hours**

PHY-106: Electronics Lab

Any ten of the following experiments:

1. Regulated power supply.
2. Active filters : low pass (single pole).
3. Active filters : high pass (double pole).
4. Voltage follower.
5. Colpitts' oscillator.
6. Opamp as an integrator and differentiator.
7. Opamp as a summing and log amplifier.
8. Opamp as an inverting and non-inverting amplifier.
9. Coder and encoder.
10. Half adder and full adder.
11. Boolean algebra-Logic gates.
12. Opamp astable multivibrator.

Total work load: 2 day(s) per week × 4 hours × 16 weeks = **128 hours**

PHY-107: Optics Lab

Any ten of the following experiments:

1. Verification of the Brewster law of polarisation.
2. Verification of Fresnel laws of reflection from a plane dielectric surface.
3. Determination of the inversion temperature of the copper-iron thermocouple.
4. Birefringence of mica by using the Babinet compensator.
5. Birefringence of mica by using the quarter-wave plate.
6. Experiments with the Michelson interferometer.
7. Determination of the refractive index of air by Jamin interferometer.
8. Determination of the size of lycopodium spores by the method of diffraction haloes.
9. Determination of wavelength by using the Fabry-Perot etalon.
10. Dispersion of the birefringence of quartz.
11. The Franck-Hertz experiment.
12. Experiments with the laser.
13. Determination of the Stokes vector of a partially polarised light beam
14. Determination of the modes of vibration of a fixed-free bar.

Total work load: 2 day(s) per week × 4 hours × 16 weeks = **128 hours**

PHY-201: Continuum Mechanics and Relativity

Continuum mechanics of solid media: Small deformations of an elastic solid; the strain tensor. The stress tensor. Equations of equilibrium. The symmetry of the stress tensor. The generalised Hooke`s law for a homogeneous elastic medium; the elastic modulus tensor. Navier equations of motion for a homogeneous isotropic medium. **(Landau L.D. and Lifshitz)**

Fluid mechanics: Equation of continuity. Flow of a viscous fluid; Navier-Stokes equation and its solution for the case of flow through a cylindrical pipe. The Poiseuille formula **(Landau L.D. and Lifshitz).**

[16 hours]

Minkowski space-time: Real coordinates in Minkowski space-time. Definition of 4-tensors. The Minkowski scalar product and the Minkowski metric η_{ij} = diag (1 -1 -1 -1). Orthogonality of 4-vectors. Raising and lowering of 4-tensor indices. Time like, null and space like vectors and world-lines. The light-cone at an event **(Griffiths).**

Relativistic mechanics of a material particle: The proper-time interval $d\tau$ along the world - line of a material particle. The instantaneous (inertial) rest-frame of a material particle; Components of 4-velocity, 4-acceleration and 4-momentum vector, statement of second law of Newton. Determination of the fourth component F_4 of the 4-force along the world-line of the particle. Motion of a particle under the conservative 3-force field and the energy integral. The rest energy and the relativistic kinetic energy of a particle. **[16 hours]**

Einstein's equations: The Principle of Equivalence and general covariance. Inertial mass, gravitational mass, Eötvös experiment. Gravitation as space-time curvature. Einstein Gravitational field equations and its Newtonian limits.

The Schwarzschild metric: Heuristic derivation of the Schwarzschild line element. Motion of particles and light rays in the Schwarzschild field. Explanation of the (1) perihelion advance of planet Mercury, (2) gravitational red shift and (3) gravitational bending of light. A brief discussion of the Schwarzschild singularity and the Schwarzschild black hole. **[16 hours]**

Total work load **48 hours**

References:

1. Landau L.D. and Lifshitz E.M., Fluid Mechanics, Pergamon Press, 1987.
2. Landau L.D. and Lifshitz E.M., Theory of Elasticity, Pergamon Press, 1987.
3. Synge J.L., Relativity: The Special Theory, North-Holland, 1972.
4. Landau L.D. and Lifshitz E.M., The Classical Theory of Fields, 4th Edn., (Sections 1 to 6, 16 to 18, 23 to 25, 26 to 35), Pergamon Press, Oxford, 1985.
5. Wald R.M., General relativity, The University of Chicago Press, Chicago, 1984.
6. Schutz B.F., A first course in general relativity, Cambridge University Press, Cambridge, 1985.
7. Bergman P., Introduction to theory of relativity, Prentice-Hall of India, 1969.
8. Rindler R., Relativity: Special, general and cosmological, Oxford University Press, 2006.
9. Narlikar J. V., An introduction to Cosmology, Cambridge Publications
10. Somnath Datta, Introduction to Special theory of Relativity, Allied Publishers, India, 1998
11. Griffiths D. J. Introduction to Electrodynamics, Pearson Publications, 2013.

PHY-202: Thermal Physics

Thermodynamics Preliminaries: Zeroth law of thermodynamics, vander Walls equation of state second law of thermodynamics **(Huang K., Laud B.B, Satya Prakash).**

Entropy: Change in entropy for reversible an irreversible process, entropy and second law of thermodynamics, thermodynamic functions and Maxwell's relations ***TdS*** equations, heat capacities equations, third law of thermodynamics. Irreversible thermodynamics; Onsager's reciprocal relation **(Huang K., Laud B.B, Satya Prakash).**

Phase equilibria; Equilibrium conditions. Classification of phase transitions; phase diagrams; Clausius-Clapeyron equation, applications. Thermoelectric phenomenon, Peltier effect, Seebeck effect, Thompson effect. Systems far from equilibrium **(Huang K., Laud B.B, Satya Prakash). [16 hours]**

Classical Statistical Mechanics: Probability, phase space, division of phase space, ensembles, density distribution in phase space, ergodic hypotheses, Liouville theorem. Statistical equilibrium, postulate of equal *a priori* probability, general expression for probability, Stirlings formula, the most probable distribution, Maxwell Boltzmann distribution law, law of equipartition of energy. Entropy and probability. Microcanonical ensemble, connection between statistical and thermodynamic quantities, Partition function of system of particles, Gibbs paradox, canonical ensemble, perfect monoatmic gas in canonical ensemble, grand canonical ensemble. Vibrational partition function of diatomic molecules (Einstein relations), Rotational partition function of diatomic molecule **(Huang K., Laud B.B, Satya Prakash).**
[16 hours]

Quantum Statistical Mechanics: The postulates of quantum statistical mechanics. Symmetry of wave functions. The Liouville theorem in quantum statistical mechanics; condition for statistical equilibrium; Ensembles in quantum mechanics; the quantum distribution functions (BE and FD), the Boltzmann limit of Boson and Fermion gases, the derivation of the corresponding distribution functions.

Applications of Quantum Statistics: Equation of state of an ideal Fermi gas (derivation not expected), Application of Fermi-Dirac statistics to the theory of free electrons in metals, degeneracy. Application of Bose statistics to the photon gas, derivation of Planck's law, comments on the rest mass of photons. Thermodynamics of Black body radiation. Bose-Einstein condensation **(Huang, Laud, Satya Prakash).**
[16 hours]

Total work load **48 hours**

References:

1. Agarwal B.K. and Eisner M., Statistical mechanics, New Age International Publishers, 2000.
2. Roy S.K., Thermal physics and statistical mechanics, New Age International Pub., 2000.
3. Huang K., Statistical mechanics, Wiley-Eastern, 1975.
4. Laud B.B., Fundamentals of statistical mechanics, New Age International Pub.,2000.
5. Schroeder D.V., An introduction to thermal physics, Pearson Education New Delhi, 2008.
6. Salinas S.R.A., Introduction to statistical physics, Springer, 2004.
7. Mark W Zemansky Heat and Thermodynamics, McGraw – Hill
8. Gupta A. B and Roy H. B., Thermal Physics Books and Allied (P) Ltd, Kolkata
9. Satya Prakash, Statistical Mechanics, Kedarnath Ramnath, 2017.
10. Mike Glazer, J.S. Wark, Statistical Mechanics: A Survival Guide, Oxford Publications, 2001.

PHY-203: Quantum Mechanics 1

The wave function and uncertainty Principle: Wave particle duality, interpretation of the wave function, wave functions for particles having definite momentum, wave packet, Gaussian wave packet. Heisenberg uncertainty principle.

Time independent Schrodinger equation, conservation of probability, expectation values and operators, the Ehrenfest theorem, Time dependent Schrodinger equation, stationary states. Energy quantisation. Properties of energy eigenfunction, general solutions of time dependent Schrodinger equation for a time independent potential. Schrodinger equation in momentum space **(Bransden & Joachain). [16 hours]**

Formalism: Hilbert space. The state of a system, Dirac notation. Dynamical variables and operators – Hermitian operators, adjoint operator, projection operators. Inverse and unitary operators. Expansion in eigenfunctions - eigenvalue and eigenfunction of an operator. Commutator algebra. General Uncertainty relation. Unitary transformation, Representation in discrete basis; Matrix representation of wave functions and operators. Change of representation and Unitary transformations. Matrix representation of eigenvalue problem. Representation in continuous bases. The Schrödinger equation and time evolution of a system. The Schrödinger picture and Heisenberg picture.

Schrodinger equation in one dimension: The free particle, the potential step, potential barrier, infinite square well, finite square well, the linear harmonic oscillator (Algebraic and Analytic method), the periodic potential **[Bransden and Joachain, Nouredine Zettili]. [16 hours]**

Angular Momentum: Orbital angular momentum; Orbital angular momentum and spatial rotations, eigenvalues and eigenfunctions of $\mathbf{L}^2$ and L_z**.** Particle on a sphere and the rigid rotator. General angular momentum. The spectrum of $\mathbf{J}^2$ and J_z**.** Matrix representation of angular momentum operators, spin angular momentum, spin one-half, total angular momentum. Addition of angular momenta - CG Coefficients**.**

Schrodinger equation in three dimensions: Separation of the Schrodinger equation in Cartesian coordinates -the free particle. Central potential. Separation of the Schrodinger equation in spherical polar coordinates; the Hydrogenic atom and its solutions **(Bransden & Joachain). [16 hours]**

Total work load **48 hours**

References:

1. Nouredine Zettili, Quantum Mechanics, WILEY Publications, U K 2009
2. Griffiths D.J., Introduction to quantum mechanics, Prentice-Hall, USA, 1994.
3. Bransden & Joachain, 2004, II edition, Pearson Low Price Edition
4. Sakurai J.J. and Tuan S.F. (Editor), Modern quantum mechanics, AddisonWesley, India, 1999.
5. Shankar R., Principles of quantum mechanics, 2nd Edn., Plenum Press, New York, 1984.
6. Schiff L.I., Quantum mechanics, 3rd. Edn., McGraw-Hill, Kogakusha Ltd., New Delhi, 1968.
7. Aruldas G., Quantum Mechanics, PHI, New Delhi
8. Mathews P. M. and Venkatesan K., Quantum mechanics, Tata - McGraw-Hill, New Delhi
9. Verma H. C., Quantum Physics, Surya Publications, Ghaziabad
10. Merzbacher E., Quantum Mechanics, III edition, Wiley publication.

PHY-204: Spectroscopy and Fourier Optics

Atomic spectroscopy: vector model of atom- orbital magnetic moment , Larmor precession, electron spin, coupling of orbital and spin angular momenta. Spectroscpic terms and their notations, spin-orbit interaction, quantum mechanical relativistic correction. Fine structure of hydrogen, Lamb shift. L-S and J-J coupling. Lande interval rule, selection rules.

Zeeman effect, Examples **1)** $^2D_{3/2} - {}^2P_{1/2}$ **2)** $^2D_{5/2} - {}^2P_{3/2}$ **3)** $^3P - {}^2S$.

Anomalous Zeeman effect, Lande-g factor, Paschen-Back effect – spin-orbit correction. Stark effect – weak field effects and strong field effects. Hyperfine structure of spectral lines. Nuclear spin and hyperfine splitting, intensity ratio and determination of nuclear spin. Breadth of spectral lines, natural breadth. Doppler Effect and external effect **(Rajkumar).** **[16 hours]**

Nuclear magnetic resonance: Quantum mechanical expression for the resonance condition. Relaxation Mechanisms; Expression for spin lattice relaxation. Chemical shift; spin-spin interaction, example of ethyl alcohol. Fourier transform technique in NMR. FTNMR spectrometer and experimental procedure. NMR in medicine.

Microwave spectroscopy: The classification of molecules. The rotational spectra of rigid diatomic rotator, the spectra of non-rigid diatomic rotator, example of HF. Microwave oven.

Infrared spectroscopy: The Born-Oppenheimer approximation. Vibrational energy of diatomic molecule. Anharmonic oscillator. Diatomic vibrating rotator, example of the CO molecule. The vibrations of polyatomic molecules; skeletal and group frequencies. Experimental technique in FTIR.

Raman spectroscopy: The quantum theory of Raman effect. Pure rotational Raman spectra of linear molecules and symmetric top molecules. Vibrational Raman spectra. Rotational fine structure. Instrumentation technique in Raman spectroscopy **(Banwell C.N. and McCash E.M and Aruldas).** **[16 hours]**

Fourier optics: Spatial frequency filter; effect of a thin lens on an incident field distribution. Lens as a Fourier transforming element. Application to phase contrast microscopy. **(Hecht)**

Propagation of light in an anisotropic medium: Structure of a plane electromagnetic wave in an anisotropic medium. Dielectric tensor. Fresnel's formulae for the light propagation in crystals. Ellipsoid of wave normals and ray normals. Normal surface and ray surface. Optical classification of crystals. Light propagation in uniaxial and biaxial crystals. Refraction in crystals. **(Born M. and Wolf E.)**

Elements of Nonlinear Optics: Second harmonic generation, optical rectification and phase matching; third harmonic generation **(Lipson, Srivatsava).** **[16 hours]**

Total work load **48 hours**

References:

1. Tralli N. and Pomilla P.R., Atomic theory, McGraw-Hill, New York, 1999.
2. Banwell C.N. and McCash E.M., Fundamentals of Molecular Spectroscopy, 4th Edn., Tata McGraw-Hill, New Delhi, 1995.
3. Mahan B.H., University Chemistry, 3rd Edn. (Chapters 3, 10, 11 and 12), Narosa, New Delhi, 1975.
4. Hecht E., Optics, Addison-Wesley, 2002.
5. Lipson S.G., Lipson H. and Tannhauser D.S., Optical physics, Cambridge University Press, USA, 1995.
6. Rajkumar, Atomic and molecular spectra:Laser, Kedarnath Ramanath Publications, Meerut.
7. Born M. and Wolf E., Principles of optics, 6th Edn., Pergamon Press, Oxford, 1980
8. Srivatsava, P K Optics, CBS Publisher & Distributors I Ediition, 2011

PHY-205: Computer Lab CL-B

Programming in C

- Check whether given number is odd or even.
- Find the largest and smallest number in the input set.
- Compute the Fibonacci sequence.
- Check whether the input number is prime or not.
- Compute the roots of a quadratic equation.
- Generate Pascal's triangle.
- To add two *m X n* matrices.
- To find the sum and average of a data stored in a file.
- Linear least-squares fitting to data in a file.
- To find the trajectory of a projectile shot with an initial velocity at an angle. Also, find the maximum height travelled and distance travelled. Write the trajectory data to a file specified and plot using Gnuplot.

Programming in Perl

- Searching for a pattern in a string.
- Counting the number of characters, words and lines in a given file.
- Sorting strings.
- Check whether the input number is prime or not.
- Compute the roots of a quadratic equation.
- Linear least squares fitting to data in a file.

Total work load : 1 day(s) per week × 4 hours × 16 weeks = **64 hours**

PHY-206: Optics Lab

For those who have completed PHY-106

Any ten of the following experiments:

1. Verification of the Brewster law of polarisation.
2. Verification of Fresnel laws of reflection from a plane dielectric surface.
3. Determination of the inversion temperature of the copper-iron thermocouple.
4. Birefringence of mica by using the Babinet compensator.
5. Birefringence of mica by using the quarter-wave plate.
6. Experiments with the Michelson interferometer.
7. Determination of the refractive index of air by Jamin interferometer.
8. Determination of the size of lycopodium spores by the method of diffraction haloes.
9. Determination of wavelength by using the Fabry-Perot etalon.
10. Dispersion of the birefringence of quartz.
11. The Franck-Hertz experiment.
12. Experiments with the laser.
13. Determination of the Stokes vector of a partially polarised light beam
14. Determination of the modes of vibration of a fixed-free bar.

Total work load : 2 day(s) per week × 4 hours × 16 weeks = **128 hours**

PHY-207: Electronics Lab

For those who have completed PHY-107

Any ten of the following experiments:

1. Regulated power supply.
2. Active filters : low pass (single pole).
3. Active filters : high pass (double pole).
4. Voltage follower.
5. Colpitts' oscillator.
6. Op-amp as an integrator and differentiator.
7. Op-amp as a summing and log amplifier.
8. Op-amp as an inverting and non-inverting amplifier.
9. Coder and encoder.
10. Half adder and full adder.
11. Boolean algebra-Logic gates.
12. Op-amp astable multivibrator.

Total work load : 2 day(s) per week × 4 hours × 16 weeks = **128 hours**

PHY-301: Quantum Mechanics 2

The time-independent perturbation theory: Nondegenerate Perturbation Theory; first and second order perturbation, Perturbed Harmonic Oscillator. Degenerate Perturbation Theory; Fine Structure of Hydrogen, The Zeeman Effect.

The Variational Principle: Theory, the Ground State of Helium.

WKB Approximation: The Classical Region, Tunneling; connection formulae, α-particle decay **(Griffiths).** **[16 hours]**

Time-dependent perturbation theory: Time dependent perturbation theory; general features, constant and periodic perturbations. Two-Level Systems; Emission and Absorption of Radiations, Spontaneous Emission, Fermi golden rule, Rabi Oscillations**.**

Adiabatic approximation - The Adiabatic Theorem, Berry's Phase. Sudden approximation.

Scattering: Introduction, scattering cross section, scattering by a spherically symmetric potential. Partial Wave Analysis, phase shifts. Optical theorem, Lippmann- Schwinger equation. Born Approximation, Rutherford scattering **(Griffiths D J)**. **[16 hours]**

Relativistic quantum mechanics: Klein-Gordon equation: free particle, stationary state solutions, continuity equation. The Dirac equation; free-particle, stationary state solutions, continuity equation. Covariant formulation; Covariant form of Dirac equation, Lorentz invariance of the Dirac equation, Plane wave solutions of the Dirac equation -non-relativistic limit. Spin and helicity operators. Normalization of the solutions. Brief discussion of the hydrogen atom according to Dirac theory, Non-relativistic limit of Dirac equation. Negative energy states - Hole theory **(Sakurai J J).** **[16 hours]**

Total work load **48 hours**

References:

1. Bransden and Joachain, II edition, Pearson Low Price Edition
2. Sakurai J.J. and Tuan S.F. (Editor), Modern Quantum Mechanics, AddisonWesley, India, 1999.
3. Shankar R., Principles of Quantum Mechanics, 2nd Edn., Plenum Press, New York, 1984.
4. Schiff L.I., Quantum mechanics, 3rd. Edn., McGraw-Hill, Kogakusha Ltd., New Delhi, 1968.
5. Griffiths D.J., Introduction to Quantum mechanics, Prentice-Hall, USA, 1994.
6. Sakurai J.J., Advanced quantum mechanics, Addison-Wesley, Harlow, England, 1999.
7. Griffiths D., Introduction to Elementary particles, John Wiley and Sons, New York, 1987.
8. Gasiorowicz S., Elementary Particle Physics, John-Wiley, New York, 1966.
9. Muirhead H., The Physics of Elementary Particles, Pergamon Press, London, 1965.

PHY-302: Condensed Matter Physics

X-ray crystallography: Crystalline state. Reference axes, equation of a plane, Miller indices. External symmetry of crystals; symmetry operations. Two and three dimensional point groups. Lattices; two dimensional lattices, choice of unit cell. **(Buerger, p12–20, 23–45).**
Three-dimensional lattices; crystal systems and Bravais lattices. Screw and glide operations. Space groups; Examples of space groups. Diffraction of X rays by crystals; Laue equations. Reciprocal lattice. [**Sherwood, p272–288**]. Bragg equation. Equivalence of Laue and Bragg equations. Significance of structure of solid for applications (**Ladd and Palmer, p55–66, p114-121)**.

Atomic scattering factor (qualitative).

Electron and neutron diffraction: Basic principles. Differences between electron, neutron and X-ray diffractions, applications (qualitative). **(Vainshtein, p 336 – 357).**

Crystal growth techniques: General methods of crystl growth. Czochralski, Kyropoulus, Stockbarger-Bridgman. Zone refining techniques **(Rose et al p 146 – 154).** **[16 hours]**

Disordered materials: Amorphous solids. Aperiodic materials.
Liquid crystals: Introduction, Classification and their applications. Morphology. The smectic (A-H), nematic and cholesteric phases (**DeGennes P.G. and Prost J, Gray and Goodby).**

Crystal lattice dynamics: Vibration of an infinite one-dimensional monoatomic lattice, First Brillouin Zone. Group velocity. Finite lattice and boundary conditions. Vibrations of a linear diatomic lattice; optical and acoustical branches, dispersion relations**. (Wahab, p288–305).**

Magnetic properties of solids: Diamagnetism and its origin. Expression for diamagnetic susceptibility. Paramagnetism; Quantum theory of paramagnetism, Brillouin function. Ferromagnetism; Curie-Weiss law, Spontaneous magnetisation and its variation with temperature. Ferromagnetic domains. Antiferromagnetism. Two sub-lattice model. Susceptibility below and above Neel's temperature.
(Dekker, p446–490). **[16 hours]**

Superconductivity: Experimental facts. Type I and type II superconductors. Phenomenalogical theory. London equations. Meissner effect. High frequency behaviour. Thermodynamics of superconductors; Entropy and Specific heat. Qualitative ideas of the theory of superconductivity. **(Kittel, p333–364).**

Semiconductors: Elemental and compound Semiconductors [Streetman, p61–95]. Crystal structure and bonding. Expressions for carrier concentrations. Fermi energy, electrical conductivity and energy gap in intrinsic semiconductors. Extrinsic Semiconductors; impurity states and ionization energy of donors. Carrier concentrations and their temperature variation **(Mckelvey, p256–277).** **[16 hours]**

Total work load **48 hours**

References:

1. Stout G.H. and Jensen L.H., X-ray structure determination, MacMillan, USA, 1989.
2. Ladd M.F.C. and Palmer R.A., Structure determination by X-ray crystallography, Plenum Press, USA, 2003.
3. Buerger M.J., Elementary crystallography, Academic Press, London.
4. Dekker A.J., Solid state physics, Prentice Hall, 1985.
5. Kittel C., Introduction to solid state physics, 7th Edn., John Wiley, New York, 1996.
6. Mckelvey J.P., Solid state and semiconductor physics, 2nd Edn., Harper and Row, USA, 1966.
7. Streetman B.G., Solid state electronic devices, 2nd Edn., Prentice-Hall of India, New Delhi, 1983.
8. DeGennes P.G. and Prost J.,The physics of liquid crystals, 2nd Edn., Clarendon Press, Oxford, 1998.
9. Wahab M.A., Solid state physics, Narosa Publishing House, New Delhi, 1999.
10. Azaroff L.V., Introduction to solids, McGraw-Hill Inc, USA, 1960.
11. Sherwood D., Crystals, X-rays and proteins, Longman, UK, 1976.
12. Rose R.M., Shepard L.A. and Wulff J., The structure and properties of materials Vol. 4, Electronic properties, Wiley Eastern, 1965.
13. Vainshtein B.K., Modern crystallography, Vol. I, Springer-Verlag, Germany, 1981.
14. Pillai S.O., Solid state physics, New Age International Publications, 2002.

PHY-303: Nuclear and Particle Physics

Properties of the Nucleus: Nuclear radius; determination by mirror nuclei, Mesic X-rays and electron scattering methods. Nuclear moments; spin, magnetic dipole moment. Relation between J and μ on the basis of single particle model. Determination of nuclear magnetic moment by Molecular beam experiment. Electric quadrupole moment – reduced Electric quadrupole moment **.**

Nuclear Models: Liquid drop model; Weissacker's formula and its application to (1) stability of isobars and (2) fission process. Shell model; Infinite square well potential, Magic numbers. Fermi gas model; well depth, level density and nuclear evaporation.

Nuclear reactions: Q-values, threshold energy. Reactions induced by proton, deuteron and particles. Photodisintegration **(Krane & Tayal)**. **[16 hours]**

Nuclear decay modes: Beta decay; Beta ray spectrum, Pauli neutrino hypothesis, mass of the neutrino from beta ray spectral shape, Fermi theory of beta decay, Kurie plot, ft- values and forbidden transitions. Methods of excitation of nuclei; Nuclear isomerism, Mossbauer effect (qualitative only), Auger effect.

Interaction of nuclear radiation with matter: Energy loss due to ionization for proton -like charged particles, Bethe-Bloch formula, Range energy relations. Ionisation and Radiation loss of fast electrons (Bremsstrahlung - qualitative only). Interaction of gamma and X-rays with matter. Detectors; Brief description of NaI (Tl) gamma ray spectrometer. Boron triflouride counter**.**

Nuclear reactors: Condition for controlled chain reactions, slowing down of neutrons, logarithmic decrement in energy. Homogeneous spherical reactor; critical size, effect of reflectors.
Breeder reactor (Qualitative discussion) **(Krane & Tayal)**. **[16 hours]**

Nuclear forces and elementary particles: General features of nuclear force; spin dependence, charge independence, exchange character, saturation other features. Meson theory of nuclear forces; Yukawa's theory. Properties of pi mesons; charge, mass, spin, isospin and parity, decay modes, meson resonances.

Particle interactions and families: Conservation laws; classification of fundamental forces and elementary particles. Associated particle production, Gellmann-Nishijima scheme, strange particles. CP violations in Kaon decay. Symmetries; Eight-fold way symmetry, quarks and gluons. Elementary ideas of the Standard model **(Griffiths D J).** **[16 hours]**

Total work load **48 hours**

References

1. Tayal D.C., Nuclear Physics, Himalaya Publishing House, New Delhi, 2012 (Unit 1. Chapter Page 6-14. Page 30- 35, 40-49. Chapter 9. Page 355-369. Chapter 10. Page 401-411.)
2. Krane K.S., Introductory nuclear physics, Wiley, New York, 1987. (Unit 1. Chapter 16 page 605-610.)
3. Ghoshal S.N., Nuclear physics, S.Chand and Company, Delhi, 1994. (Unit 2: Chapter 5 page 137-155, Chapter 6 page 187-204, 222, 262, Chapter 13, page 647-651, chapter 15, page 717-721.)
4. Wong S.S.M., Introductory nuclear physics, Prentice Hall of India, Delhi, 1998.
5. Khanna M.P., Introduction to particle physics, Prentice Hall of India, Delhi, 2008.
6. Kapoor S.S. and Ramamoorthy V., Nuclear radiation detectors, Wiley Eastern, Bangalore,2007

PHY-304: Solid State Physics 1

Dielectric properties of solids: Macroscopic description of static dielectric constant, the static electronic and ionic polarisabilities of molecules, orientation polarization. Local electric field at an atom; Lorentz field, field of dipoles inside cavity. The static dielectric constant of solids; Clausius- Mossotti relation. Complex dielectric constant. Polarization catastrophe. Dielectric losses and Debye relaxation time. Classical theory of electronic polarization and optical absorption.

Ferroelectricity: Basic properties and classification of ferroelectric materials. The dipole theory of ferroelectricity, objections against the dipole theory. Ionic displacements and behavior of Barium titanate above the Curie temperature. Theory of spontaneous polarization of Barium titanate. Thermodynamics of ferroelectric transitions. Landau theory of phase transitions, Dielectric constant near the Curie point. Ferroelectric domain **(Dekker and Kittel).** **[16 hours]**

Magnetic properties: Definition of magnetization and susceptibility. Hund`s rule; calculation of L, S and J for 3d and 4f shells. Setting up of Hamiltonian for an atom in an external magnetic field; explanation of diamagnetism, Van Vleck Paramagnetism and quantum theory of paramagnetism **(Ashcroft & Mermin).** Interpretation of the Weiss field in terms of exchange integral **(Dekker p473-474,).** Calculation of the singlet triplet splitting, spin Hamiltonian and Heisenberg model **(Ashcroft and Mermin).**

Zero-temperature properties: Ground state of the Heisenberg ferromagnet. First excitation of one dimensional ferromagnetism at zero-temperature; spin waves, anti-ferromagnetism. Low-temperature behaviour of ferromagnets; Bloch's $T^{3/2}$ law **(Ashcroft and Mermin, Kittel).**

Magnetic resonance: Phenomenological description, Relaxation mechanisms, Derivation of Casimir Durpe relation. Nuclear Magnetic moments, condition for resonance absorption, setting up of Bloch's equations, solutions for steady state and weak RF field. Expression for power absorption, change of inductance near resonance. Dipolar line width in a rigid lattice **(Dekker p498-512).** **[16 hours]**

Band theory of solids: Statement and proof of Bloch theorem; periodic potentials in solids. Reciprocal lattice, periodic boundary conditions, density of states. Construction of Brillouin zones for a square lattice. Nearly free electron model and solution at the boundary. Energy gap using nearly free electron model. Tightly bound electron approximation, application to SC , BCC and FCC lattices **(Dekker**).

Superconductivity: BCS theory; Cooper pairs, Energy gap, Meissner effect. Flux quantization. Theory for DC and AC bias; Josephson tunnelling, Josephson junction. High T_c superconductors **(Ibach and Luth).**

Elastic constants of crystals: Elastic strains and stresses. Elastic compliance and stiffness constants, applications to cubic crystals and isotropic solids. Elastic waves and experimental determination of elastic constants **(Kittel).** **[16 hours]**

Total work load **48 hours**

References:

1. Dekker A.J., Solid state physics, Prentice Hall, 1985.
2. Kittel C., Introduction to solid state physics, 7th Edn., John Wiley, New York, 1996.
3. Ashcroft N.W. and Mermin N.D., Solid State Physics, Saunders College Publishing, 1996.
4. Ibach H. and Luth H., Solid State Physics Narosa, New Delhi, 1996.
5. Pillai S.O., Solid state physics, New Age International Publications, 2002.
6. Wahab M.A., Solid state physics, Narosa Publishing House, New Delhi, 1999.

PHY-305: Nuclear Physics 1

Nuclear detectors: Scintillation processes in inorganic crystals (NaI(Tl)). Semiconductor detector - Diffused junction, Surface barrier and Lithium drifted detectors. Relation between applied voltage and depletion layer thickness in junction detectors, Hyper pure germanium detectors, Cerenkov detectors.

Nuclear pulse techniques: Preamplifier circuits; charge sensitive and voltage sensitive preamplifiers. Linear pulse amplifiers; Linearity, stability, pulse shaping, pulse stretching.
Operational amplifiers; analog to digital converters. Scalars, Schmidt trigger as a pulse discriminator, Single channel analyser; Integral and differential discriminators.
Multichannel Analysers, memory devices and online data processing. **[16 hours]**

Shell model: Motion in a mean potential, Square well and simple harmonic oscillator potential well, spin orbit interaction and Magic numbers. Extreme single particle model, Ground state properties of nuclei based on shell model. Nordhiem's Rules.

Collective model: Evidences for collective motion. Nuclear rotational motion; Rotational energy spectrum and nuclear wave functions for even-even nuclei. Odd- A nuclei energy spectrum and wave function.

Nilsson model: Nilsson diagrams.

Many body self-consistent models: Hartree-Fock model. **(Hans H.S)** **[16 hours]**

Timing spectroscopy: Coincidence and anti-coincidence circuits. Delay circuits. Time to amplitude conversion; start-stop and overlap converters.

Gamma ray spectroscopy: Life time measurements. Gamma-gamma, beta-gamma angular correlation studies. Angular distribution of gamma rays from oriented nuclei. Polarization of gamma rays. **[16 hours]**

Total work load **48 hours**

References:

1. Mermier P. and Sheldon E., Physics of the nuclei and particles, Vol. 1 and 2, Academic Press, New York 1970.
2. Segre E., Nuclei and particles, Benjamin Inc, New York, 1977.
3. Arya A.P., Fundamentals of nuclear physics, Allyn and Bacon, USA, 1968.
4. Blatt J.M. and Weisskopf V.F., Theoretical nuclear physics, Wiley and Sons, New York, 1991.
5. Siegbahn K., The alpha, beta and gamma ray spectroscopy: Vol. 1 and 2, North Holland, Amsterdam, 1965.
6. Price J.W., Nuclear radiation detectors, McGraw Hill, New York, 1965.
7. Kapoor S.S. and Ramamoorthy V., Nuclear radiation detectors, Wiley Eastern, Bangalore, 1993.
8. Kowalski E., Nuclear electronics, Springer Verlag, Berlin,1970.
9. Leo W.R.,Techniques for nuclear and particle physics experiments, Springer Verlag, 1992.
10. Roy R.R. and Nigam B.P., Nuclear physics, New Age International, New Delhi, 1986.
11. Hans H.S., Nuclear physics—Experimental and theoretical, New Age International Publishers, 2001.
12. Tayal D.C., Nuclear Physics, Himalaya Publishing House, New Delhi, 2012

PHY-306: Theoretical Physics 1

General theory of relativity: Tensor Calculus and Riemannian geometry : Covariant Differentiation, Parallel Transport, Geodesies, The Curvature Tensor.

Riemannian geometry: Riemannian space, The determinant of $g_{\mu\nu}$. Metrical Densities, The Connection of a Riemannian Space: Christoffel Symbols, Geodesies in a Riemannian Space, The Curvature of a Riemannian Space: The Riemann Tensor. **[16 hours]**

Gravitational field: The Principle of Equivalence, The Field Equations of General Relativity, Metrics with Spherical Symmetry, The Schwarzschild Solution. Geodesies in the Schwarzschild Space, Advance of the Perihelion of a Planet, The Deflection of Light Rays, Red Shift of SpectralLines, The Schwarzschild Sphere. Gravitational Collapse. Black Holes. **[16 hours]**

Quantum field theory-1: Classical and quantum fields: Particles and fields, Discrete and continuous mechanical systems, Classical scalar fields, Maxwell fields Quantum Theory of Radiation: Creation, annihilation, and number operators, Quantized radiation field, Fock states, Emission and absorption of photons by atoms, Rayleigh scattering, Thomson scattering, and the Raman effect. **[16 hours]**

Total work load **48 hours**

References:

1. Papapetrov A., Lectures on general relativity, D. Reidel Publishing Company, USA, 1974.
2. Dirac P.A.M., The general theory of relativity, John Wiley and Sons, New York, 1975.
3. Adler R., Bazin M. and Schiffer M., Introduction to general relativity, McGraw-Hill Kogakusha, Ltd. New Delhi, 1965.
4. Hartle J.B., Gravity: An introduction to Einstein's general relativity, Benjamin-Cummings Pub. Co., USA, 2002.
5. Sakurai J.J., Advanced quantum mechanics, Addison-Wesley, Harlow, England, First ISE Reprint, 1999.
6. Griffiths D., Introduction to elementary particles, John Wiley and Sons, New York, 1987.
7. Gasiorowicz S., Elementary particle physics, John-Wiley, New York, 1966.
8. Muirhead H., The physics of elementary particles, Pergamon Press, London, 1965.

Open Elective Papers

Paper to be offered to Non-Physics Postgraduate students

PHY-321: Modern Physics

Nuclear physics: A brief overview of nuclear physics. Nuclear reactions, a brief description of nuclear models. Interactions of X-rays and γ-rays with matter, slowing down and absorption of neutrons. Fundamental particles, classification of fundamental particles, fundamental forces, conservation laws in particle physics, a brief outline of the quark model.
Nuclear power: Nuclear fission, fission chain reaction, self sustaining reaction, uncontrolled reaction, nuclear bomb. Nuclear reactors, different types of reactors and reactors in India. Nuclear waste management. Nuclear fusion, fusion reactions in the atmosphere. Radiation effects; dosage calculation. Nuclear energy; applications and disadvantages. **[16 hours]**

Condensed matter physics: Amorphous and crystalline state of matter. Crystal systems. Liquid crystals. X-ray diffraction; Bragg equation. Structure of NaCl. FTIR; Experiment analysis. NMR; Experiment and analysis. Electrical conductivity of metals and semiconductor. Magnetic materials; para,ferro, ferri and anti-magnetism. Dielectrics—para, ferro, pyro and piezo properties. Symmetry in physics. **[16 hours]**

Quantum physics: Qualitative discussion. Molecules, atoms, nucleus, nucleons, quarks and gluons. Particle physics (qualitative). Stern-Gerlach experiment and consequences. Uncertainty relation. Hydrogen atom. Positron annihilation. Laser trapping and cooling. Ion traps. Electromagnetic, strong, weak and Gravitational forces. Big Bang theory, String theory. Large Hadron Collider experiment, consequences. Higgs Boson. **[16 hours]**

Tutorial **[16 hours]**

Total work load **64 hours**

References:

1. Ghoshal S.N., Atomic and nuclear physics, Vol.2., S. Chand and Company, Delhi, 1994.
2. Evans R.D., Atomic nucleus, Tata Mc Grow Hill, New Delhi, 1976.
3. Penrose R., Road to Reality, Vintage Books, 2007.
4. Ladd M.F.C. and Palmer R.A., Structure determination by X-ray crystallography, Plenum Press, USA, 2003.
5. De Gennes P.G. and Prost J., The physics of liquid crystals, 2nd Edn., Clarendon Press, Oxford, 1998.
6. Myer R., Kennard E.H. and Lauritsern T., Introduction to modern physics, 5th Edn., McGraw- Hill, New York, 1955.
7. Halliday D., Resnick R. and Merryl J., Fundamentals of physics, Extended 3rd Edn., John Wiley, New York, 1988.

PHY-322: Energy Science

Renewable energy resources: Forms of Energy, Basics of Thermodynamics: Heat capacity, Heat transfer mechanism, entropy, First and second law of thermodynamics Carnot Cycle, Rankin cycle. Fossil fuels, time scale of fossil fuels. Solar energy: Sun as the source of energy and its energy transport to the earth, Extraterrestrial and terrestrial solar radiations, Measurement techniques of solar radiations using Pyranometer and Pyrheliometer. **[16 hours]**

Materials and solar cell technology : Single, poly and amorphous silicon, GaAs, CdS, fabrication of single and polycrystalline silicon solar cells, amorphous silicon solar cells, photovoltaic systems and technical problems. Wind Energy Origin and classification of winds, Aerodynamics of windmill: Maximum power and Forces on the Blades and thrust on turbines; Wind data collection and field estimation of wind energy, Site selection, Basic components of wind mill, Types of wind mill, Wind energy farm, Hybrid wind energy systems: The present Indian Scenario. **[16 hours]**

Biomass energy and biogas technology: Nature of Biomass as a fuel, Biomass energy conversion processes, Direct combustion: heat of combustion, combustion with improved Chulha and cyclone furnace; Dry chemical conversion processes: pyrolysis, gasification, types of gasification. Importance of biogas technology, anaerobic decomposition of biodegradable materials, Factors affecting Bio-digestion, Types of biogas plants, Applications of biogas. **[16 hours]**

Tutorial **[16 hours]**

Total work load **64 hours**

References:

1. Peter A., Advances in energy systems and technology, Academic Press, USA, 1986.
2. Neville C.R., Solar energy conversion: The solar cell, Elsevier North-Holland, 1978.
3. Dixon A.E. and Leslie J.D., Solar energy conversion, Pergamon Press, New York, 1979.
4. Ravindranath N.H., Biomass, energy and environment, Oxford University Press, 1995.
5. Cushion E., Whiteman A. and Dieterle G., World Bank Report, 2009.

PHY-311: Condensed Matter Physics Lab

Any eight of the following experiments:

1. Determination of the paramagnetic susceptibility of the given salt by Quincke's method
2. Study of mercury spectrum by superimposing it on brass spectrum
3. Sodium spectrum analysis by using Edser-Butler fringes
4. Temperature coefficient of resistance of a thermistor
5. Analysis of the powder X-ray photograph of a simple cubic crystal
6. Thermionic work function of a metal (Richardson-Dushmann formula)
7. Energy gap of a semiconductor
8. Frank Hertz experiment
9. Measurement of magneto resistance of semiconductors
10. Stefan's Constant of Radiation
11. Thermal Conductivity of Poor Conductor
12. Di-electric constant of a Non polar liquid
13. Dipole moment of an organic Molecule
14. High Resistance by Leakage

Total work load : 2 day(s) per week × 4 hours × 16 weeks = **128 hours**

PHY-312: Nuclear and Particle Physics Lab

Any eight of the following experiments:

1. Half-life of Indium-116 measurement.
2. Energy Resolution of a NaI(Tl) scintillation spectrometer.
3. Compton scattering—determination of the rest energy of an electron.
4. Beta absorption coefficient measurement.
5. Dekatron as a counter of signals.
6. Gamma-ray absorption coefficient measurement.
7. End-point energy of Beta particles by half thickness measurement.
8. Common Source amplifier.
9. Astable multivibrator using timer IC 555.
10. Dead time of the G.M. counter.

Total work load : 2 day(s) per week × 4 hours × 16 weeks =**128 hours**

Reference: 1. Varier K. M., Antony Joseph and Pradyumman P. P., Advanced experimental techniques in Modern Physics, Pragati Prakashan, 2011

PHY-313: Solid State Physics Lab 1

*For those who have opted for **Solid State Physics Specialisation***

Any five of the following experiments:

1. Optical rotatory dispersion of a uniaxial crystal.
2. Birefringence of quartz using spectrometer.
3. Paramagnetic susceptibility by Gouy balance method.
4. Fermi energy of copper.
5. Cell parameter(s) from an X-ray powder diffractogram.
6. Verification of Langmuir-Child's law.
7. Thermoluminescence.
8. Curie temperature of a ferroelectric material.
9. Dielectric constant and its temperature variation.
10. Determination of the polarisabilities of the molecules of an uniaxial crystal using spectrometer.
11. Photoelasticity in crystalline solids.
12. Thermal expansion coefficient in solids.
13. Determination of Stefan's constant using Photo Cell
14. Calibration of Si Diode
15. Measurement of Electrical and Thermal Conductivity of Copper
16. Verification of Curie-Weiss law
17. BH Curve in a ferromagnetic Material

Total work load : 1 day(s) per week × 4 hours × 16 weeks = **64 hours**

PHY-314: Nuclear Physics Lab 1

*For those who have opted for **Nuclear Physics Specialisation***

Any five of the following experiments:

1. Cockroft-Walton voltage multiplier.
2. Coincidence circuit.
3. Linear amplifier.
4. Transistorised binary circuit.
5. Pulse shaping circuits.
6. Linear Gate.
7. Randomocity of radioactive decay.
8. Nomogram method : Measurement of endpoint energy of beta rays.
9. Study of linearity of the NaI(Tl) gamma ray spectrometer.
10. Determination of the energy of an unknown gamma ray source.

Total work load : 1 day(s) per week × 4 hours × 16 weeks = **64 hours**

PHY-315: Theoretical Physics Lab 1

*For those who have opted for **Theoretical Physics Specialisation***
Any five of the following experiments:

1. Calculation of Christoffel symbols.
2. Geodesics and curvature calculations.
3. Exterior Schwarzschild metric calculations.
4. Robertson-Walker metric calculations.
5. Lagrangian and Hamiltonian, Euler Lagrange equations for Schroedinger field.
6. Lagrangian for Maxwell's field and The field equations.
7. Symmetries of the Lagrangian and Constants of motion.
8. Operator algebra-BCH formula.
9. Relativistic kinematics-1: Relations between center of momentum and laboratory frames.
10. Relativistic kinematics-2: Non-relativistic limit of relativistic kinematics.

Total work load : 1 day(s) per week × 4 hours × 16 weeks = **64 hours**

PHY-401: Solid State Physics 2

X-ray diffraction by crystals: The reciprocal lattice. Ewald sphere and construction. Scattering by an electron and atom; Atomic scattering factor. Anomalous scattering. Fourier analysis and inversion of Fourier series; Physical significance. Geometrical structure factor of the unit cell. Absent reflections and space groups. **(Sherwood, P290 – 358).**

Experimental techniques: Brief introduction to Laue, Powder and single crystal methods. Use of Synchrotron radiation for structure studies. Weissenberg and precession methods. Cell parameter and space group determination. Molecular weight determination. **(Stout and Jensen,p 90–211). [16hours]**

Structure analysis: Low angle scattering. Reduction of intensities to structure amplitudes. Various corrections. Absolute scale factor and temperature factor from statistical methods. Statistical method for finding the presence of center of symmetry Fourier analysis of electron density. Patterson synthesis. Harker sections and lines. Heavy atom methods. Direct methods for phase determination. The inequality relations. Difference Patterson synthesis and error Fourier synthesis. Figure of merit. Cyclic Fourier refinement, Difference Fourier synthesis. Refinement of structures: The least squares method. Accuracy of the parameters. Bond lengths and angles. **(Sherwood, Ladd and Palmer)**

SAXS; Particle Size study of Fibre structure **[16 hours]**

Imperfections in solids: Different types of imperfections. Schottky and Frenkel defects; expression for energy for the formation of Frenkel and Schottky defects. Diffusion in metals; Kirkendall effect. Ionic conductivity in pure and doped halides. Photoconductivity **(Kittel).**

Dislocations: Buerger's Vector. Expression for strain in edge and screw dislocations **(Wahab and Kittel).**

Synthesis and Device fabrication of Nanomaterials: Nanomaterials**.** Bottom-Up approach; Sol-gel synthesis, hydrothermal growth, thin-film growth, physical vapor depositon, chemical vapor depostion. Top- Down Approach; Ball milling, Microfabrification, Lithography, Ion-beam lithography**(Ramachandra rao and Shubra singh, p129-142).**

Luminescence: Excitation and Emission. Franck-Condon principle. Decay mechanisms;Temperature dependent and independent decays. Thermoluminescence and glow curve. Gudden-Pohl effect **(Dekker). [16 hours]**

Total work load **48 hours**

References:

1. Stout G.H. and Jensen L.H., X-ray structure determination, MacMillan, USA, 1989.
2. Ladd M.F.C. and Palmer R.A., Structure determination by X-ray crystallography, Plenum Press, USA, 2003.
3. Sherwood D., Crystals, X-rays and proteins, Longman, London, 1976.
4. Wahab M.A., Solid state physics, Narosa Publishing House, New Delhi, 1999.
5. Azaroff L.V., Introduction to solids, McGraw-Hill Inc, USA, 1960.
6. Weertman J. and Weertmann J.R., Elementary dislocation theory, McMillan, USA, 1964.
7. Pillai S.O., Solid state physics, New Age International Publications, 2002.

PHY-402: Solid State Physics 3

Free electron theory of metals: Boltzmann transport equation, Sommerfeld's theory of electrical conductivity, mean free path in metals, dependence of resistivity on temperature and impurities. Matthiessens rule. Electron-phonon collisions. Electrical conductivity of metals at high frequencies. Plasma frequency. Transparency of alkali metals to UV radiation. Anomalous skin effect. Plasmons. Field enhanced emission, Schottky effect. Hall effect and magnetoresistance in metals. Cyclotron frequency **(Kittel & Pillai).** Thermal conductivity of insulators; Umklapp processes **(Dekker, p275-292)**. **[16 hours]**

Impurity semiconductors: A brief discussion on Elemental and Compound Semiconductors and their properties. Carrier concentrations; effect of temperature and impurity density. Electrical neutrality condition. Fermi energy; Variation with temperature and impurity density, when the Boltzmann approximation is valid,. Effect of impurity density at very low temperatures. Mobility of current carriers; effect of temperature and impurity. Electrical conductivity; effect of temperature, impurity density and the energy band gap.

Hall effect in semiconductors; Expression for Hall co-efficient,
Magneto-resistance phenomenon (qualitative) **(M A Wahab).**
Cyclotron resonance; Cyclotron resonance in Si and Ge semiconductors. Effective mass tensor. Variation of cyclotron resonance frequency with orientation of the crystal in the magnetic field **(Mckelvey, p270–300).** **[16 hours]**

Excess carriers in semiconductors: Generation and recombination rates. Continuity equations; Einstein equations, Expression for the diffusion length of electrons and holes **(Mckelvey, p320–335).**
High field transport in semiconductors; electron temperature. Gunn effect, Expression for drift velocity. Superlattice Phenomenon **(Roy, p29–39).**

Semiconductor devices: The pn junction; space charge region, effect of the applied field on barrier potential, barrier thickness and contact field. Transition capacitance. Current density for excess carriers. Characteristics and applications of phototransistors, JFET, SCR and UJT **(Mckelvey, p390–441).**
[16 hours]

Total work load **48 hours**

References:

1. Dekker A.J., Solid state physics, Prentice Hall, 1985.
2. Mckelvey J.P., Solid state and semiconductor physics, 2nd Edn., Harper and Row, USA, 1966.
3. Roy D.K., Physics of semiconductor devices, University Press, Hyderabad, 1992.
4. Schur M., Physics of semiconductor devices, Prentice-Hall of India, New Delhi, 1999.
5. Wilson J. and Hawkes J.F.B., Optoelectronics—An introduction, 2nd Edn., Prentice-Hall of India, New Delhi, 1996.
6. Streetman B.G., Solid state electronic devices, 2nd Edn., Prentice-Hall of India, New Delhi, 1983.
7. Omar M.A., Elementary solid state physics, Addison Wesley, New Delhi, 2000.
8. Wahab M.A., Solid state physics, Narosa Publishing House, New Delhi, 1999.
9. Pillai S. O. Solid State Physics, ew Age International Publications, New Delhi.

PHY-403: Nuclear Physics 2

Nuclear fission: Nuclear fission, Mass-energy distribution of fission fragments. Statistical model of fission.

Reactor theory-1: Neutron and its interaction with matter-collision kinematics, differential elastic scattering cross sections, isotropic scattering, the criticality condition for a reactor. Neutron transport equation using elementary diffusion theory. One group critical equation, critical size on the basis of Fermi age theory. **[16 hours]**

Reactor theory-2: Reactors; One group theory, spherical and cylindrical homogeneous reactor. Effective multiplication factor. Reflector reactors: effects of reflector. One group method of a homogeneous reactor with reflector. reflector savings. Infinite multiplication factor, critical size and critical mass.
Heterogeneous reactor system; calculation of thermal utilization factor. Fast Breeder reactor, Evaluation of Buckling using one group model. **[16 hours]**

Beta decay: Classification of beta interactions. Matrix elements. Fermi and Gamow-Teller selection rules for allowed beta decay. The non conservation of parity in beta decay. Wu et al experiment. The universal Fermi interaction.

Gamma decay: Electromagnetic interactions with nuclei. Multipole transitions. Transition probabilities in nuclear matter. Weisskopf's estimates. Structure effects. Selection rules. Internal conversion Photo disintegration of deuteron and radiative capture of neutron by proton. **[16 hours]**

Total work load **48 hours**

References:

1. Glasstone S. and Edlund M.C., Elements of nuclear reactor theory, D. Van Nostrand Co., USA, 9th Print, 1963.
2. Garg S., Ahmed F. and Kothari I.S., Physics of nuclear reactors, Tata McGraw-Hill, New Delhi, 1986.
3. Roy R.R. and Nigam B.P., Nuclear physics, New Age International, New Delhi, 1986.
4. Hans H.S., Nuclear physics—Experimental and theoretical, New Age International Publishers, 2001.
5. Ghoshal S.N., Nuclear physics, Vol. 2., S.Chand and Company, Delhi, 1994. Chapter 15, page 714-730.

PHY-404: Nuclear Physics 3

Two particle systems: Deuteron; Schrodinger equation for a two nucleon system, Theory of the ground state of the deuteron under central and non central forces, Excited states of the deuteron. Rarita-Schwinger relations. Deuteron magnetic and Quadrupole moments.

Nucleon-nucleon scattering processes: Theory of s-wave scattering of neutrons by free protons and experimental results. Wigner's formula for n-p scattering. Theory of scattering of slow neutrons by bound protons (Ortho and Para hydrogen) and experimental results. Effective range theory for n-p scattering.
S wave theory of proton-proton scattering. Mott's modification of Rutherford's formula. Pion-nucleon scattering experimental results, (3/2, 3/2) resonance. **[16 hours]**

Nuclear reactions-1: Plane wave theory of direct reactions. Born approximation (Plane wave); Butler's theory. Cross section for nuclear scattering and reactions. Shadow scattering, Breit-Wigner resonance formulae.

Nuclear reactions-2: Bohr's independence hypothesis. The compound nucleus (CN) reactions, decay rates of CN, Statistical theory of nuclear reactions. Evaporation probability and cross sections for specific reactions. **[16 hours]**

Optical model: Giant resonances, Kapur-Pearls' dispersion formula for potential scattering. Direct reactions: Kinematics of stripping and pickup reactions. Theory of stripping and pickup reactions. Inverse reactions.

Heavy ion physics: Special features of heavy ion Physics. Remote heavy ion electromagnetic interactions. Coulomb excitations. Close encounters. **[16 hours]**

Total work load **48 hours**

References:

1. Roy R.R. and Nigam B.P., Nuclear physics—Theory and experiment, New Age International Ltd, New Delhi, 1986.
2. Hans H.S., Nuclear physics—Experimental and theoretical, New Age International Publishers 2001.
3. Sachtler G.R., Nuclear reactions, Addison Wesley, New York, 1983.
4. Mermier P. and Sheldon E., Physics of nuclei and particles, Vol. 2 Academic Press, USA, 1971.
5. Jackson D.F., Nuclear reactions, Chapman and Hall, London, 1975
6. Mermier P. and Sheldon E., Physics of nuclei and particles, Vol. 3 Academic Press, USA, 1971.

PHY-405: Theoretical Physics 2

Relativistic quantum mechanics: Probability conservation in relativistic quantum mechanics, The Dirac equation, Conserved current, Representation independence, large and small components, approximate Hamiltonian for an electrostatic problem, free particle solutions, Relativistic covariance, Space inversion, Bilinear covariants and their properties, Klein's paradox, Hole theory and charge conjugation. **[16 hours]**

Quantization of the Dirac field: Second quantization, positron operators and positron spinors, Electromagnetic and Yukawa couplings. Weak interactions and parity nonconservation: Classification of interactions, parity and hyperon decay, Fermi theory of beta decay, the two-component neutrino. Pion decay and the CPT theorem. **[16 hours]**

Covariant perturbation theory: Natural units and dimensions, S-matrix expansion in the Interaction representation. Unitarity, First order processes: Matrix element for electron scattering. Cross section for Mott scattering. Helicity change and spin projection operator. Pair annihilation, pair creation, hyperon decay. S -matrix for two photon annihilation, electron propagator, Matrix element for Compton scattering, Feynman rules. Cross section for two photon annihilation. **[16 hours]**

Total work load **48hours**

References:

1. Sakurai J.J., Advanced quantum mechanics, Addison-Wesley, Harlow, England, First ISE Reprint, 1999.
2. Griffiths D., Introduction to elementary particles, John Wiley and Sons, New York, 1987.
3. Gasiorowicz S., Elementary particle physics, John-Wiley, New York, 1966.
4. Muirhead H., The physics of elementary particles, Pergamon Press, London, 1965.

PHY-406: Theoretical Physics 3

Angular momentum theory and applications: Angular momentum: Transformations under rotations. Coupling of three and four angular momenta. Racah coefficients, Wigner 9j symbols, applications. Wigner-Eckart theorem. Projection theorem. j-j and L-S coupling. Angular momentum in nuclear reactions, Spherical tensors. Evaluation of matrix elements between coupled angular momentum states. Vector spherical harmonics. Gradient theorem (without proof). Multipole radiation. **[16 hours]**

Spin density matrix: Spin and helicity in a relativistic process. Effect of Lorentz and discrete transformations on helicity states. Wick and Wigner rotations, pure rotation, pure boost, parity, time reversal and charge conjugation. The spin density matrix (ρ), general properties, multipole parameters, combined systems, Diagonalization of ρ. Oriented and non-oriented systems, Polarized and aligned systems, Spherical tensor basis and SU(N) basis. **[16 hours]**

Relativistic density matrix: Helicity multipole parameters and their transformation laws. Helicity amplitudes for elastic reactions and their symmetry properties. Polarization in scattering of spin ½ particles, Final state density matrix. Observables of a reaction, reactions involving polarized beam and polarized targets. **[16 hours]**

Total work load **48 hours**

References:

1. Sakurai J.J. and Tuan S.F. (Editor), Modern quantum mechanics, AddisonWesley, India, 1999.
2. Leader E., Spin in particle physics, Cambridge University Press, London, 2001.
3. Rose M.E., Elementary theory of angular momentum, John Wiley and Sons, USA, 1957.
4. Blum K., Density matrix theory and applications, Plenum Press, New York, 1981.

Elective Papers 1

PHY-407: Accelerator Physics

Ion sources: Brief introduction to ion sources for positive and negative ions. Ion production. Semi classical treatment of ionization, Townsend theory-comparison of theory and experiment for ion production. Examples of ion sources-properties of ion sources. Insulation at high voltages-Spark voltage. Paschen's law for gas breakdown.

Ion optics and focussing: Focussing properties of linear fields. Electrostatic and magnetic lenses.

[16 hours]

Particle accelerators: Introduction, development of accelerators. Direct-voltage accelerators: Cockroft-Walton generator, Van de Graff generator, Tandem accelerators, Pelletron. Resonance accelerators: Cyclotron - fixed and variable energy, principles and longitudinal dynamics of the uniform field cyclotron. Linear accelerators. **[16 hours]**

Electron accelerators: Betatron; Beam focusing and Betatron Oscillation. Microtron. Synchronous accelerators; Principle of phase stability, Mathematical theory for Principle of phase stability. Electron synchrotron. Proton synchrotron.

Alternating gradient machines; Alternating gradient principle, AG proton synchrotron. **[16 hours]**

Total work load **48 hours**

References:

1. Townsend P.D., Kelly J.C. and Hartley N.E.W., Ion implantation, sputtering and their applications, Academic Press, London, 1976.
2. Humphrey S. Jr., Principles of charged particle acceleration, John Wiley, 1986.
3. Arya A.P., Fundamentals of nuclear physics, Allyn and Bacon, USA, 1968.
4. Ghoshal S.N., Atomic and nuclear physics, Vol. 2, S.Chand and Company, Delhi, 1994.
5. Varier K.M., Joseph A. and Pradyumnan P.P., Advanced experimental techniques in modern physics, Pragathi Prakashan, Meerut, 2006.

PHY-408: Liquid Crystals

Anisotropic fluids: Main Types and properties: Introduction. The building blocks. Small organic molecules. Long helical rods. Associated structures. Nematics and Cholesterics. Nematics proper. Static pretransitional effects above T_{N-1}^{i}. The cholesterics. A distorted form of the nematic phase. Smectic. Smectic A. Smectic B. Smectic C. Other mesomorphic phases. Exotic smectics; long range order in a system of long rods. Lyotropic systems. Remarkable features of liquid crystals. Applications of liquid crystals.
[De Gennes and Prost] **[16 hours]**

Long and short range order in nematics: Definition of an order parameter. Microscopic approach. Order parameter from optical method, from diamagnetic anisotropy. Mean field theory with S2 interaction (Maier-Saupe).

Static distortion in nematics: Long range distortions, distortion free energy. Magnetic field effects—Molecular diamagnetism, Magnetic coherence length.

Defects and textures in nematics: Observations. Black filaments. Schlieren structures. Types of defects (qualitative discussion only).

Smectics: Continuum description of smectics A and C, Mean field description of S_A-N transition.
[De Gennes and Prost] **[16 hours]**

Dynamical properties of nematics: Experiments measuring the Leslie coefficients-Laminar flow under a strong orienting field, Attenuation of ultrasonic shear waves, Laminar flow in the absence of external fields. Convective instabilities under electric fieldsb - Basic electrical parameters, Experimental observations at low frequencies, The Helfrich interpretation. Extension to higher frequencies (qualitative).

Cholesterics: Optical properties of an ideal helix—The planar texture, Bragg reflection, Transmission properties at arbitrary wavelengths (normal incidence), The Mauguin limit, Rotatory Power. Agents influencing the pitch—Physicochemical factors, External fields (qualitative). Textures in cholesterics.
[De Gennes and Prost] **[16 hours]**

Total work load **48 hours**

References:

1. De Gennes P.G. and Prost J., The physics of liquid crystals, 2nd Edn., Clarendon Press, Oxford, 1998.
2. Chandrashekhar S., Liquid crystals, Cambridge University Press, 1977.
3. Gray G.W., Molecular structure and the properties of liquid crystals, Academic Press, 1962.
4. Maier G., Sackmann E. and Grabmanier I.G., Applications of liquid crystals, Springer Verlag, 1975.
5. Gray G.W. and Goodby J.W., Smectic liquid crystals (Textures and structures), Leanard Hill, London, 1984.

PHY-409: Atmospheric Physics

Atmospheric composition: Energy in the atmosphere, heating of the atmosphere, motions in the atmosphere. Variations in atmospheric composition, Structure on the basis of composition. Thermal structure of the atmosphere.

Thermodynamics: Entropy of dry air, vertical motion of saturated air, tephigram, potential energy of an air column.

Dynamics: Escape of hydrogen, photodissociation of oxygen, photo chemical processes. Equations of motion, the geostrophic approximation, cyclostrophic motion. **[16 hours]**

Terrestrial and extra terrestrial radiation: General features of direct, diffuse and global radiation-attenuation of direct solar radiation-Rayleigh and Mie scattering. Angstrom turbidity formula for all aerosols. Direct transmittance due to continuum attenuation, diffuse spectral irradiance due to Rayleigh and aerosol scattering.

Aerosols: Production and properties of aerosols. Aerosol optical depth, Beer's law - Sun Photometer. Optical filters.

Clouds: Microphysics of clouds, Macro characterization of clouds. Radiative transfer in clouds and aerosols. **[16 hours]**

Atmospheric radioactivity: Background Radiation, Radioactivity in Atmosphere, Radon, Properties of radon, Origin of radon, Radon entry into the atmosphere: Diffusion, Advection and Convection. Health Effects: Dose.

Atmospheric electricity: The generation of an ion, The mobility of ions, Ion size, recombination of ions. Ions in an electric field, Ionizing agencies, radioactivity. The conductivity of the atmosphere and its origin, Measurement of conductivity of the atmosphere near the ground. Relationship between ions and conductivity. The current voltage characteristics in a gas under conditions of volume ionization.
[16 hours]

Total work load **48 hours**

References:

1. Salby M.L., Fundamentals of atmospheric physics, Academic Press, USA, 2006.
2. Houghton J., The physics of the atmosphere, Cambridge University Press, 2002.
3. Siddhartha K., Atmosphere, weather and climate, Kisalaya Publications, 2000.
4. Lutgens F.K. and Tarbuk E.K., The atmosphere: An introduction to meteorology, Prentice Hall USA, 1986.
5. Holton, J.R., Dynamic meteorology, 3rd edition, Academic Press, USA, 1992.
6. Keshvamurthy R.N. and Shankar Rao M., The physics of monsoons, Allied Publishers, 1992.
7. Iqbal M., An introduction to solar radiation, Academic Press, USA, 1983.
8. Wilkening M., Radon in the environment, Elsevier Science Publishers, The Netherlands, 1990.
9. Israel H., Atmospheric electricity-Vol II, Israel Program for Scientific Translations, Jerusalem. 1973.

PHY-410: Numerical Methods

Computer arithmetic: Integers; Floating point representation of numbers; Arithmetic operations with normalisation; Errors in representation; Commonly used number types and their limits like max. and min. integer, float, double precision, long, etc.

Iterative methods: Bisection method, Newton-Raphson method, Secant method, the method of successive approximations. Solution of a polynomial equation. **[16 hours]**

Linear algebraic equations: The Gauss elimination method, LU decomposition method, Gauss-Jordon method, An introduction to the solution of simultaneous non-linear equations.

Interpolations: Introduction, Newton interpolation formulae, extrapolation, Lagrange interpolation. spline interpolation.

Least-squares approximation of functions: Introduction, linear regression, algorithm for linear regression. Polynomial regression, fitting exponential and trigonometric functions. **[16 hours]**

Numerical integration. Trapezoidal method, Simpson rule. Errors in integration formulae (Romberg method). Algorithms for integration of a tabulated function. Algorithms for integrating a known function. Gaussian quadrature formulae.

Numerical solution of differential equations: Euler method, Runge - Kutta methods, Runge - Kutta 4th order formulae, predictor - corrector method. comparison of predictor-corrector and Runge- Kutta methods. **[16 hours]**

Total work load **48 hours**

References:

1. Atkinson K.E., An introduction to numerical analysis, John Wiley and Sons, USA, 1988.
2. Press W.H., Flannery B.P., Teukolsky S.A. and Vetterling W.T., Numerical recipes in C, Cambridge University Press, UK, 1989.
3. Krishnamurthy E.V. and Sen S.K, Numerical algorithms, Affiliated East West Press Pvt. Ltd., India, 1993.
4. Rajaraman V., Computer oriented numerical methods, Prentice Hall of India Pvt. Ltd., India,m 2001.

Elective Papers 2

PHY-411: Nuclear Spectroscopy Methods

Ion implantation and backscattering spectroscopy: Ion implantation, Implantation technique, Ion beam diffusion, Thermal annealing and sputtering, Analysis techniques. Backscattering, Energy loss and straggling. Kinematics factor, differential scattering cross sections, depth scale, backscattering yield, instrumentation. Application to elemental and compound targets. Axial and planar half angles. Estimates of minimum yield. Lattice location of impurities, alignment procedures. Ion induced X-rays. Application of ion implantation. **[16 hours]**

Compton scattering: Compton scattering from free electrons. Effects of external potential. Klein-Nishina cross sections for polarized and unpolarized radiation. Compton profiles, momentum distributions and impulse Compton profiles. Calculation of Compton profiles for electron models. Relativistic profile corrections: experimentation. Discussion of methodology including sources, detectors and geometry. Data accumulation, analysis and multiple scattering corrections. Discussion of experimental results for some simple metals, ionic and covalent crystals. **[16 hours]**

Positron annihilation spectroscopy: The positron and its discovery, Positronium, its characteristics, formation. Spur model and Ore gap model of positronium formation. Quenching and enhancement. Theory of 2-gamma and 3-gamma annihilations. Positron and positronium states in solids: trapping of positrons. Two state trapping model.

Experimental methods of positron annihilation spectroscopy: Positron lifetime techniques (PLT), Angular Correlation of Annihilation Radiation (ACAR), Doppler broadening (DB) and Coincidence DB. Methods of data analysis: PLT and ACAR. Experimental results of some metals and defected materials. Interpretation of the experimental results. PAS in the study of polymers. Multiparameter techniques.
A brief mention of slow positron beams. **[16 hours]**

Tutorial **[16 hours]**

Total work load **64 hours**

References:

1. Townsend P.D., Kelly J.C. and Hartley N.E.W., Ion implantation, sputtering and their applications, Academic Press, London, 1976.
2. ChuW.K., Mayer J.W. and Nicholate Mar A.O., Backscattering spectroscopy, Academic Press, New York, 1978.
3. Mayer J.W. and Rimini B. (Eds.), Ion beam handbook for material analysis, Academic Press, 1977.
4. Williams B. (Ed.), Compton scattering, McGraw-Hill, New York, 1977.
5. Hautojarvi P. (Ed.), Positrons in solids, Springer Verlag, New York, 1979.
6. Fava R.A. (Ed.), Methods of experimental physics, Academic Press, New York, 1980.
7. Schradev D.M. and Jean Y.C., Positron and positronium chemistry, Elsevier Science Publication, Amsterdam, 1988.
8. Jayaram B., Mass spectrometry–Theory and applications, Plenum Press, New York, 1966.

PHY-412: Modern Optics

Polarization of light: Pure states and mixed states. Density operator, properties and equation of motion. Polarization of light, states of polarized light, Jones matrices, Jones formalism, Stokes parameters, Poincar´e sphere, Mueller matrices and Mueller formalism, Mueller matrices and their characterization, Few illustrative examples; comparison of Jones and Mueller formalisms. Pancharatnam phase, dynamical phase, cyclic evolution of polarization state on Poincar´e sphere; Applications of the concept of Pancharatnam phase. **[16 hours]**

Quantum features of radiation field: Planck's law of radiation and Einstein coefficients, Thermal equilibrium, Semi-classical theory of two level atoms, quantum theory of B coefficient, Optical resonance, damping, Theory of chaotic light, coherence, temporal, spatial, mutual coherence, line broadening, natural and Doppler width, collision broadening. **[16 hours]**

Quantized radiation field: Quantization of radiation field, States of radiation field; Fock states and phase eigenstates; Interaction of radiation with matter, theory of spontaneous emission; Coherent states and their properties, BCH formula, P, Q and Wigner distribution functions, Squeezed states of light and their properties; applications. Correlation functions, Brown-Twiss correlations. **[16 hours]**

Tutorial **[16 hours]**

Total work load **64 hours**

References:

1. Loudon R., The quantum theory of light, Clarendon Press, Oxford, 1973.
2. Mandel L. and Wolf E., Optical coherence and quantum optics, Cambridge University Press, 1995.
3. Louisell W.H., Quantum statistical properties of radiation, John Wiley and Sons, New York, 1973.
4. Blum K., Density matrix theory and applications, Plenum Press, New York, 1981.
5. Pancharatnam S., Collected works, Oxford University Press, 1975.

PHY-413: Electronics

BJT AC Analysis: Amplification in AC domain. BJT transistor modeling, common emitter voltage divider bias configuration. Emitter follower configuration. Darlington connection. Hybrid equivalent model, Approximate Hybrid equivalent circuit ; Voltage divider configuration, Complete hybrid equivalent model.
Feedback and Oscillator Circuit: Feedback concept, Feedback connections types, Practical feedback circuits. Feedback amplifier; Phase and frequency considerations. Oscillator operation, Phase - shift Oscillator, Wien-bridge Oscillator, Crystal Oscillator—BJT version.
FET amplifiers: JFET small signal model, Biasing of FET, Common drain, common gate configurations, FET amplifier and its frequency response. MOSFET – types and E – MOSFET Voltage divider configurations
(Boylestad and Nashelsky) **[16 hours]**

Operational amplifiers: Concepts of differential amplifier, Ideal op-amp, op-amp parameters, ideal voltage transfer curve, open loop and closed op-amp configurations, inverting amplifier, non inverting amplifier, limitations of open loop op-amp configurations.
Operational amplifier applications: Summing, scaling and averaging amplifiers, voltage to current converter with grounded load, current to voltage converter, integrator, differentiator,. V to I and I to V converters, Log and antilog amplifiers, Wave form generators, phase shift oscillator, Wein bridge oscillator. Non-linear circuit applications: Crossing detectors, 555 timer as a mono-stable and astable multivibrators, Active Filters—First and second order Low pass and High pass filters, Butterworth filters
(Gaekwad R.A) **[16 hours]**

Digital electronics: Boolean Laws and Theorems, addition and subtraction based on 1's and 2's complements, Families of gates, RS and JK flip-flops, The Master-Slave JK Flip-Flop, D and T flipflops. Karnaugh maps for 3 and 4 variables, Decoders-BCD decoders, Encoders.
Combinational logic circuits: Shift registers-series, series in-series out and parallel in parallel out. Half and full adders, Registers, Counters - Binary Ripple Counters, Synchronous Binary counters, Counters based on Shift Registers, Synchronous counters, Synchronous Mod-6 Counter using clocked JK Flip-Flops. Synchronous Mod-6 Counter using clocked D, T, or SR Flip-Flops. Memory cells, memory registers
[16 hours]

Tutorial **[16 hours]**

Total work load **64 hours**

References:

1. Boylestad R.L. and Nashelsky L., Electronic devices and circuit theory, 4th Edn., Pearson Education, 2006.
2. Bell D.A., Operational amplifiers and linear circuits, 2nd Edn., Pearson Education, 2004.
3. Gayakwad R.A., Operational amplifiers and linear integrated circuits, Prentice-Hall of India, New Delhi, 1993.
4. Malvino A.P. and Leach D.P., Digital principles and applications, 4th Edn., Tata McGraw Hill, 1988.
5. Arivazhagan S. and Salivahananan S., Digital circuits and design, Vikash Publishing House Pvt. Ltd.New Delhi, 2001.
6. Op-amps and linear integrated circuits, ramakanth A Gaekwad, 3rd edition,Pearson education Asia, 2002
7. Linear ICs and applications Uday A Bakshi & Atul P Godse, Technical Publications
8. Linear integrated Circuits, Roy & Choudary
9. Digital fundamentals, Thomos L Floyd

PHY-414: Minor Project

Total work load 64 hours

PHY-421: Nuclear and Particle Physics Lab

For those who have completed ***Condensed Matter Physics Lab PHY311***

Any eight of the following experiments:

1. Half-life of Indium-116 measurement.
2. Energy Resolution of a NaI(TI) scintillation spectrometer.
3. Compton scattering determination of the rest energy of an electron.
4. Beta absorption coefficient measurement.
5. Dekatron as a counter of signals.
6. Gamma-ray absorption coefficient measurement.
7. End-point energy of beta particles by half thickness measurement.
8. Common source amplifier.
9. Astable multivibrator using timer IC 555.
10. Dead time of the G.M. counter.

Total work load : 2 day(s) per week × 4 hours × 16 weeks = **128 hours**

PHY-422: Condensed Matter Physics Lab

For those who have completed ***Nuclear Physics Lab PHY 312***

Any eight of the following experiments :

1. Determination of the paramagnetic susceptibility of the given salt by Quincke's method.
2. Study of mercury spectrum by superimposing it on brass spectrum.
3. Sodium spectrum analysis by using Edser-Butler fringes.
4. Temperature coefficient of resistance of a thermistor.
5. Analysis of the powder X-ray photograph of a simple cubic crystal.
6. Thermionic work function of a metal (Richardson-Dushmann formula).
7. Energy gap of semiconductor.
8. Determination of Stefan's constant.
9. Frank Hertz experiment
10. Magnetic hysteresis.
11. Measurement of magneto resistance of semiconductors.

Total work load : 2 day(s) per week × 4 hours × 16 weeks = **128 hours**

PHY-423: Solid State Physics Lab 2

*For those who opted for **Solid State Physics Specialisation***

Any five of the following experiments:

1. Photovoltaic cell.
2. Photoconductive cell.
3. Hall effect in semiconductors.
4. Determination of the energy gap of semiconductors by four-probe method.
5. Temperature variation of the junction voltage of a p-n diode.
6. Temperature variation of the reverse saturation current in a p-n diode.
7. Depletion capacitance of a junction diode.
8. Determination of material constant of an intrinsic semiconductor.
9. Schottky effect.
10. Ionic conductivity of an alkali halide crystal.
11. Dielectric constant and its temperature variation.
12. Ultrasonic velocity and elastic constants of a solid.
13. Determination of Curie temperature of a magnetic material
14. Magnetic field variation along with axis of the solenoid
15. Magnetic Hysteresis
16. Thermal Diffusivity of Brass
17. Temperature co-efficient of resistance of copper

Total work load : 1 day(s) per week × 4 hours × 16 weeks = **64 hours**

PHY-424: Nuclear Physics Lab 2

*For those who opted for **Nuclear Physics Lab Specialisation***

Any five of the following experiments:

1. Schmitt trigger.
2. Variable delay line.
3. Pulse recorder.
4. Display devices.
5. Feather analysis: End-point energy of beta rays measurement.
6. Z dependence of external Bremsstrahlung radiation.
7. Fermi-Kurie plot : Determination of the end-point energy of beta rays using a plastic scintillation detector.
8. Determination of the resolving time of a coincidence circuit.
9. Determination of source strength by gamma-gamma coincidence.
10. Determination of source strength by beta-gamma coincidence.
11. Multichannel analyser : Study of the variation of energy resolution as a function of gamma ray energies.
12. Verification of Mosley's law
13. Beta ray absorption studies – relation between $\frac{\mu}{\rho}$ and end point energy.
14. Absorption coefficient of Al using Sr-90 and Y-90 beta sources.

Total work load : 1 day(s) per week × 4 hours × 16 weeks = **64 hours**

PHY-425: Theoretical Physics Lab 2

*For those who opted **Theoretical Physics Lab Specialisation***

Any five of the following experiments:

1. Density matrix description of polarization of light.
2. Double scattering of spin-1/2 particles on spin-zero targets.
3. Second order QED processes (Compton scattering).
4. Evolution of matrix elements between coupled angular momentum states.
5. Dirac matrix representations.
6. Algebra of Dirac matrices.
7. Electron-proton scattering, Rosenbluth formula.
8. Relativistic kinematics-3: Study of decay and production processes.
9. Feynman diagrams and calculations.
10. Energy matrix calculation.

Total work load : 1 day(s) per week × 4 hours × 16 weeks = **64 hours**

J.S.S. College of Arts, Commerce and Science
(Autonomous)
Ooty Road, Mysuru-570 025

DEPARTMENT OF ZOOLOGY (PG)

Programme outcome, Programme specific outcome, Course outcome and curriculum for Postgraduate Zoology
(2018-2019 & onwards)

Program Outcome

1. Imbibe the knowledge with facts and figures related Zoology.
2. Understand the basic concepts, fundamental principles, and the scientific theories related to various scientific phenomena and their relevancies in the day-to-day life.
3. Identify, formulate, research literature, and analyze complex problems reaching substantiated conclusions using first principles of mathematical, biological, physical and chemical sciences.
4. Will be able to think creatively to propose novel ideas in explaining facts and figures or providing new solution to the problems.
5. Develop scientific outlook not only with respect to Zoology but also in all aspects related to life.
6. Realize that interdisciplinary knowledge in other faculties can have greatly and effectively influence which inspires in evolving new scientific theories and inventions.
7. Imbibe ethical, moral and social values in personal and social life leading to highly cultured and civilized personality.
8. Develop various communication skills such as reading, listening, speaking, etc.
9. Realize that acquiring knowledge is a continuous process and in combination with untiring efforts and positive attitude and other necessary qualities leads towards a successful life.

Programme Specific outcome:

At the completion of M.Sc. in Zoology the students are able to:

1. Understand the classification and taxonomic aspects of the animal world (chordates and non-chordates). The students will be able to identify the taxonomic group of a given animal based on the external characteristics.
2. Understand the basic concepts of Animal physiology. The students will be able to identify and understand the important life processes which are essential for continuation of life on earth.
3. Understand the nature and structure of biomolecules and basic concepts of Biological chemistry.
4. Understand the concepts of Genetics, Cell Biology and Molecular Biology.
5. Understand the basic principles and concepts of environmental science, ecology and nature conservation.
6. Understand the importance of knowledge of wild life and animal behaviour for conservation and balancing the nature.
7. Understand the tools and techniques employed in Biological research and experiments.
8. Understand the process of evolution.
9. Understand the concept and applications of sericulture, apiculture, animal husbandry, Lac culture etc.

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE
OOTY ROAD, MYSURU
PG DEPARTMENT OF ZOOLOGY
Syllabus Adopted from the academic year 2018-19

Semester	HC / SC	Paper title	CREDITS			Total Credits
			L	T	P	
I	HC - 1.1	Biosystematics & Non Chordata	2	0	2	**4**
	HC - 1.2	Biological Chemistry	2	0	2	**4**
	HC - 1.3	Cytogenetics	2	0	2	**4**
	SC - 1.4	Tools and techniques in Biology	3	1	0	**4**
	SC - 1.5	Chronobiology	3	1	0	**4**
	SC - 1.6	Histology and Histopathology	3	0	1	**4**
	Any two of the Soft core paper may be opted					**20**
II	HC - 2.1	Chordata	2	0	2	**4**
	HC - 2.2	Animal Physiology	2	0	2	**4**
	HC - 2.3	Entomology	2	0	2	**4**
	SC - 2.4	Developmental Biology	3	0	1	**4**
	SC - 2.5	Immunology	3	1	0	**4**
	SC - 2.6	Evolutionary Biology	3	1	0	**4**
	Any two of the Soft core paper may be opted					**20**
III	HC - 3.1	Molecular Biology & Biotechnology	2	0	2	**4**
	HC - 3.2	Reproductive Biology	2	0	2	**4**
	HC - 3.3	Ecology and Wildlife**	2	0	2	**4**
	SC - 3.4	Ethology *	3	1	0	**4**
	SC - 3.5	Pollution and Toxicology *	3	1	0	**4**
	OE - 3.6	Concepts of Zoology	3	1	0	**4**
	Any one of the Soft core paper may be opted** * Field visits are included in this paper**					**20**
IV	HC - 4.1	Advanced Genetics and Computational Biology	2	0	2	4
	HC - 4.2	Applied Zoology*	2	0	2	4
	HC - 4.3	Project	0	2	6	**8**
	*** Field visits are included in this paper**					**16**

Total credits

Hard Core - 52 Credits

Soft Core - 20 Credits

Open Elective - 04 Credits

Total credits required to complete M.Sc Course - 76 Credits

M.Sc, I SEMESTER
HC 1.1 Non Chordata

32hrs

Course Outcome:
After completing the course student will be able to

1. Understand the classification of major and minor invertebrate phyla
2. Give some examples and basic characteristics of some examples of each phylum
3. Understand the evolutionary pathway and its significance
4. Adaptive characters of animals coming under different invertebrate phyla

UNIT I Basic concepts of animal taxonomy: 8 hrs

A. Introduction and history of taxonomy
B. Species concept
C. Zoological classification - theories of classification - taxonomic ranks – hierarchy
D. Zoological nomenclature: Binomial nomenclature, trinomial nomenclature-ICZN
E. taxonomical keys: key to the species
F. Linnaean taxonomy and classical taxonomy - level of taxonomy.

Unit II : Classification, Locomotion and Nutrition: 8 hrs

A. General Characteristics of Non chordata.
B. Locomotion: Muscle filaments and myonemes,
Flagella and cilia. Amoeboid movement.
C. Nutrition in Protozoa: Filter feeding in polychaetes, Filter feeding and digestion in Deuterostomia and molluscs.
D. Respiration:
Structure and function of respiratory organs- Skin, gills, book lungs and Trachea. Respiratory pigments

Unit III: 8 hrs

A. Excretion and osmoregulation:
Osmoregulation in fresh water and marine Invertebrates
Structure and function of excretory organs- Coelom, Coelomoducts, Nephridia, Maliphigian tubules and Coxal glands
B. Nervous system:
Primitive nervous system: Coelenterata and Echinodermata
Advanced nervous system: Annelida, Arthropoda(Crustacea and insecta) and Mollusca (Cephalopod)
C. Sense organs and their importance

Unit IV: 8 hrs

A. Invertebrate paleontology and larval forms:
Free living and parasitic Larval forms
B. Fossil: types and importance of fossil study, overview of Geological Time Scale

NON CHORDATA –PRACTICALS 4x16=64 Hrs

1. PROTOZOA; 4x12=48 hrs

Slides : 1) *Trypanosoma cruzi* 2) Plasmodium – signet ring stage 3) Ceratium 4)*Leishmania donovani* 5) Vorticella 6) Noctiluca 7) Radiolaria 8*) Entamoeba histolytica* 9) Foraminifera 10) Opalina

2. PORIFERA;

a) Slides: 1)Sponge spicules 2)Sponge gemmules

b) Specimen: 1) Grantia 2) Euspongia 3) Clypeaster

3. CNIDARIA:

a) Slides: 1) Obelia polyp and Medusa 2) Pennaria 3) Aurelia-tentaculocyst

b) Specimens: 1) Physalia 2) Gorgonia 3) Spongodus 4) Zoanthus 5) Favia 6) Pennatula 7)Sea anemone 8) *Corallium rubrum*

4. HELMINTHES:

a) Slides: 1) *Fasciola hepatica* 2) *Ancylostoma*

b) Specimens: 1) Planaria 2) Male and female *Ascaris lumbricodes* 3) *Taenia solium* 4)

5. ANNELIDA:

a) Slides: 1) Leech 2) Earthworm setae

b) Specimens: 1)Neries 2) *Chloea flava* 3) *Pheretima postuma* 4) Terebella 5) Eurythoe

6. ARTHROPODA:

a) Slides: 1) Daphnia 2) Sacculina 3) T.S of Peripatus

b) Specimens: 1) Balanus 2) Lepas 3) Palinurus 4) Scolopendra 5) Rhinocerous beetle 6)Spider 7) Gongylus 8) Belostoma 9) Limulus 10) Squilla 11) Eupagarus 12) Julus

7. MOLLUSCA :

Specimens: 1) Aplysia 2) Glochidium 3) Loligo 4) Chiton 5) Cypreae 6) Octopus 7)Sanguinolaria 8) Chicoreus 9) Ficus 10) Lambis 11) Mytillus 12) Doris 13) Onchidium 14) Oliva 15) Murex 16) Turritella 17) Cardium

8. ECHINODERMATA:

Specimens: 1) Sea Urchin 2) Linckia 3) Echinodiscus 4) Holothuria 5) Antedon

9. MINOR PHYLA: —1) Lingula

10. LARVAL FORMS:

Slides: 1) Cercaria 2) Trochophore 3) Megalopa larva 4) Nauplius 5) Zoea 6) Mysis

7) Phyllosoma 8) Protozoea 9) Bipinnaria 10) Veliger 11) Tornaria

12) Glochidium 13) Pluteus

11. Field Study: Visit to different areas around the college campus, to observe and study Non chordates in their natural habitat. **4x2=8 hrs**

II. Study of Nervous system, Respiratory system, Reproductive system and Excretory system in invertebrates by employing computer animation/charts: **4x2=8 hrs**

REFERENCES :

1. Barnes, R.D.1974. Invertebrate Zoology, III edition. W.B Saunders Co., Philadelphia
2. Barrington, E.J.W, 1976. Invertebrate Structure and Function. Thomas Nelson and Sons Ltd.,London.
3. Hyman L,H. 1940. The invertebrates. Vol. 1. Protozoa through Ctenophora, McGraw hill Co.,N.Y.
4. Hyman. L H. 1959. The Invertebrates smaller coelomate groups, Vol. V. McGraw Hill Co.,
5. Hyman. L. H. 1951. The Invertebrates. Vol. 2. McGraw Hill Co., N.Y.
6. Hyman. L H. 1968. The invertebrates Vol. 8. McGraw Hill Co., N.Y and London.
7. Simpson, G C. Principles of Taxonomy.

M.Sc, I SEMESTER
HC -1.2 BIOLOGICAL CHEMISTRY

32 hrs

Course Outcome:

After completing the course student will be able to

1. Identify the five classes of polymeric biomolecules and their monomeric building blocks.
2. Explain the specificity of enzymes (biochemical catalysts), and the chemistry involved in enzyme action.
3. Understand types, Structure, biochemical properties and functions of vitamins.
4. Explain how the metabolism of organic compounds leads ultimately to the generation of large quantities of ATP.

UNIT I Chemical Bonds and Carbohydrates: 8 Hrs

A. Structure of an atom, orbitals, chemical bonds - covalent, co-ordinate, ionic and hydrogen; Vander-Waal's force; hydrophobic interactions; Normality and Molarity of solutions.

B. Carbohydrates – Chemistry and biological properties

UNIT II Proteins and Lipids: 8 Hrs

A. Proteins- Chemistry and biological properties, Christian Anfinsen's experiment, Biological values of proteins

B. Lipids: Chemistry, triglycerides; prostaglandins and steroids –biosynthesis, Chemical importance of lipids.

UNIT III Enzymes: 8 Hrs

A. Enzymes: Nomenclature – current status; factors influencing velocity of enzyme reaction, enzyme dynamics and enzyme inhibition.
Ribozymes and abzymes; co-enzymes, isozymes, clinical importance.

UNIT IV Nucleic acids & Vitamins: 8 Hrs

A. Nucleic acids: Chemistry, alternative models of DNA,

B. Vitamins and trace elements – chemical nature, vitamins as co-enzymes, Deficiency diseases, role of trace elements

Biological Chemistry practicals 4x16=64 Hrs

1. Qualitative analysis for identification of carbohydrates (Starch, Glycogen, Sucrose, Lactose, Maltose, Glucose, Fructose).
2. Qualitative analysis for identification of Proteins (Egg albumin, Casein, Gelatin, Peptone)
3. Precipitation reaction of proteins (Egg albumin, Peptone)
4. The absorbance curves for two dyes and demonstration of Beer-Lambert's law.
5. Estimation of amino acids by Sorenson's formal titration (Arginine, Alanine, Leucine, lysine)
6. Determination of concentration of Glucose and Maltose by calibration curve.
7. Determination of amylase activity.
8. Determination of effect of temperature, pH and incubation period on amylase activity.
9. Test for non-esterified fatty acid.
10. Demonstration of gel electrophoresis.

REFERENCES

1. Barrington, E. J. W (1976) An introduction to general and comparative endocrinology, Oxford University press, London.
2. Conn, E. E., Stumpt, P. K., Bruencing, G. and Dol, R. G. 1995. Outlines of Biochemistry. Pub. John Wiley, Singapore.

3. Eckert, R and Randall, D. 2002, Animal physiology, 2nd Edn, W.H..Freman
4. Guyton. A.G. 1986, Text book of Medical Physiology, 7th Edn., Saunders Publication
5. Harper, H. A. 1993. A review of Physiological Chemistry, Lange Medical Publication, 2nd Edn.
6. Lehninger, A. L., Nelson, D. L. and Cox, M. M., 2nd Edn. 1993. Principles of Biochemistry,CBS Publishers and Distributors, New Delhi.
7. Oser, B. L. (Ed.) 1993. Hawk's Physiological Chemistry. Tata Graw Hill Publishing Co. Ltd.New Delhi.

M.Sc., I SEMESTER
HC – 1.3 CYTOGENETICS

32 Hrs

Course Outcome:

After completing the course student will be able to

1. Described the fundamental molecular principles of genetics
2. Understood the structure and function of DNA & RNA
3. Understand about the transmission, distribution, arrangement, and alteration of genetic information and how it functions and is maintained in populations
4. Described the basics of genetic mapping
5. Explain basic structure of animal cell and its organelles
6. Describe the functions and organization of cell organelles

Unit I: Introduction to the Cell & Cell Organelles **8 hrs**

A. The origin and evolution of the cell, From molecules to first cell, from Prokaryotes to eukaryotes, from single cell to multicellular organisms.
B. Membrane Structure and Function,
C. Structural organization and functions of intracellular organelles- The nucleus, Mitochondria, Lysosomes, Peroxisomes, Golgi apparatus, and endoplasmic reticulum.

Unit II: Cell Cycle and Cell signalling **8 Hrs**

A. Phases of cell cycle.
B. Biochemical studies with oocytes, eggs and early embryos.
C. Regulation of cell cycle: Molecular mechanisms regulating mitotic events.
   Regulation of cell cycle progression.
   Check points in cell cycle regulation.
   Cell cycle control in polytene cells.
D. Molecular basis of signal transduction
E. Cellular aging and death: (a)Causes of aging
   (b)Cellular changes due to aging
   (c)Theories of aging
   (d) Apoptosis
   (e) Longivity genes

UNIT III Gene mutations **8 Hrs**

A. Types of mutations (Spontaneous, Induced, Base substitutions and frameshifts - Transitions, Transversions, gain in function, loss in function, Neutral mutations),
B. Molecular mechanism of mutations (Base analogs, alkylating agents); Detection of mutations: Dominant lethal test, Sex-linked recessive lethal test, II-III translocations, Ames test, P-mediated mutagenesis

UNIT IV Chrmosomal mutations **8 Hrs**

A. Structure and organization of eukaryotic chromosomes
B. Structural and numerical variations of chromosomes, Chromosomal rearrangements and their cytogenetic consequences with examples from plants, Drosophila and Man,

Practical applications of chromosome rearrangements - Balancers and attached X-chromosome in Drosophila. Cytogenetic effects of ionizing and nonionizing radiations

CYTOGENETICS PRACTICALS **4X16 =64 Hrs**

1) Life cycle of *Drosophila melanogaster* 1x4=04hrs
2) Preparation of culture media. Culture of Drosophila - Methods of maintenance. 1x4=04hrs
3) Study of morphology of *Drosophila melanogaster* 1x4=04hrs
4) Mounting of Sex comb of *Drosophila melanogaster* 1x4=04hrs
5) Mounting of Wing of *Drosophila melanogaster* 1x4=04hrs
6) Study of mutants of *D. melanogaster* 1x4=04hrs
7) Preparation of genital plate of *D. melanogaster* 2x4=08hrs
8) Chi square Analysis of F1, F2 and Test cross progeny in *Drosophila melanogaster* to understand pattern of inheritance of different characters and to demonstrate. 3x4=12hrs
   a) Law of segregation
   b) Law of Independent assortment
   c) Sex-linked inheritance
9) Temporary squash preparation of Mitotic chromosomes from root tip meristem of *Allium cepa* 2x4=08hrs
10) Temporary squash preparation of Meiotic chromosomes from testis of *Poicelocerus pictus* 2x4=08hrs
11) Study of Barr body using buccal smear of volunteers 1x4=04hrs

REFERENCES:

1. Alberts, B., A. Jhonson, J. Lewis, M. Raff, K. Roberts and P. Walter 2008. Molecular Biology of the cell. V Ed. Garland Science, New York.
2. Brachet, J. 1985. Molecular Cytology, Academic Press, N. Y.
3. Furukawa, R., and M. Fechheimer. 1997. The structure, function and assembly of actin filament bundles. Int. Rev. Cytol. 175: 29-90.
4. Lewin B. (1997) Gene VI Oxford University Press, Oxford
5. Lodish, H., A. Berk, C.A Kaiser, M.P. Scott, A Bretscher, H. Ploegh, P. Matsudaira. 2008. Sixth Edition, Molecular Cell Biology. W. H. Freeman and Co., N. Y.
6. Pollard, T. D. and W. C. Earnshaw. 2002. Cell Biology. Saunders
7. Russel P.J (1998) Genetics. The Benjamin Cummings Publishing Co Inc.
8. Snustad D.P and M.J.Simons. (1997) Principles of Genetics. John Wiley and Sons Inc. N.Y.
9. Strickberger M.W. (1977) Genetics. MacMillan Collier Co. Pvt Ltd
10. Watson J.D, Hopkins, N.H, Roberts J.A, Steitz and A.M.Weiner. (1987) Molecular biology of gene. The Benjamin Cummings Publishing Co Inc.
11. Wolfe, A. 1995. Chromatin: Structure and function. Academic Press, N. Y.

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M.Sc., I SEMESTER
SC – 1.4 TOOLS AND TECHNIQUES OF BIOLOGY

48 hrs

Course Outcome:
After completing the course student will be able to

1. Describe the methodology involved in biotechniques.
2. Describe the applications of bioinstruments
3. Demonstrate knowledge and practical skills of using instruments in biology and medical field.
4. Perform techniques involved in molecular biology and diagnosis of diseases
5. Update current knowledge regarding biomedical engineering involving new methods and the instrumentation.

UNIT I: MICROSCOPY: 12hrs

Basic principles of microscopy, Types of microscopes and their biological applications Bright-field microscope, numerical aperture, limit of resolution, types of objectives, ocular & stage micrometers, Electron Microscope, SEM, Confocal microscope.
Dark-field microscope
Phase-contrast microscope
Differential interference contrast microscope
Fluorescence microscope
Photomicrography and image processing

UNIT II: SEPARATION TECHNIQUES: 12hrs

Centrifugation - Basic principles, Types of rotors, Clinical, high speed & ultracentrifuge
Electrophoresis – Agarose and polyacrylamide gel, Two-dimensional, Isoelectrofocussing
Chromatography - Paper and Thin layer chromatography, Column chromatography, Gel filtration, Ion-exchange, Affinity, Introduction to FPLC and HPLC

UNIT III: 12hrs

A. Radio-tracer techniques
Unit of radioactivity and half life, Measurement of radioactivity (β and γ emission), Applications of radioisotopes, Safety measures
B. Techniques in immunodetection: Immunoblotting and immunofluorescence
C. Immunological techniques: Immunodiffusion and Imunoelectrophoresis

UNIT IV: 12hrs

A. Cell culture techniques: Design and functioning of tissue culture laboratory; Culture media, essential components and preparation; Cell viability testing
B. Cytological techniques: Mitotic & Meiotic chromosome preparations from insects and vertebrates Chromosome banding techniques (G-, C-, Q-, R- banding etc.)
C. Molecular cytological techniques: In situ hybridization (radiolabelled & non-radiolabelled methods), FISH, and Restriction banding
D. Molecular biology techniques: Southern hybridization and Northern hybridization DNA sequencing Polymerase chain reaction (PCR)

TUTORIALS 2x16 = 32 Hrs

REFERENCES

1. Alberts et al: Molecular Biology of the Cell, Garland, 2002
2. Karp: Cell and Molecular Biology, John Wiley & Sons, 2002
3. Lodish et al: Molecular Cell Biology, Freeman, 2000
4. Pollard & Earnshaw: Cell Biology, Saunders, 2002
5. Ruthman: Methods in Cell Research, Bell & Sons, 1970.

6. Boyer: Modern Experimental Biochemistry and Molecular biology (2nd Ed.), Benjamin/Cumin, 1993
7. Freifelder: Physical Biochemistry (2nd Ed.), Freeman, 1982
8. Holme and Peck: Analytical Biochemistry (3rd Ed.), Tata McGraw Hill, 1998
9. Plumer: An Introduction to Practical Biochemistry (3rd Ed.), Tata-McGraw Hill, 1990
10. Switzer and Garrity: Experimental Biochemistry 92nd Ed.), Freeman, 1999
11. Wilson and Walker: Practical Biochemistry (3rd Ed.), Cambridge Univ. Press, 2000

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M.Sc., I SEMESTER
SC – 1.5 CHRONOBIOLOGY

48 hrs

Course Outcome:

After completing the course student will be able to

1. Understand the concept of Chronobiology
2. Identify the way by which circadian rhythms affect life from the genome to the complex behaviour of the individual
3. Acknowledge the role of Chronobiology and chronodisruption on several physiopathological events
4. Acknowledge the input of the synchronizers on homeostasis
5. Characterize the biological relevance of several chronotypes
6. Acknowledge the relevance of circadian rhythms on therapeutic interventions
7. Acknowledge the importance of scientific research on Chronobiology
8. To interpret study designs and scientific parameters related to Chronobiology.

UNIT I: Introduction: **4 hrs**

History, Biological rhythms, Biological clocks, Significance of biological timekeeping

UNIT II: Biological rhythms: **10 hrs**

A. Types of rhythms- Circadian, Circatidal,Circalunar, Circannual
B. Methods of measurement
C. Properties: Entrainment, Re-entrainment, Phase angle difference, Freerun, Phase shift, Phase response curve, Arrhythmia.

UNIT III: Factors influencing biological rhythms: **10 hrs**

A. Environmental: Photoperiod -Photoreception and photo-transduction;
   The physiological clock and measurement of day length;
   Role of photic and non-photic cues in seasonality,Other zeitgebers
   Reversal of roles of principal and supplementary cues.
B. Evolution of photoperiodism: comparative studies; Circannual rhythms and seasonality.

UNIT III: Circadian pacemaker system: **8 hrs**

A. Suprachiasmatic nuclei, B. Pineal gland, C. Optic lobes.

UNIT IV: Molecular basis of circadian rhythms **8 hrs**

A. Clock genes, B. Drosophila, C. Mouse

UNIT V: Applied Chronobiology: **8 hrs**

A. Human circadian rhythms: Melatonin: Input or output signal of the clock system, Clock function (dysfunction); Human health and diseases
B. Applications of circadian rhythm principles: Jet-lag/shift work, Depression and

sleep disorders, Chronopharmacology and Chronotherapy

TUTORIALS **2X16=32 Hrs**

References

1. Binkley, S. (1990): The clockwork sparrow: time, clocks, and calendars in biological organisms, Prentice-Hall, New Jersey.
2. Chandrashekaran, M. K. (1985): Biological rhythms, Madras Science Foundation, Chennai.
3. Jay. C. Dunlap, Jennifer. J. Loros, Patricia J. DeCoursey (ed). 2004: Chronobiology Biological Timekeeping, Sinauer Associates, Inc. Publishers, Sunderland, MA, USA
4. Nelson, R. J. (2000) An Introduction to Behavioural Endocrinology, 2nd edition, Sunderland Publishers, Massachusetts.
5. Saunders D.S., C.G.H. Steel, X., afopoulou (ed.)R.D. Lewis. (3rd Ed) 2002: Insect Clocks, Barens and Noble Inc. New York, USA
6. Shapiro, C. M. and Heslegrave, R. J. (1996): Making the shift work, Joli Joco Publications, Inc. Toronto.
7. Vinod Kumar (ed 2002) : Biological Rhythms Narosa Publishing House, Delhi/ Springer-Verlag, Germany

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M.Sc., I SEMESTER
SC – 1.6 HISTOLOGY AND HISTOPATHOLOGY

48 Hrs

Course Outcome:

After completing the course student will be able to

1. Understand the applications of dyes and its classification.
2. Know the functional morphology of various mammalian organs.
3. Imbibe the knowledge on histochemical techniques.
4. Describe the etiology and pathology of liver cirrhosis and atheroscleorsis.
5. Explain histopathology of breast and prostate tumours.

UNIT – I Basics of Histology **8Hrs**

A. Objectives and applications
B. Tissue fixation : Objectives, methods, chemical fixatives-types and chemistry of fixation; Physical methods-:freezing and microwave fixation; choice of fixatives, fixation artifacts.
C. Dyes. –Natural and Synthetic, Classification

UNIT-II Functional Morphology (mammalian) **8 Hrs**

A. Histological organization of GI tract- stomach and intestine,
B. Histological organization of lungs & kidney
C. Histological organization of spleen & thymus,
D. Bone and bone marrow.

Unit-III Histochemistry **8 Hrs**

A. Principles and methods of application
B. Classical histochemical Techniques: for localization of glycoproteins (PAS), nucleic acids (Feulgen) and steroid dehydrogenase activity.

Unit-IV Immunohistochemistry **8 Hrs**

A. Principles, method of application
B. Imunohistochemistry techniques for localization of proteins in endocrine cells (Pituitary cell types or islet of Langherhans)

C. Immunofluorescence: In situ hybridization of nucleic acids

UNIT-V Histopathology **8 Hrs**

A. Morphological alterations in cells due to disease,
B. Types of degeneration: clouding, hyaline, hydrophic and fatty degeneration.
C. Etiology, pathogenesis and histopathology of Liver cirrhosis and atheroscelerosis
D. Neuropathology of alcoholism and methanol poisioning.

Unit-VI Histopathology of tumors **8 Hrs**

A. Malignant and non-malignant
B. Types of carcinoma
C. histopathology of breast and prostate tumors

PRACTICALS **2x8= 16 Hrs**

I. Histology:

1. Microtomy and staining: Hematoxylin-eosin - Demonstration 2x2=4 hrs
2. Histology: 2x2=4 hrs

Observations of permanent slides of mammalian organs – stomach, intestine, spleen, liver, kidney, lungs, testis, epididymis, vas deferens, ventral prostate, seminal vesicle, ovary, uterus and Fallopian tube.

II. Histometry: **2x3=6hrs**

Histometrical measurements and statistical analysis of some tissues.

III. Histopathology: **2x1=2hrs**

Study of histopathological changes (permanent slides) – gastric ulcers, cirrhosis of liver, breast tumors, cystic follicles of ovary, pancreas in diabetics, cryptorchid testis and leukemia.

REFERENCES:

1. Boyd,W. 1976:A text book of Pathology. Structure and function in disease, 4th edition. Lea and Fibiger, Philadephia.
2. Pearse, A.G.E. (1980): Histochemistry, theoretical and Applied ,J & A, Churchill Ltd., London.
3. Rogers, A.W.(1983): Cells and Tissues, An introduction to Histology and Cell Biology, Academic Press, NY.
4. Telford, I.R. and Bridgman,C.F.(1990). Introduction to Functional Histology, Harper and Row, NY.

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M.Sc., II SEMESTER
HC – 2.1 CHORDATA

32 Hrs

Course Outcome:

After completing the course student will be able to

1. Understand the classification of chordates
2. Give some examples and basic characteristics of some examples of protochordates
3. Give some examples and basic characteristics of some examples of vertebrates
4. Understand the evolutionary pathway and its significance
5. Analyse adaptive characters of animals coming under different vertebrate classes

UNIT I General characters and outline classification of Chordata **8hrs**

A. General and Comparative study: Comparision of three Protochordates, Subphyla in terms of General comparision, Habits and habitats,

B. Alimentary canals and associated glands, Pharynx, Food and feeding and excretory system in Protochordates.
C. Adaptive radiation in vertebrates – fishes, amphibians, reptiles, aves and mammals

UNIT II **8hrs**

A. **Integument and its Derivatives**: Epidermal Integument or Skin Functions, Structure & its Derivatives (Glands, Scales and scutes, digital cornifications, horns, feathers, hairs), Integument in different classes of Chordates.
B. **Nervous system**- Development of Brain, spinal cord, Peripheral nerves and sense organs

UNIT III **8hrs**

A. **Respiratory System**: Introduction Respiratory organs: Gills (Internal or true gills, External or Larval gills). Lungs and Ducts, Accessory Respiratory organs and Swim Bladders.
B. **Circulatory system:** Evolution of heart and aortic arches

UNIT IV **8hrs**

A. **Digestive System:** Introduction Embryonic Digestive Tract
Alimentary Canal: Divisions, Digestive Glands
B. **Urinogenital System:** Vertebrate kidneys and ducts, Gonads and their ducts

CHORDATA PRACTICALS **4x16=64 Hrs**

1. **Protochordates**: Specimens:1)Amphioxus , Herdmania
Slides- Salpa (sexual), Doliolum

2. **Fishes** : 1) *Rhinobatus* 2) *Hippocampus* 3) Goldfish (aquarium fish) 4) *Clarius*
5) *Anabas* 6) Coffer fish 7) *Acipenser* 8) *Periopthalmus* 9) *Triacanthus*
10) *Notopterus* 11) *Exocoetus* 12) *Diodon hysterix* 13) *Echenenis neucrates*

3. **Amphibians** : 1) Ichthyophis 2) Axolotl Larva 3) *Rana tigrina* 4) *Amblystoma*

4. **Reptiles** : 1) *Calotes* 2) *Mabuya* 3) Chameleon 4) *Phrynosoma* 5) *Chelone mydas*
5) Varanus 6)*Naja naja* 7) Krait 8) Hydrophis 9)Viper

5. **Birds** : 1) Blue jay 2) Indian koel -male and female 3) Kite

6. **Mammals** : 1) Guinea pig 2)Domestic cat 3) Loris 4) *Megaloderma lyra* (bat)
5) Pangolin

7. **Integuments of vertebrates**: Scales of fish, Hoofs, nails, horns, claws,
plastron and carapace of tortoise, snout of saw fish

8. **Osteology :**
1) **Skull and lower jaw**:- a) Crocodile b) Bird c) Carnivore mammal (dog)
d) Herbivore mammal (horse)
2) **Types of vertebrae**:- a) Procoelous b) Ophisthocoelous c) Amphicoelous
d) Amphiplatian e) Heterocoelous f) Axis and atlas vertebrae.

II. Study of following systems in rat by employing computer animation/charts:
a) Circulatory system b) Nervous system c) Reproductive system
d) Digestive system e) Sense organs f) Urinary system

REFERENCES :

1. Alexander, R. M. 1975. The Chordata. Canbridge University Press, London.
2. Barrington, E.J.W. 1965. The Biology of Hemichordata and Protochordata, Oliver and Boyd, Edinbourgh.
3. Colbert, E. H, 1969. Evolution of the vertebrates, John Wiley and Sons, Inc., N.Y.
4. Kent, C. G. 1954. Comparative anatomy of vertebrates
5. Kingsley, J.S. 1962. Outlines of Comparative anatomy of vertebrates. Central book depot Allahabad.

M.SC., II SEMESTER
HC – 2.2 ANIMAL PHYSIOLOGY

32 Hrs

Course Outcome:

After completing the course student will be able to

1. Understand the mechanism of transport of molecules, stepwise release of energy , aerobic and anaerobic respiration
2. Describe the physiology of digestive and respiratory system of human beings.
3. Understand the blood composition, types, groups and circulatory system.
4. Describe the physiology of excretory system and nervous system of human beings.
5. Know the physiology of sense organs, muscles and reproductive system.

UNIT I: Membrane Transport, Bioenergetics & Circulation — 8 Hrs

A. Membrane Transport:

Molecular mechanisms of passive and active transport.

B. Bioenergetics:

a) Energy – Concept, laws of thermodynamics
b) Redox potential
c) Stepwise release of energy through cytochromes, production of ATP, uncoupling of oxidative phosphorylation,inhibitors.
d) Anaerobic and aerobic breakdown of glucose, alternate pathway – HMP shunt and glucoronic acid pathway.
e) Citric acid cycle as common metabolic pathway.

C. Circulation:

a) Major types of body fluids and their composition.
b) Neurogenic and myogenic hearts.
c) Mammalian heart – cardiac cycle, ECG.

UNIT II: Physiology of excitation & Excretion — 8 Hrs

A. Muscle Physiology:

a) Molecular organization of sarcomere.
b) Mechanism of contraction with emphasis on sliding filament and Davies models, regeneration of storage phosphate.
c) Physiological adaptations of muscles for jumping, swimming and flight.

B. Neurophysiology:

a) Axonal and synaptic transmission of nerve impulses.
b) Synaptic integrity, synaptic plasticity.
c) Molecular mechanism of sensory transduction and neural output in receptor cells.

C. Excretion:

a) Comparative physiology of excretion in animals- Nitrogenous wastes and waste elimination.
b) Mammalian kidney- Structure and physiology of urine formation.

Unit III: Basic Concepts of Endocrinology **8 hrs**

A. Chemical messengers:
Autocrine, Paracrine and endocrine secretions,
Types of hormones, an overview of human endocrine system

B. Hormone synthesis: Peptide and steroid hormones.
Role of Hormones in homeostasis- Glucose and Water balance

C. Hypothalamus and pituitary gland:
Structure, function and control of hypothalamic hormones.
Pituitary hormones and their physiological actions
chemical structure and. Feedback regulation. Pathophysiology.
Hyppothalamo - hypophysial portal system

D. Pineal gland–Structure and function**.**

Unit IV: **8 hrs**

A. Thyroid gland: Structure, function and biosynthesis of thyroid hormone

B. Parathyroid : Structure and PTH – Calcitonin – Role of hormones in calcium and phosphate metabolism.

C. Adrenal gland hormones
Adrenal cortex hormones: Corticoids: role played in Stress management – Aldosterone and the rennin- angiotensin system
Adrenal medullary hormones: Catecholamines as emergency hormones

D. Gastrointestinal hormones: Secretion, control and function

E. Pancreatic Hormones: Insulin and glucagons, their role in the regulation of Carbohydrate, protein and lipid metabolisms.

ANIMAL PHYSIOLOGY PRACTICALS **4x16=64 Hrs**

1. Estimation of Proteins by Lowry *et al* method. (in tissue sample from slaughter house)
2. Determination of serum cholesterol. (Clinical sample)
3. Determination of glucose content by Anthrone method. ((in tissue sample from slaughter house)
4. Estimation of liver and skeletal muscle glycogen. (in tissue sample from slaughter house)
5. Determination of serum/ blood urea by DAMO method. (Clinical sample)
6. Estimation of creatinine in the urine sample.
7. Total count of RBC and WBC.
8. Differential count of WBC
9. Response of RBC's to Hypertonic, hypotonic and isotonic solutions
10. Observation of permanent slides of T.S of endocrine glands
    a. Pituitary gland b. Thyroid gland c. Adrenal gland d. Pancreas
11. Identification of chemical structures of steroid hormones

REFERENCES:

1. Adler N. T (1981) Neurcendocrinology of Reproduction, Physiology and Behaviour.Austin, C. R and R. V. Short (eds) (1972) Reproduction in mammals. (1) Germ cells andFertilization (2) Embryonic and Foetal development (3) Hormones in Reproduction (4) Reproduction pattern (5) Artificial control of reproduction, Cambridge University press,London.
2. Barrington, E. J. W (1976) An introduction to general and comparative endocrinology,Oxford University press, London
3. Raghavendra Puri (2003) Mammalian endocrinology Vol. I & II, Dominant Publishers and Distributors, New Delhi.
4. Eckert, R and Randall, D. 2002, Animal physiology, 2nd Edn, W.H..Freman

5. Guyton. A.G. 1986, Text book of Medical Physiology, 7th Edn., Saunders Publication

M.Sc., II SEMESTER
HC – 2.3 ENTOMOLOGY

32hrs

Course Outcome:
After completing the course student will be able to

1. Understand insects encountered in agricultural fields.
2. Envisage an insight on economically important pests of various foods, fiber and household
3. Understand various insect pest management methods and its significance
4. Learn to apply various agricultural equipment and understand the effect of chemicals and its dosages in agricultural pest management
5. Learn to apply the pest control methods wisely to minimise ecological backlash
6. Discuss the evolutionary significance of insect plant interaction and insect animal interaction.

Unit I: General Entomology **10 hrs**

A. Classification of class Insecta up to orders with suitable examples; Integument appendages.

B. Insect Endocrinology

I. Insect Hormones and their regulation**:** Chemistry and functions of hormones, Hormones in metamorphosis, Ecdysis and Diapause

II. Semiochemicals:**:** Allelochemicals and Pheromones (Primer & releaser)

Unit II: Agricultural Entomology **10hrs**

A. Role of insects in plant pollination

B. Insects pests: Classification and categories of pests, origin and emergence of pests, pest out breaks and pest resurgence
Structure, life history, significance, nature of damage and control methods of major pests of sugarcane, Paddy and Coconut.

C. Structure, life history, significance, nature of damage and control measures of stored grain pests: (a) *Sitophilus* (b) *Trogoderma* (c) *Rhizopertha* (d) *Tribolium* (e) *Bruchus* (f) *Sitotruga* (g) *Ephestia*

Unit III: General and household insect pests **06hrs**

A. Structure, life history, significance, nature of damage and control measures of following general pests: (a) grasshoppers & locusts (c) termites (d) aphids (e) hairy caterpillars

B. Household pests: Cockroaches, Ants, Wasps, Silverfish, furniture beetle, and their control

Unit IV: Medical Entomology **06hrs**

A. Insect vectors: Role of insect as vectors of human diseases (Malaria, filariasis, Kala azar and their control)
Mosquitoes as pests and their control.
Housefly: A human health hazard and its control

B. Arboviral diseases: Dengue, chicken gunya, swine flu.

PRACTICALS: **4x16=64 Hrs**

1. Collection and preservation of dead insects for systematic studies & field report 4x4=16 hrs
2. Identification of different insects upto orders- House fly, Cockroach :
Mosquitoes, stored grain beetles, destructive insects, important crop and household pests
4x4=16 hrs

4. Fixing and preservation of dead insects by Plastination technique. 4x4=16 hrs
5. Field studies of insects to understand their habit: Ants, Butterflies, termite, wasps, Moths. 4x2=08 hrs
6. Study of insect mouth parts: Mosquito, Cockroach, House fly, Butterfly 4x2=08 hrs

REFERENCES:

1. Awasti V.B. 2009 Introduction to general entomology 3rd Ed. Scientific publication (India), Jodhpur
2. Awasti V.B.2007, Agricultural Insect Pests and their control. Scientific publishers (India) Jodhpur
3. Trigunayat M.M. 2009, A Mannual of practical entomology, scientific publishers, Jodhpur, India.
4. Dhaliwal G.S. Ramsingh and B.S. Chillar 2006, Essentials of Agricultural entomology. Kalyani Publishers, New Delhi.
5. L . K Jha. Applied Agricultural Entomology. New central book agency. Culcutta

M.Sc., II- SEMESTER
SC – 2.4 DEVELOPMENTAL BIOLOGY

48 Hrs

Course Outcome:

After completing the course student will be able to

1. Understand the molecular concepts of developmental biology during fertilization.
2. Know about Noble prize concepts during frog development viz., Nucleocytoplasmic interactions.
3. Explain on axis development in drosophila.
4. Describe endocrine and molecular control in metamorphosis of insects and amphibians.
5. Explain the various stages of chick embryonic development.

Unit I:

A) Introduction : Descriptive V/s. Experimental Embryology **8hrs**
B) Fertilization : a) An overview of structure and differentiation of egg and sperm
b) General sequence and molecular events during fertilization

Unit II: Early development - I **8 hrs**

a) Nucleocytoplasmic interactions in early development: An overview of Nuclear transplantation experiments in Amphibians and mammals
b) Creations of multicellularity: Cleavage-Regulatory mechanism
c) Gastrulation: Morphogenetic movements and regulatory mechanisms in amphibian and mammalian embryo.

Unit III: Early development - II **8hrs**

a) Morphogenetic determinants and their role in development:
Yellow cytoplasm in Ascidians, Polar body in Mollusca, Pole plasm in *Drosophila*
b) Laying down the embryonic body plan :
Determination of embryonic axes in *Drosophila* – Anterior-posterior (maternal effect genes) & Dorsoventral; Amphibians (cell-cell interaction) & Mammals (Hox Genes)
c) Cell lineage studies and cell death genes in *Caenorhabditis elegans*.

Unit IV: Morphogenesis –I **8 hrs**

a) Early embryogenesis in Drosophila : Regional specification by. Segmentation genes: Gap genes, Pair rule genes, Segment polarity genes, and Homeotic genes.
b) Cellular differentiation and morphogenesis:
i. Neuronal v/s epidermal fate specification in *Drosophila*.

ii. Vulval induction in Caenorhabditis elegans.

Unit V: Morphogenesis-II **8 hrs**

a) Role of Cell Adhesion molecules in morphongenesis : Cadherins and Fibronectins
b) Genetics of imaginal discs and transdetermination
c) Limb development-an over view :
i. Proximo-distal axis specification in developing limb.
ii. Cell death and formation of digits.

Unit VI: Post embryonic development **8 hrs**

a) Metamorphosis : Endocrine and molecular control of metamorphosis in insects and amphibians b) Types of growth c) Regeneration : Types, Blastema formation,Sources of cells for regeneration d) Abnormal development as seen in Teratogenesis.

PRACTICALS **16X2=32Hrs**

1. Study of internal changes during early development of frog & chick (permanent slides) 3X2=06hrs
2. Development of chick-Embryo mounting-permanent preparation 2X2=04hrs
3. Study of early developmental stages of *Drosophila* (Live Observation of embryo) and dechorionation and observation of embryos 2X2=04hrs
4. Study of Imaginal discs – the precursors of adult structures in *Drosophila* 3X2=06hrs
5. Demonstration of window technique to observe chick embryo development 2X2=04hrs
6. Effect of thyroid hormone on development in frog 2X2=04hrs
7. Study of various developmental stages in frog up to tadpole stage 2X2=04hrs

REFERENCES:

1. Balinsky, B.I., 1965. An introduction to embryology, W.B.Saunders company.
2. Gilbert, S. F. 2006, Developmental Biology, 8th Ed.Sinauer Associates Inc.,
3. Kalthoff, 2000, Analysis of Biological Development, 2nd Ed., McGraw-Hill Science, New Delhi, INDIA. Massachusetts, USA.
4. Vasudeva Rao, 1994. Developmental Biology: A modern synthesis, Oxford & IBH, New Delhi.
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7. Ann Kiessling and Scott C. Anderson, Human Embryonic Stem Cells: An Introduction to the Science and Therapeutic Potential, 2003. Jones and Bartlett Publishers, Boston MA, USA

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M.Sc., II SEMESTER
SC – 2.5 IMMUNOLOGY

48hrs

Course Outcome:

After completing the course student will be able to

1. Outline the key components of the innate and adaptive immune responses.
2. Describe about cell types and organs which are involved in an immune response¬
3. Describe the Infectious diseases, hypersensitivity, autoimmune disorders,¬ immunodeficiency diseases

Unit I: Introduction to immunity **8hrs**

A. History; types of immunity – Innate and acquired immunity.
B. Cells and Organs of immune system: Cells: Lymphocytes (T & B cells), monocytes, macrophage; eosinophills, basophills, neutrophils and mast cells.
C. Primary and secondary lymphoid organs: Bone marrow, Thymus, Spleen, Lymph nodes

Unit II: Antigens and Immunoglobulins **8hrs**

A. Antigens: factors influencing immunogenicity, adjuvant, epitope, hapten
B. Immunoglobulins: Basic structure of the immunoglobulin;
Types and functions of immunoglobulins.
C. Monoclonal antibodies:Antigen-antibody reactions

Unit III: Immune response **8hrs**

A. Humoral and cell mediated immune responses
B. Primary and secondary immune modulation; Cytokines; role of complement system in immune response (Classical pathway, Alternate pathway);
C. Immune response against bacterial (tuberculosis), parasitic (malaria) and viral (HIV) infections;

Unit IV Immunotechniques **8hrs**

A. Agglutination; Precipitation;
B. Immunofluorescence; RIA, ELISA, Immuno-electrophoresis and Western blotting.

Unit V Major histocompatibility complex and Hypersensitivity **8hrs**

A. Transplantation and graft rejection,
B. Genetic organization of H2 and HLA complexes, HLA typing;
C. Immediate and delayed hypersensitivity.

Unit VI Vaccines and Vaccination **8hrs**

A. Types of Vaccines and their significance
B. Vaccine delivery systems.
C. Congenital and acquired immunodeficiencies

TUTORIALS **2X16=32 Hrs**

References:

1. Austyn, J.M. and Kathym, J. Wood. 1993. Principles of cellular and molecular Immunology. Oxford University Press. Oxford.
2. Benjamin, Elisunshine, Geoffrey Leskowitz.1996. Immunology: A short course. 3rd Edition. New York.
3. Kubey, J.M. 1990. Essential Immunology. 6th Edition. Blackwell Scientific Publication, New York.
4. Rao, C.V. 2002. An introduction to Immunology. Narona Publishing House, New Delhi.
5. Rotti, I. 1994. Essential Immunology. Blackwell, London.
6. Stibes, D.P. and Terr, A.I. 1991. Basic and Clinical Immunology. 7th Edition. Appleton and Large. California.

M.Sc., II SEMESTER
SC – 2.6 EVOLUTIONARY BIOLOGY

48 Hrs

Course Outcome:
After completing the course student will be able to

1. Understand that many of the organisms that inhabit the Earth today are different from those that inhabited it in the past
2. Understand that the propositions underlying Darwin's theory of evolution.
3. Explain adaptation, providing examples from several different fields of biology
4. Explain how the molecular record provides evidence for evolution
5. Understand the Human origin and evolution.

UNIT I Emergence of concept of evolution: 8 Hrs

A. Pre Darwinian concepts, Darwinism and its impact in the development of synthetic theory.
B. Neodarwinism: Birth of population genetics, Components of population genetics, Mendelian population, gene pool, allele frequencies and genotype frequencies,

UNIT II Speciation: **8 Hrs**

A. Concept of species,
B. Types of species
C. Models of speciation,
D. Patterns and mechanisms of reproductive isolation,
E. Hybridization, polyploidy and speciation.

UNIT III Molecular evolution 8 Hrs

A. Phyletic gradualism and punctuated equilibrium.
B. Micro and macroevolution.
C. Molecular evolution: Selectionists theory of evolution, Neutral theory of evolution and Molecular clock and emergence of non-darwinism,

UNIT IV Phylogeny 8 Hrs

A. Phylogenetic trees : Construction with nucleic acid and amino acid sequences,
B. Types of trees and Techniques employed in construction of phylogenetic trees,
C. Molecular phylogenetics of Homo sapiens.

UNIT V Population genetics and Evolution 8 Hrs

A. Gene pool, gene frequency, Hardy-Weinberg Law.
B. Destabilizing forces of evolutionary equilibrium (Mutation, Migration, Selection, Meiotic drive and genetic drift).
C. Founder effect, Isolating mechanisms and speciation.
D. Micro Macro and Mega evolution, Co-evolution.

UNIT VI Genome and Evolution **8 Hrs**

A. Genes and gene clusters
B. Origin of new genes by gene duplication (Ohno's concept)
C. Selfish DNA
D. Karyotypic evolution (Drosophila).

TUTORIALS 2X16=32Hrs

REFERENCES:

1. Dobzhansky Th, (1951) Genetics and origin of species, 3rd Edn. Chapman and Hall, London.
2. Dobzhansky Th, Ayala F.J, Stebbins G.L and J.M. Valentine, (1976) Evolution, Surjeet Publication, New Delhi.
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5. Jha A.P (1992) Genes and Evolution - John Wiley Publicaion, New Delhi

6. King M (1993) Species evolution - The role of chromosomal change. The Cambridge University Press, Cambridge

M.Sc., III SEMESTER
HC – 3.1 MOLECULAR BIOLOGY AND BIOTECHNOLOGY

32 hrs

Course Outcome:
After completing the course student will be able to

1. Know nucleic acids, DNA replication and its mechanism.
2. Understand transcription and its modifications.
3. Explain genetic code, enzymes, factor and the process of translation.
4. Analyse gene regulation, lytic and lysogenic cycles in prokaryotes.
5. Understand gene regulation in eukaryotes.
6. Explain molecular mechanism of DNA damage repair.

Part A: Molecular Biology

Unit I Introduction to nucleic acids **8hrs**

A. DNA Replication: i) Enzyme components of replication unit ii) Mechanism with emphasis on Dna A in initiation, Co-ordinated synthesis, End replication in eukaryotes iii) Fidelity.
B. Transcription: i) Transcription apparatus and process (RNA polymerase, cisregulatory elements, terminators, transcription factors). ii) Post transcriptional modifications of mRNA in eukaryotes (G-cap, Poly tail, Splicing).
C. Translation: i) Genetic code (major features, usage of different codons). ii) Enzymes, factors and the process (Aminoacyl t-RNA synthatase, Peptidyl transferase, IFs, EFs, RFs and Ribosome)

Unit II Gene regulation **8hrs**

A. Gene regulation in Prokaryotes: (i) Regulation at transcription initiation: Eg. lac operon (+ve and -ve control) (ii) Regulation beyond transcription initiation: trp attenuator (iii) Regulation in Lambda Phage - Lytic and lysogenic cycle induction.
B. Gene regulation in Eukaryotes: (a) Transcriptional activators (b) Transcriptional repression: (i) direct repression, indirect repression (ii) Gene silencing by modification of histones and DNA (c) RNA interference
C. Molecular basis of homologous recombination: Models and protein machinery
D. Molecular mechanisms of DNA damage repair**.**

Part B: Biotechnology

Unit III: **8 hrs**

A. **Genetic engineering:**
Definition, objectives and outline of recombinant DNA technology procedure.
Enzymes**:** Restriction Enzymes; DNA ligase, Klenow enzyme,
T4 DNA polymerase, Polynucleotide kinase, Alkaline phosphatase.
Cloning vectors: Plasmids, Phages, Cosmids, Phagemids, Artificial chromosomes (YAC, BAC, HAC),

B. **Cloning:**
Construction of Genomic and cDNA libraries.
Indetification of Recombinants: Genetic selection, Use of chromogenic substrates, Insertional inactivation.
Analysis of recombinant DNA clones: Characterization of clones, Restriction mapping, Southern hybridization.
Polymerase chain reaction and DNA sequencing-Maxam and Gilbert's method, Sanger's method, Automated DNA sequencing

Unit IV: **8 hrs**

C. **Applications of Biotechnology:**
Production of medicinally important products – vaccines, Gene therapy, AIDS therapy, Biofertilizers, biopesticides, medicine and human health

D. **Animal Biotechnology**
Animal cell and Tissue culture: Principles of cell culture, cell and tissue types, cell lines, transformation.
Cell and tissue culture media: Natural and defined, role and components of serum in culture.
Applications of tissue culture: Tissue culture in biomedical research karyological studies, amniocentesis, mutagenesis, Cytotoxicity assays.

PRACTICALS **4x16=64 Hrs**

1. Extraction of DNA by rapid method.
2. Extraction of DNA by standard method.
3. Estimation of DNA concentration by Diphenylamine method.
4. Localization of DNA in prefixed paramecium slides by Feulgen staining
5. Localization of nucleic acids in prefixed paramecium slides by Toluidine blue staining
6. Estimation of RNA concentration by Orcinol method
7. PCR amplification of DNA and gel electrophoresis.
8. Restriction digestion and gel electrophoresis.
9. Isolation of plasmid DNA from bacteria.
10. Molecular biology problems

REFERENCES

1. Griffiths A J F, H. J. Muller, D. T. Suzuki, R. C. Lewontin and W. M. Gelbart 2000. An introduction to genetic analysis. W. H. Greeman. New York.
2. Lewin, B 2003 Genes VIII. Oxford University Press. Oxford
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4. Das, H.K. 2007. Text book of Biotechnology.Wiley India Pvt. Ltd. New Delhi
5. Freshney, Ian, R. 2006. Culture of Animal Cell (5th edn).Wiley- Liss publications
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7. Primrose, S.B., Twyman, R.M., and Old, R.W. 2001. Principle of Gene Manipulation (6th edn). Blackwell Science Ltd, London
8. Singh .B.D. 2006. Biotechnology. Kalyani Publishers, New Delhi
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M.Sc., III SEMESTER
HC – 3.2 REPRODUCTIVE BIOLOGY

32 hrs

Course Outcome:
After completing the course student will be able to

1. Understand structure and function of reproductive organs
2. Explain the structure of reproductive cells
3. Describe the role of internal cues in reproduction
4. Describe the role of external factors in reproduction
5. Analyse the role of endocrine glands and their secretions in reproduction
6. Identify the factors affecting fertility
7. Know different types of assisted reproductive technologies.

UNIT I: Male reproduction: **8 hrs**

A. Functional morphology of male reproductive system
B. Kinetics of spermatogenesis – wave and cycle
C. Hormonal control of mammalian testis and spermatogenesis
D. Ultrastructure of spermatozoa
E. Abnormalities of sperm
F. Brief description of histomorphology and hormonal control of male accessory organs viz., epididymis, vas deferens, seminal vesicles, ventral prostate, bulbourethral gland and preputial gland
G. Sperm maturation – morphological and biochemical events, influence of accessory organ secretions
H. Biochemistry of semen and capacitation

UNIT – II Female reproduction : **8 hrs**

A. Origin and migration of primordial germ cells; genetic and hormonal control of differentiation of gonads and gonadal ducts in mammals.
B. Female Reproductive System-Functional morphology of mammalian ovary, Fallopian tube and uterus.
C. Ovarian steroid hormones and their actions

UNIT III: Reproductive cycles in Mammals: **8 hrs**

A. Comparison of estrous and menstrual cycles
B. Menstrual cycle : Different phases, changes in the ovary and uterus and hormonal control
C. Implantation – Process, Types and hormonal control
D. Pregnancy – length of gestation, hormonal control
E. Parturition – Process of birth and influence of hormones
F. Lactation – Hormonal control of mammary gland, development and lactogenesis

UNIT – IV: Fertility and reproductive management **8 hrs**

A. Fertility control – Need, principles of different male and female temporary and permanent contraceptive methods.
B. Assisted Reproduction: Causes of infertility, Artificial insemination, different methods of assisted reproduction (*In-vitro* Fertilization, Gamete Intra Fallopian tube Transfer, Zygote Intra Fallopian tube Transfer).

PRACTICALS **16X4=64 hrs**

1. Demonstration of surgical technique by video clipping
2. Counting of spermatozoa in semen sample collected from volunteers
3. Staining of spermatozoa for abnormalities in semen samples collected from volunteers /clinical samples
4. Study of different contraceptive devices
5. Observation of permanent Histology slides
   a. Comparative morphology of ovary
   b. Comparative morphology of testis
   c. Comparative study of male accessory organs
   d. Comparative study of female accessory organs
6. Observation of permanent slides of T.S of endocrine glands
   a. Pituitary gland b. Thyroid gland c. Adrenal gland d. Pancreas

REFERENCES

1. Adler N. T (1981) Neurcendocrinology of Reproduction, Physiology and Behaviour.
2. Austin, C. R and R. V. Short (eds) (1972) Reproduction in mammals. (1) Germ cells andFertilization (2) Embryonic and Foetal development (3) Hormones in Reproduction (4) Reproduction pattern (5) Artificial control of reproduction, Cambridge University press,London.
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9. Knobil, E and Neil J. D (1994) The physiology of reproduction, Vol. I & II. Raven press, New York.

M.Sc., III SEMESTER
HC – 3.3 ECOLOGY AND WILDLIFE

32 hrs

Course Outcome:

After completing the course student will be able to

1. Demonstrate and Understand ecological relationships between organisms and their environment.
2. Present an overview of diversity of life forms in an ecosystem.
3. Explain and identify the role of the organism in energy transfers
4. Describe the Habitat ecology and Resource ecology
5. Understand the types of environmental Pollution and their management
6. Scope, Values and Conservation strategies of wildlife.

Part-A Ecology

UNIT - I **8 hrs**

A. Ecosystem: Historical account, Scope, Basic concepts and Approaches to the study of Environmental Biology. Components of Environment - An overview of abiotic factors and Biotic factors. Concepts of habitat and Ecological niche. Ecotone and Edge effect. Food chains, Food-webs and their structure in Ecological Pyramids in aquatic, terrestrial and parasitic Environments.

B. Population Ecology: Introduction. An overview of important population attributes – Density, Natality, Growth rates, Growth forms and concept of carrying capacity, Patterns in human population growth and its explosion -Remedial measures. Mortality - life tables and survivorship curve, sex ratio, age distribution, dispersal and dispersion, aggregation and Allee's principle, population fluctuation and cyclic oscillations and Population interactions.

UNIT - II **8 hrs**

A. Community Ecology Concept of community - community structure and attributes, concept of climax Species diversity in community and it's measurement- Alpha diversity- Simpson's diversity index, Shannon index, Fisher's alpha, rarefaction. Beta diversity- Sorensen's similarity index, Whittaker's index, Evenness, Gamma diversity. Drivers of species diversity loss and conservation.

B. Bioecology of Freshwater Zooplankton: Definition, Types and adaptations of Zooplankton. Brief study of organizations, life cycles and Ecological importance of Rotifers, Cladocerans, Copepods-Calanoids, Harpacticoids and Cyclopoids, and Ostracods. Mass culturing of Zooplankton.

C. Microbial Ecology: Ecological role, beneficial and pathogenic Microorganisms. Indicator Microorganisms. Role of microorganisms in biodegrading and bioremediation of organic and metal pollution.

Part B Wildlife Biology

UNIT – III **8hrs**

A. Scope and values of wildlife (Ecological, Aesthetic, Scientific, Recreational, Medicinal)

B. Causes of wildlife depletion: Degradation and destruction of natural habitats, Exploitation for commercial purposes, Deforestation, Agricultural expansion, Urbanization and Industrialization, forest fires and hunting.

C. Wildlife corridors, Human-wildlife conflicts

D. Wildlife awareness and education, Wildlife and tribal welfare

UNIT – IV

A. Conservation strategies: Red data book, protected area network, Role of NGOs in conservation.

B. Wildlife act and legislation: Wildlife Protection Act 1972; Biological Diversity Act 2002.

C. Wildlife conservation projects in India (with special reference to Project Tiger, Project Hungul and Gir Project)

D. In-situ conservation: Bioreserves, National parks, Wildlife sanctuaries and Safari's in India

E. Management of Bioreserves, National parks, Wildlife sanctuaries and Safari.

F. Ex-situ conservation: Zoo garden, Management of Zoos, Captive breeding, Artificial insemination, Cryopreservation (techniques and applications) Germplasm banks,

PRACTICALS: **4X16=64 Hrs**

1. Qualitative and Quantitative study of freshwater planktons.
2. Determination of species diversity by Shannon-Weiner Index
3. Determination of species diversity by Simpson's index
4. Field visit to Sewage pond, Natural lake (and if possible river): Collection of water samples and study of physico-chemical parameters such as colour, pH, temperature, conductivity, total solids and turbidity
5. Estimation of Dissolved Oxygen in three natural (sewage, pond and Tap) water samples.
6. Estimation of free Carbon di-Oxide in three natural (sewage, pond and Tap) water samples.
7. To study the relationship between Dissolved Oxygen and free Carbon di-Oxide, if any, in three natural (sewage, pond and Tap) water samples.
8. Determination of BOD in three natural (sewage, pond and Tap) water samples
9. Determination of COD in three natural (sewage, pond and Tap) water samples
10. To study the relationship between BOD and COD, if any, in three natural (sewage, pond and Tap) water samples
11. Collection, observation of planktons (Phytoplankton and Zooplankton) from polluted and non-polluted water bodies.
12. Estimations of bacterial abundance in different water samples – using DEMT.
13. Visit to RMNH, Mysore, to study models of freshwater, marine, estuarine and terrestrial habitats.
14. Survey of Animal Population - to visit different habitats/areas in and around Mysore and collect data on some population attributes, application of Bio-statistical tests to the collected data and its interpretation.
15. Visit to nearby Zoological garden, wildlife sanctuaries, Animal rehabilitation centres.

REFERENCES

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4. Emmel, T.C. 1976. Population Biology, Harper and Row publishers, N.Y.
5. Kormondy, E.J. 1978. Concepts of Ecology, Prentice Hall of India Pvt. Ltd., New Delhi.
6. Odum E.P. 1971. Fundamentals of Ecology. III Edition. W.B.Saunder's Co., Philadelphia.
7. Odum, E.P. 1983. Basic Ecology, Holt Saunders, Japan.
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12. Saharia, V.B. 1982. Wildlife in India. Natraj Publishers. Dehara Dun.

M.Sc., III SEMESTER
SC 3.4 ETHOLOGY

48 Hrs

Course Outcome:
After completing the course student will be able to

1. Evaluate the learning and instinct behavior.
2. Explain the mechanisms in instinct and behaviour
3. Explain how animals learn
4. Compare learning and instinct behaviour.
5. Analyse any problem about animal behaviour
6. Explain the importance of evolution for animal behaviour.
7. Explain evolution and behaviour.
8. Explain natural selection and behaviour.
9. Explain the relationship between predators and prey
10. Explain social behaviour.

UNIT - I **8 Hrs**

A. Descriptive versus experimental approaches

B. Reflexes and complex behaviour- Latency, after discharge, summation, warm up, fatigue inhibition and feedback control

C. Instinctive Behaviour - Fixed action pattern, Types of sign stimuli and releasers as triggers, Genetic basis of instinctive behaviour.

UNIT- II **8 Hrs**

A. Development and behaviour- Causes of behavioral changes during development, development of bird song.

B. Learning- Classical conditioning experiment, latent and insight learning. Social learning, learning sets and play.

C. Importance of early experience – Critical period- Filial imprinting, Sexual imprinting in birds, Imprinting like process in mammals.

UNIT- III Foraging and anti-predator behaviour **8 Hrs**

i. Anti predator behaviour – avoiding detection through colour and Markings (Mullarian mimicry)

ii. Warning coloration
iii. Batesian mimicry

UNIT-IV Biological communication **8 Hrs**

i. Forms of signals,
ii. Visual communication with suitable examples,
iii. Auditory Communication
iv. Tactile and Chemical communication

UNIT -V Sexual Behaviour **8 Hrs**

i. Hormones and sexual behaviour – Selected examples of courtship and mating behaviour.
ii. Pheromones in Insects and Mammals
iii. Lee Boot, Whitten, Bruce, Collidge and Castro-Vandenberg effect/s
iv. Selected examples of courtship and mating behaviour

UNIT-VI Social Behaviour **8 Hrs**

i. Introduction
ii. Advantages of grouping
iii. Social organization in insects with special reference to ants and honeybees
iv. Social organization in sub human primates
v. Altruism, Kin selection and Genetic control of behaviour

TUTORIALS – On the basis of the proposed chapters. **2x16 = 32 Hrs.**

REFERENCES

1) Goodenough J.E., Mc Guire B. and Wallace R. A. (1993) Perspectives on Animal Behaviour. John Wiley and sons, New York.
2) Tinbergen (2006) Social ehaviour in Animals. J.V. Publishing House Jodhpur India.
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4) Agrawal, K.C. 2000. Biodiversity. Agrobios. India.

M.Sc., III SEMESTER
SC – 3.5 POLLUTION AND TOXICOLOGY

48hrs

Course Outcome:

After completing the course student will be able to

1. broader understanding of how science and the scientific method work to address environmental problems.
2. Earth's major systems (ecosystems and biogeochemical cycles), how they function and how they are affected by human activity (population growth, air, water and soil pollution, ozone depletion, global warming, and solid waste disposal).
3. the interaction of human society (urban sprawl, energy use/generation, resource consumption and economics) with the Earth's systems.

Part A - Pollution **24 hrs**

Unit I: **8 hrs**

A. Concept of Biosphere: Its components, hydrosphere, atmosphere, and lithosphere, Origin of life in the biosphere.

B. Water pollution: Definition, sources Types and classification of pollutants. Effects of Water Pollution, River Pollution, Oxygen sag curves and Eutrophication Drinking water: Collection, purification and distribution. Wastewater treatment: Primary, secondary and tertiary treatment.

Unit II: **8 hrs**

A. Atmospheric pollution: Primary and secondary air pollutants. Biological effects of Nox, SOx, SPM, Hydrocarbons, Acid rain, Global warming, Photochemical smog and Ozone hole.
B. Solid waste and Biomedical waste: Sources, collection, transport, treatment and Disposal methods.. Noise Pollution: Sources, Biological effects, Control measures and OSHA standards.

UnitIII: **8hrs**

A. Radiation & Thermal pollution: Sources, types, effects, Atmospheric fallout and abatement.
B. Environmental Impact Assessment: Basic elements, Methods Guideline for industrial EIA, Aquaculture related EIA, Transport related EIA and Water related EIA. Case studies: Konkan Railway, Silent valley, Bhopal Tragedy and Love canal tragedy, Mangalore Bojpe tragedy

Part B – Toxicology **24 hrs**

Unit IV: **8hrs**

A. General Principles of Toxicology: Introduction, Definition of toxicology Importance of Dose and Dose-response, factors influencing toxicity, Bioassay-toxicity evaluation studies using fish as model.
B. Toxic compounds: Heavy metals-Lead and mercury, Hydrocarbons- Aromatic and Aliphatic, and cyanides, and toxic gases - Bhopal tragedy.

Unit V: **8hrs**

A. Biotransformation: Bioactivation, Biodetoxification of organo phosphates and organo chorines in the bodies of animals.
B. Natural toxins, Venoms and poisons: Properties and their effects, Major Sites and mechanism of action, Toxins in lower and higher organisms, Toxin and Venom therapy.

Unit VI: **8hrs**

A. Smoking aids: Active and Passive smoking, Consumption of tobacco, Mariguana(Ganja), their effects and Prevention measures.
B. Cosmetics: Types of cosmetics, Chemical Characteristics, Applications, Exposure and risk assessment, Cosmetic safety regulations.
C. Risk assessment: Exposure assessment, Dose-Dosage, Risk characterization, Risk analysis and communications, Occupational health and illness.

TUTORIALS – On the basis of the proposed chapters **2x16 = 32 Hrs**

REFERENCES:

1. Nandini, .N. Sunitha N. and T. Sucharita 2010. Environmental Studies, Sapna Book House Bangalore
2. Frant C.L.V. 1991, Basic Toxicology II (Eds.), Hemisphere publishing corporation, Washington, London
3. Sambasiva Rao K.R.S. 1999. Pesticide impact on fish metabolism. (Eds.) Discovery Publishing House, New Delhi.
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5. APHA, AWWA and WEF. 1992: Standard Methods for Examination of Water and Wastewater, XVIII Ed, American Public Health Association. NY, USA
6. Nebel, B.T. and Wrigly R.T. 1998. Environmental Science, VI Ed. Prentice Hall New Jersey, USA

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M.Sc., III Semester:
OPEN ELECTIVE-(For Science discipline students).
CONCEPTS OF ZOOLOGY.

48 Hrs

Course Outcome:
After completing the course student will be able to

1. Broader understanding of Zoology and its concepts
2. Understand the concepts and basics of animals taxonomy
3. Understand the basics of histology
4. Describe the structure and basic functions of organ systems
5. Explain ecological concepts and effects of environmental pollution
6. Explain the mechanism of inheritance.

1. Introduction: **8 Hrs**

a) Branches of animal science: Taxonomy, Animal Physiology, Genetics, Developmental Biology, Evolution, Ethology, Ecology, Applied Zoology, Entomology, Histology, c) Indian Wildlife- Status, Causes of wildlife depletion, Wildlife corridors, Conservation strategies- *In situ* and *Ex situ* d) e) Animals and human welfare.

2. Animal Taxonomy: **4 Hrs**

a) Carl Linnaeus – Taxonomic hierarchy: Kingdom, Division, Phylum, Class, Order, Family and Binomial nomenclature

3. Animal cells and Tissues : **8 Hrs**

a) Brief description of animal cell (light and ultra structure) b) Functions of cell organelles c) Structure and functional diversity in animal cell d) Cell division: Types and significance e) Structure and functions of basic tissues.

5. Structure and functions of organ systems: **16 Hrs**

a) Human alimentary canal and outlines of digestion and absorption
b) Respiration: Human respiration – exchange of gases.
c) Circulation : Structure of human heart, Blood vessels and capillaries, composition of blood, blood coagulation.
d) Excretion : Mammalian kidney and urine formation.
e) Locomotion in vertebrates – Swimming, walking running, flying
f) Nervous system and their functions, A brief account of human endocrine system
g) Reproduction : Asexual and sexual reproduction, significance of sexual reproduction, outlines of human reproduction and fertility control

6. Ecology and Environmental Biology: **8 Hrs**

a) Abiotic and Biotic factors b) Environmental Pollution – brief account of Air, Water and Noise pollution.

7. Heredity: **4 Hrs**

a) Continuity of life – Mendel's laws b) Structure of chromosomes c) DNA and RNA

TUTORIALS **2x16=32 Hrs**

REFERENCES :

1. Barnes, R. D. 1974. Invertebrate Zoology, III edition, W. B. Saunders Co., Philadelphia.
2. Barrington, E. J. W. 1976. Invertebrate structure and function. Thomas Nelson and Sons
3. Ltd., London

4. Hyman L. H. 1940. The invertebrates Vol.1 Protozoa through Ctenophora, McGraw hill
5. co., N. Y.
6. Hyman. L. H. 1968. The Invertebrates Vol.8 McGraw Hill Co., N. Y and London.
7. Parker, T. J. Haswell, W. A. 1961. Text book of Zoology, Vol.I, Macmillon Co., London.
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9. London.
10. Barrington, E. J. W. 1965. The Biology of Hemichordata and Protochordata – Oliver and Boyd, Edinbourgh.
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M.Sc., IV SEMESTER
HC – 4.1 ADVANCED GENETICS AND COMPUTATIONAL BIOLOGY

32 hrs

Course Outcome:
After completing the course student will be able to

1. Understand the genomic organization of prokaryotes and eukaryotes.
2. Know the applications of various model organisms in genomic research.
3. Able to analyse the pedigree, psychosomatic disorders, prenatal diagnosis and genetic counselling.
4. Recognise few heritable diseases in man.
5. Understand the basic concepts of genomics
6. Understand the basic concepts of proteomics
7. Understand the nucleic acid and proteinr databases and tools**.**

Part A-Advanced Genetics

Unit I: Genome organization: 3 hrs

Prokaryotes, Eukaryotic nuclear genomes - C-value paradox, Eukaryotic organelle genomes Split Genes Mobile genetic elements in Prokaryotes (bacteria) and Eukaryotes (Drosophila, maize and humans), Genome Projects of model organisms (*C. elegans*, *Drosophila* and Mouse).

Unit II: Cancer Genetics: 5 hrs

Cancer incidence and mortality, types of cancer, causes of cancer, properties of cancer cells, Genetic basis of Carcinogenesis- Oncogenes: proto-oncogenes, oncogenes, retroviral oncogenes in human cancer. Tumor suppressor genes: Functions of tumor suppressor gene products. Cancer as a multistep process. Animal models of cancer research: Transgenic mouse and Drosophila models.

Unit III: Human genetics: 5 hrs

History of human genetics, pattern of inheritance, pedigree analysis. Human genome: Organization, distribution of genes, gene families. Genetic basis of syndromes and disorders: Cystic fibrosis, Neurofibromatosis, Schizophrenia, Anxiety disorder, Congenital heart diseases, Dyslexia.

Unit IV: Quantitative genetics: 3hrs

Introduction, types of quantitative trait, Nature of quantitative traits and their inheritance-Polygenic inheritance (Multifactorial hypothesis) – analysis of continuous variation; Variations associated with polygenic traits.

Part B-Computational Biology

Unit VII: Introduction and Scope of the Computational Biology 4 hrs

Genomics: Definition and types of genomics Structural genomics: whole genome shotgun sequencing, gene annotation, gene families and clusters. Orthologs and paralogs. Functional genomics: Transcriptome, Microarray technology.

Unit VIII: Proteomics: 4 hrs

Definition, Protein structure determination, protein domains, protein folding, Computer aided protein structure analysis, Protein-protein interactions, Protein microarrays.

Unit IX: Nucleic acid sequence and Protein analysis: 4 hrs

Alignment, similarity searches including remote similarity searches, secondary structure element, motifs, Single nucleotide polymorphism (SNP), Two dimensional polyacrylamide gel electrophoresis, Mass Spectrometry.

Unit X: Genomics and proteomics databases and tools: 4 hrs

Nucleic acid sequence databases and tools: Genbank, UCSC, ENSEMBL, EMBL, DDBJ, BLAST vs FASTA, file formats-FASTA, GCG, Genscan and ClustalW. Protein sequence databases and tools: Uni- prot, PDB, PIR, BLAST, PSI- BLAST (steps involved in use and interpretation of results).

PRACTICALS:

1. Study of mitotic chromosomes of *Drosophila* species- *Drosophila melanogaster*, *Drosophila nasuta*.
2. Preparation of metaphase chromosomes from bone marrow cells of mouse.
3. Karyotypic studies of normal human chromosomes and syndromes.
4. Creation of pedigrees and study of patterns of inheritance.
5. Studies on phenotypes of different diseases and syndromes.
6. Study of Quantitative characters: Sternopleurals, Acrosticals – mean, standard deviation.
7. Data mining for sequence analysis.
8. Web– based tools for sequence searches and homology screening-BLAST, FASTA
9. Nucleic acid sequence databases: GenBank retrieval, GeneScan.
10. Proteomics data bases: Uni-Prot, PROSITE, PDB, PIR, ProtParam.
11. Annotations: ORF finder, Use of ARTEMIS or any other suitable software

REFERENCES:

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3. The Caenorhabditis elegans genome 1998. Science Vol. 282.
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6. Principles of Neural Science. Eric R. Kandel, James H. Schwartz, and Thomas M. Jessell. McGraw-Hill Medical; 4 edition(2000)
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8. The Molecular and Genetic Basis of Neurologic and Psychiatric Disease. Roger N Rosenberg, Salvatore DiMauro, Henry L Paulson, and Louis Pt (2007) Lippincott Williams & Wilkins; Fourth edition

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10. Brown T. A. 2007, Genomes 3. Garland Science Publishing, New York.
11. A.Malcolm Campbell and Laurie J.Heyer. Discovering Genomimcs, Proteomics and Bioinformatics. 2004. Low Price edition. Pearson Education, Inc.

M.Sc., IV SEMESTER
HC – 4.2 APPLIED ZOOLOGY

32 hrs

Course Outcome:

After completing the course student will be able to

1. Explain plant insect interaction, origin of pest and its control.
2. Understand vectors and its communicable diseases.
3. Explain races of silkworm their disease and its control.
4. Know about the importance of insects in forensic science and medicine.
5. Know about aquaculture and its practices in India.

UNIT I: Aquaculture **8hrs**

Aquaculture in India: an overview – nutritional value and food security - Site selection and preparation of culture ponds - Fish culture: carps, marine fishes and ornamental fishes. Prawn culture: Freshwater prawns and marine shrimps. Fattening of crabs. Crayfish and Lobster - Molluscs: mussels, clams, chanks and oysters including pearl oyster. Live feeds: micro algae, micro-invertebrates (*Artemia* nauplii, Rotifers, Cladocerans, Copepods, Ostracodes) and worms as live baits – Water quality management and maintenance of sanitation - Plant and animal nutrients - Balanced diet (iso-nitrous and iso-caloric) - Artificial feed formulation – Low cost feed formulation - Aquatic weeds.

UNIT II: Sericulture **8hrs**

Salient features of Saturnidae and Bombycidae. Mulberry and non mulberry silkworms, classification based on voltinism, moulting and geographic origin.

Morphology and life cycle of *Bombyx mori*. Structure and functions of Silk glands.

Silkworm rearing technology: Building, equipments, disinfection, environmental factors, Seed cocoons, preservation, grainage activity, LSPs, egg production, incubation, artificial hatching.

Pests and diseases: Protozoan, Fungal, Viral and Bacterial diseases and their control measures. Silkworm pests and Predators

UNIT III: Apiculture **8hrs**

Scope and its importance, Classification and morphology of honey bees, species and races of honey bees, tribal life and bee hunting. sex seperation, comb building, orientation of comb, communication, collection of propolis and water.

Honey and its chemical composition, medicinal importance.

Eonomic importance of honey, wax, bee pollination, pollen and Venom.

UNIT IV: Vermiculture **8hrs**

A. Introduction to vermiculture. Definition, meaning, history, economic importance, their value in maintenance of soil structure. Useful species : Local species and Exotic species of earthworms. Role of four R's.

B. Taxonomy Anatomy, Physiology and Reproduction of Lumbricidae and Eudrilidae.

C. Earthworm Farming (Vermiculture) for home gardens, larger scale, Extraction (harvest), vermicomposting harvest and processing.

D. Nutritional Composition of Vermicompost for plants, comparison with other fertilizers

E. Enemies of Earthworms, Sickness

PRACTICALS: **16X4=64 hrs**

1. Study of morphometric characters of Indian major carps.
2. Diversity of fishes.
3. Collection of phytoplankton and zooplankton from natural resources and their identification.
4. Study of morphology of honey bee and cast system.
5. Mounting of mouth parts, stinging apparatus of honey bee.
6. Study of digestive system of honeybee.
7. Study of structure and types of honey comb.
8. Study of bee plants.
9. Study of morphology of lifecycle of *Bombyx mori*
10. Study of digestive and silk gland of *Bombyx mori*
11. Study of Non mulberry silkworms and their food plants.
12. Field trip- Collection of native earthworms & their identification
13. Study of systematic position& External characters of locally available earthworm species.
14. Mounting of setae and identification of earthworm species.
15. Study of equipments used in Vermiculture.

REFERENCES

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2. Edwards, C.A. and J.R. Lofty (1977) "Biology of Earthworms" Chapman and Hall Ltd., London.
3. G.S. Shukla, V.B. Upadhyay (2006) Economic Zoology.
4. Kevin, A and K.E.Lee (1989) " Earthworm for Gardeners and Fisherman" (CSIRO, Australia, Division of Soils)
5. Lee, K.E. (1985) "Earthworms: Their ecology and Relationship with Soils and Land Use" Academic Press, Sydney.
6. Pradip. V Jabde, (2005) Text Book of Applied Zoology.
7. R. L. Kotpal (2000) Modern Textbook of Zoology. Rastogi Publications
8. Satchel, J.E. (1983) "Earthworm Ecology" Chapman Hall, London.
9. Wallwork, J.A. (1983) "Earthworm Biology" Edward Arnold (Publishers) Ltd. London.

M.Sc., IV SEMESTER
HC – 4.3 Project

Course Outcome:

After completing the course student will be able to

1. understand the concepts of Project Management for planning to execution of projects
2. find importance of reference work Using tools of information such as periodical , journals, online resources
3. break work down the tasks of project and determine handover procedures
4. Interpret, analyse and presentation of the results obtained and compare with similar works and draw conclusion.

M.Sc., Examination
(Scheme CBCS)
M.Sc., ZOOLOGY
HARD CORE- Model question paper

Time: 3 hrs **Max Marks: 70**

Instructions: ***1. Answer all questions***
2. Illustrate your answer wherever necessary

I. Write short notes on the following: **[8×2=16]**

1.
2.
3.
4.
5.
6.
7.
8.

II. Write elaborate notes on any FIVE of the following: **[5×6=30]**

9.
10.
11.
12.
13.
14.
15.
16.

Q3. Answer the following: **[2×12=24]**

17. (i)
Or
(ii)

18. (i)
Or
(ii)

M.Sc Examination
(Scheme CBCS)
M.Sc., ZOOLOGY
Softcore - Model question paper

Time: 3 hrs **Max Marks: 70**

Instructions: ***1. Answer all questions***
2. Illustrate your answer wherever necessary

I. Write short notes on the following: **[8×2=16]**

1.
2.
3.
4.
5.
6.
7.
8.

II. Write elaborate notes on any FIVE of the following: **[5×6=30]**

9.
10.
11.
12.
13.
14.
15.
16.

Q3. Answer the following: **[2×12=24]**

17. (i)
Or
(ii)

18. (i)
Or
(ii)

M.Sc Examination
(Scheme CBCS)
M.Sc., ZOOLOGY
Open Elective-Model question paper

Time: 3 hrs **Max Marks: 70**

Instructions: ***1. Answer all questions***
2. Illustrate your answer wherever necessary

I. Write short notes on the following: **[8×2=16]**

1.
2.
3.
4.
5.
6.
7.
8.

II. Write elaborate notes on any FIVE of the following: **[5×6=30]**

9.
10.
11.
12.
13.
14.
15.
16.

Q3. Answer the following: **[2×12=24]**

17. (i)
Or
(ii)

18. (i)
Or
(ii)

Credit Matrix, Course of Study and Scheme of Examination for M.Sc. Degree Programme in Biochemistry

(With effect from 2021-22)

Programme Code: BIC

Course Type	Credits to be earned				Total Credits
	I Semester	II Semester	III Semester	IV Semester	
Hard Core Course	12	12	12	16	**52**
Soft Core Course	08	08	04	–	**20**
Open Elective Course*	–	–	04	–	**04**
Semester Total	**20**	**20**	**20**	**16**	**76**

*An Open Elective course offered by PG Dept. of Biochemistry to the students of other Depts.

Course Code	Course Type	Course Title	Credit Pattern (L:T:P)	Credits
Semester – I				
BCA040	HC	Analytical Biochemistry–I	3:1:0	4
BCA050	HC	Chemistry and Metabolism of Proteins and Nucleic Acids	3:1:0	4
BCA060	HC	Experiments in Biochemical Techniques and Enzymology** and Seminar	0:0:4	4
BCA230	SC	Enzymology	3:1:0	4
BCA250	**Choose any ONE from the following**		3:1:0	4
	SC	(i) Chemical Principles and Biochemical Reactions (ii) Plant Biochemistry (iii) Microbial Biochemistry		
Semester Total Credits				**20**

Course Code	Course Type	Course Title	Credit Pattern (L:T:P)	Credits
Semester – II				
BCB040	HC	Analytical Biochemistry–II	3:1:0	4
BCB050	HC	Chemistry and Metabolism of Carbohydrates and Lipids	3:1:0	4
BCB060	HC	Experiments in Immunology and Biochemical Estimations** and Seminar	0:0:4	4
BCB250	SC	Immunology and Microbiology	3:1:0	4
BCB260	**Choose any ONE from the following**		3:1:0	4
	SC	(i) Human Physiology and Nutrition (ii) Research Methodology and Biostatistics (iii) Clinical Research Methods and Industrial Biochemistry		
Semester Total Credits				**20**

Course Code	Course Type	Course Title	Credit Pattern (L:T:P)	Credits
Semester – III				
BCC070	HC	Cell Biology, Endocrinology and Cell Signaling	3:1:0	4
BCC050	HC	Clinical Biochemistry	3:1:0	4
BCC060	HC	Experiments in Clinical Biochemistry and Molecular Biology** and Research Paper Presentation	0:0:4	4
BCC220	**Choose any ONE from the following**		4:0:0	4
	SC	(i) Genomics, Proteomics and Bioinformatics (ii) Biotechnology and Research Methodology (iii) Pharmaceutical Biochemistry		
BCC630	OE	Nutrition and Health	4:0:0	4
		Semester Total Credits		**20**

Course Code	Course Type	Course Title	Credit Pattern (L:T:P)	Credits
Semester – IV				
BCD010	HC	Molecular Biology and Gene Regulation	3:1:0	4
BCD070	HC	Genetics and Genetic Engineering	3:1:0	4
BCD060	HC	Project Work OR Dissertation***	0:4:4	8*
		Semester Total Credits		**16**
		Total CREDITS to be earned for M.Sc. BIOCHEMISTRY		**76**

* Grade Point will be calculated with respect to the allotted credits

HC	Hard Core Course
SC	Soft Core Course
OE	Open Elective Course
C1	Component 1 of Internal Assessment (IA)
C2	Component 2 of Internal Assessment (IA)
C3	Component 3 (Semester-end Exam)
L	Lecture (1 Credit=1 hr)
T	Tutorial (1 Credit=2 hrs)
P	Practical (1 Credit=2 hrs)

** Weekly Four hrs of practical for Two days

*** Project work OR Dissertation should be in-house only and may be allotted to the students in the 2nd/3rd semester

Note: Two Practical examinations of four hrs duration each for C3 (component 3) of Hardcore Course with Practical Component Only.

SCHEME OF ASSESSMENT

Course Code	Course Type	Course Title	Exam Hrs	Max. Marks			
				IA		Exam C3	Total
				C1*	C2*		
Semester - I							
BCA040	HC	Analytical Biochemistry–I	3	15	15	70	100
BCA050	HC	Chemistry and Metabolism of Proteins and Nucleic Acids	3	15	15	70	100
BCA060	HC	Experiments in Biochemical Techniques and Enzymology ** and Seminar	4	15	15	70	100
BCA230	SC	Enzymology	3	15	15	70	100
BCA250	**Choose any ONE from the following**		3	15	15	70	100
	SC	(i) Chemical Principles and Biochemical Reactions (ii) Plant Biochemistry (iii) Microbial Biochemistry					
Semester Total Marks							**500**

Course Code	Course Type	Course Title	Exam Hrs	Max. Marks			
				IA		Exam C3	Total
				C1*	C2*		
Semester - II							
BCB040	HC	Analytical Biochemistry–II	3	15	15	70	100
BCB050	HC	Chemistry and Metabolism of Carbohydrates and Lipids	3	15	15	70	100
BCB060	HC	Experiments in Immunology and Biochemical Estimations** and Seminar	4	15	15	70	100
BCB250	SC	Immunology and Microbiology	3	15	15	70	100
BCB260	**Choose any ONE from the following**		3	15	15	70	100
	SC	(i) Human Physiology and Nutrition (ii) Research Methodology and Biostatistics (iii) Clinical Research Methods and Industrial Biochemistry					
Semester Total Marks							**500**

Course Code	Course Type	Course Title	Exam Hrs	Max. Marks			
				IA		Exam C3	Total
				C1*	C2*		
Semester - III							
BCC070	HC	Cell Biology, Endocrinology and Cell Signaling	3	15	15	70	100
BCC050	HC	Clinical Biochemistry	3	15	15	70	100
BCC060	HC	Experiments in Clinical Biochemistry and Molecular Biology** and Research Paper Presentation	4	15	15	70	100
BCC220	**Choose any ONE from the following**		3	15	15	70	100
	SC	(i) Genomics, Proteomics and Bioinformatics (ii) Biotechnology and Research Methodology (iii) Pharmaceutical Biochemistry					
BCC630	OE	Nutrition and Health	3	15	15	70	100
Semester Total Marks							**500**

Course Code	Course Type	Course Title	Exam Hrs	Max. Marks			
				IA		Exam C3	Total
				C1*	C2*		
Semester - IV							
BCD010	HC	Molecular Biology and Gene Regulation	3	15	15	70	100
BCD070	HC	Genetics and Genetic Engineering	3	15	15	70	100
BCD060	HC	Project Work OR Dissertation***	–	15	15	70	100
Semester Total Marks							**300**

- C1* & C2* Internal test will be conducted for 20 marks (if MCQs are used as assessment pattern, then there will be 30 MCQs carrying one mark each conducted through LMS of one hour duration and in both the cases the scored marks is reduced to 10 marks and 5 marks for continuous assessment is added, making a total of 15 marks each for C1 and C2.
- Continuous assessment comprise of assignments, group discussions, seminars and tutorials
- ** The Project evaluation is as below

  Component 1 (C1): Periodic Progress Report (15%)
  Component 2 (C2): Periodic Progress Report (15%)
  Component 3 (C3): Final Viva-Voce and Evaluation (70%)
  (The report evaluation is for 40% and the Viva-Voce examination is for 30%)

Program Outcome(s):

PO1: Provides with the necessary knowledge and skills to undertake a career in research, either in industry or in an academic setting
PO2: Provides the breadth and depth of scientific knowledge in Biochemistry and allied areas
PO3: Equips to apply for a PhD or to gain employment in biochemistry and allied areas
PO4: Provides a substantial element of hands-on research experience, with enhanced experimental skills
PO5: Demonstrates detailed knowledge and understanding of the principles and theories of biochemistry
PO6: Helps to understand the principle techniques of biomolecular structural characterization, including spectroscopy

Program Specific Outcome(s): The Specific Outcome of this programme is to train and provide the candidate with knowledge related to

PSO1: Global level research opportunities to pursue PhD programme targeted approach of CSIR-NET examination
PSO2: Enormous job opportunities at all level of chemical, pharmaceutical, food products, life oriented material industries
PSO3: Specific placements in R&D and quality control or analysis division of nutraceutical, pharmaceutical industries and allied division

Course Code	Title of the Course	Credits
BCA040	ANALYTICAL BIOCHEMISTRY–I	4

COURSE OUTCOME(S):

CO1 Specify in depth cell fractionation techniques

CO2 Write down in details with application, if applicable, chromatography and spectroscopy

CO3 Write down in details with application, if applicable, principle and applications of electrophoresis

CO4 Understand the classification and characteristics of centrifugation and microscopy

		No. of Lectures
Unit I:		**08**
1.1	**Cell Fractionation**	
1.1.1	Cell fractionation techniques: Preparation of extracts for biochemical investigations. Physico-chemical properties of solvents, solubility and miscibility, salting–in and salting–out.	
1.1.2	Choice of solvent for solvent extraction, mixed solvents, solid phase extraction. Cell lysis, dialysis, precipitation and ultra filtration.	

Unit II:		**14**
2.1	**Chromatography and Spectroscopy**	
2.1.1	Adsorption *vs.* Partition chromatography. Paper, TLC, Ion exchange, Reverse phase, Gel filtration, Affinity, HPLC, and Gas chromatographic techniques.	
2.1.2	Beer-Lamberts Law, Its verifications and Deviations, Concept of Absorptions, Transmission, Scattering, Phosphorescence, Fluorescence, Luminescence, Diffraction Spectra.	
2.1.3	Principle, instrumentation, working and applications of– UV and Visible Spectroscopy,	
2.1.4	Turbidometry and Nephlometry.	

Unit III:		**12**
3.1	**Electrophoresis**	
3.1.1	Theory of electrophoresis, continuous and discontinuous PAGE, SDS-PAGE.	
3.1.2	Other electrophoretic methods–Isoelectric focusing, 2–dimensional gel electrophoresis, Capillary electrophoresis and PFGE.	
3.1.3	Agarose gel electrophoresis of nucleic acids. Isotachophoresis.	
3.1.4	Separation of proteins, lipoproteins, visualizing separated	

	components–staining, fluorescence, PAS staining, zymogram and reverse zymogram,	

Unit IV:		
4.1	**Centrifugation and Microscopy**	**14**
4.1.1	Analytical and Preparative Ultracentrifuge–Principle, instrumentation and applications.	
4.1.2	Analysis of subcellular fractions, marker enzymes and determination of relative molecular mass–Svedberg's constant, sedimentation velocity and sedimentation equilibrium.	
4.1.3	Theories of Tissue Fixation and Staining Techniques. Principles of Transmission and Scanning Electron Microscopy.	
4.1.4	Principles of Phase Contrast and Fluorescence Microscopy, Confocal Microscopy	

References

[1] Analytical techniques in Biochemistry and Molecular Biology; Katoch, Rajan. Springer (2011)

[2] Basic Methods for the Biochemical Lab; Martin Holtzhauer, Springer, (2007).

[3] Principles and Techniques of Biochemistry and Molecular Biology 7th Edn. Keith Wilson and John Walker, Cambridge University Press, (2010).

[4] Biochemistry LabFax, Ed. J.A.A. Chambers and D. Rickwood,, Blackwell Science, (1993),

[5] Protein Purification Applications, S.L.V. Harris and Angal IRL Press, (1990)

[6] Laboratory Techniques in Biochemistry and Molecular Biology, Work and Work Vol. I & II, North Holland, (1969).

[7] Basic Mathematics for Biochemists; Cornish Bowden, Oxford University Press (1998),.

[8] Biophysical Tools for Biologists *In Vivo* Techniques; John Correia H. Detrich, III Elsevier (2008).

[9] Practical Biochemistry by Keith Wilson and Walker 5th ed. Cambridge.

[10] Biophysical chemistry, Upadhyaya, A., Upadhyaya, K. and Nath, N. Himalayan Publishing House.

[11] Practical biochemistry- Principles and Techniques. Wilson and Walker. J.Cambridge Uni. Press.

[12] Physical Biochemistry-David Freifelder, 2nd Edition.

[13] Principles of Instrumental Analysis. 5th Ed. Douglas A Skoog, James Holler and Timothy A Nieman.

[14] Introduction to Electron Microscopy for Biologists; Terry Allen, Academic Press (2008).

Course Code	Title of the Course	Credits
BCA050	CHEMISTRY AND METABOLISM OF PROTEINS AND NUCLEIC ACIDS	4

COURSE OUTCOME(S):

CO1 Identify the details of amino acids and proteins

CO2 Understand in details with application, if applicable, nitrogen metabolism and degradation

CO3 Write down the classification and characteristics of synthesis of amino acids and proteins

CO4 Write down in details with application, if applicable, metabolism of nucleic acids

		No. of Lectures
Unit I:		10
1.1	**Chemistry of Amino acids and Proteins**	
1.1.1	Classification and structure of 20 amino acids, newly discovered amino acids, essential, non–essential, unusual and non-protein	
1.1.2	General properties of aa, acid–base titrations, pKa Peptide bond–stability and formation, chemical synthesis of peptide. Primary structure and determination, GN Ramachandran plots	
1.1.3	Secondary structure and motifs, α helix, β sheet, Leucine zipper, Zinc finger	
1.1.4	Tertiary & Quaternary structure (myoglobin, hemoglobin) Protein-protein interactions (actin, tubulin) Small peptides (glutathione, peptide hormones), Cyclic peptides (Gramicidin)	
1.1.5	Classification of proteins-globular, fibrous, membrane, metallo–proteins, Denaturation (pH, temperature, chaotropic agents), refolding, Role of chaperones in folding	
Unit II:		14
2.1	**Nitrogen Metabolism and Degradation of Amino Acids**	
2.1.1	Nitrogen cycle, Nitrogen fixation – symbiotic and non-symbiotic, Nitrogenase complex. Assimilation of ammonia	
2.1.2	Metabolic fate of dietary proteins and amino acids Degradations to glucose and ketone bodies	
2.1.3	Amino acids degraded to Pyruvate, Oxaloacetate	
2.1.4	Amino acids degraded to Acetyl-CoA, Succinyl-CoA Metabolism of branched chain amino acids, urea cycle, regulation of urea cycle	
2.1.5	Genetic defects in metabolism of amino acids (albinism, Phenylketonuria, maple syrup urine disease, homocystinuria alkaptonuria, methyl malonic Acidemia)	

Unit III:		
3.1	**Biosynthesis of Amino Acids and Protein Degradation**	
3.1.1	Biosynthesis of amino acids and regulation of amino acid metabolism	**08**
3.1.2	Biosynthesis and degradation of heme	
3.1.3	Biosynthesis of polyamines, creatine, gramicidine and glutathione	
3.1.4	Biosynthesis and degradation of glycoproteins and proteoglycans	
3.1.5	Protein degradation pathway–Ubiquitin–Proteosome pathway, lysosomal pathway	

Unit IV:		
4.1	**Chemistry and Metabolism of Nucleic Acids**	
4.1.1	Purines, pyrimidines, nucleosides, nucleotides, unusual bases. Structure of DNA – Watson Crick Model, A- and Z- forms.	**16**
4.1.2	Supercoiling of DNA – negative and positive, linking number	
4.1.3	Structure of RNA, tRNA, rRNA, siRNA / miRNA Denaturation and renaturation, Tm (factors affecting Tm) and Cot curves, Isolation and purification of nucleic acids from biological sources.	
4.1.4	Biosynthesis of purines and pyrimidines, Degradation of purines and pyrimidines, Regulation: de novo, salvation, nucleotide analogs, conversion of nucleotides to deoxynucleotides, mechanism of action of methotrexate, 5–flurouridine, azathymidine.	
4.1.5	Gout and Lesch–Nyhan syndrome	
4.1.6	Biosynthesis of NAD, FAD and Co–enzyme A	

References

[1] Lehninger Principles of Biochemistry 4th Ed By David L. Nelson and Michael M. Cox, WH Freeman and Company.

[2] Biochemistry by Lubert Stryer. WH Freeman and Co.

[3] Biochemistry: The Molecular Basis of Life by Trudy McKee and James R McKee. Publisher: McGraw-Hill Higher education.

[4] Biochemistry and Molecular biology By William H. Elliott and Daphne C. Elliott. Oxford University Press.

[5] Biochemistry 3rd Ed. By Donald J. Voet and Judith G. Voet. John Wiley and Sons.

[6] Biochemistry: Biomolecules, Mechanisms of Enzyme Action and Metabolism Vol 1 by D Voet. John Wiley and Sons.

Course Code	Title of the Course	Credits
BCA060	**EXPERIMENTS IN BIOCHEMICALTECHNIQUES AND ENZYMOLOGY AND SEMINAR**	**4**

COURSE OUTCOME(S):

CO1 Identify the details of spectrophotometer

CO2 Identify the details of specific activity of enzymes

CO3 Deliberate the characteristics of gel electrophoresis

CO4 Deliberate the characteristics of use of pipettes

Group I:	1. Determination of Normality, Molarity and Molality of solutions 2. Preparation of buffers: Acetate, Phosphate and Tris buffer 3. Colorimetry–Beer's law and its applications 4. Determination of Molar Extinction Coefficient 5. Chromatography–Separation of amino acids by ascending, descending, circular paper chromatography 6. TLC of amino acids 7. Gel filtration, Ion exchange chromatography	
Group II:	8. Estimation of protein by Lowry's method. 9. Estimation of protein by Biuret reagent method. 10. Estimation of amino acids by Ninhydrin method 11. Isolation of casein from milk and its quantification 12. Electrophoresis–Separation of proteins by Native and SDS-PAGE 13. Determination of *pKa* and *pI* of amino acid, formal titration. 14. Separation of nucleic acids by agarose gel electrophoresis	
Group III:	15. Isolation of microbes from air, soil and water 16. Gram's staining 17. Determination of growth curve of bacteria 18. Antibiotic sensitivity tests 19. Determination of specific activity of (i) Acid Phosphatase (ii) Alkaline Phosphatase (iii) Salivary Amylase (iv) Protease (v) Invertase (vi) Aminotransferase	

Group Study	Extraction, Isolation, Purification and enzyme characterization. Determination of specific activity, optimum pH, temperature, time and energy of activation. Determination of *Km* and *Vmax* Enzyme inhibition studies	

References

[1] Analytical techniques in Biochemistry and Molecular Biology; Katoch, Rajan. Springer (2011).

[2] Basic Methods for the Biochemical Lab; Martin Holtzhauer, Springer, (2007).

[3] Principles and Techniques of Biochemistry and Molecular Biology 7th Edn. Keith Wilson and John Walker, Cambridge University Press, (2010).

[4] Biochemistry LabFax, Ed. J.A.A. Chambers and D. Rickwood,, Blackwell Science, (1993),

[5] Protein Purification Applications, S.L.V. Harris and Angal IRL Press, (1990)

[6] Laboratory Techniques in Biochemistry and Molecular Biology, Work and Work Vol. I & II, North Holland, (1969).

[7] Physical Biochemistry, Kansal Edward Van Halde. Prentice Hall.

[8] Modern Experimental Biochemistry R.F.Boyer [Ed.] (1986) Addition Wesley.

[9] Analytical Biochemistry; D.J. Holme and H. Pick Longman (1983).

[10] Principles and techniques of Biochemistry and Molecular Biology; Keith Wilson and John Walker; 6th Edn. (2005) Cambridge University Press.

[11] Biochemical Calculations, Irwin H. Segel (1976) 2nd Ed. John Wiley and Sons.

Course Code	Title of the Course	Credits
BCA230	ENZYMOLOGY	4

COURSE OUTCOME(S):

CO1 Write down in details with examples enzyme kinetics

CO2 Identify in details with examples enzyme catalysed reactions

CO3 Identify the characteristics of cooperativity reactions

CO4 Learn the classification and characteristics of multienzyme complex reactions

		No. of Lectures
Unit I:		**16**
1.1	**Enzyme Kinetics and Inhibition**	
1.1.1	Nature of enzymes, Nomenclature and IUB classification of enzymes, Units of enzyme activity, IU and activity and specific activity. Localization, isolation, purification and characterization of enzymes. Criteria of purity of enzymes. Assay methods–coupled enzyme assays, continuous, end point and kinetic assay.	
1.1.2	Enzyme Kinetics: Rate of a reaction, order and molecularity. Michaelis Menten equation, initial velocity approach, steady state approach. Vmax, Km and their significance. Linear transformation of Michaelis Menten equation–Lineweaver Burk plot, Eadie Hofstee, Haynes–Wolf and Cornish–Bowden.	
1.1.3	Inhibition: Reversible inhibition–Competitive, Non competitive and Uncompetitive, product inhibition, irreversible inhibition–suicide inhibition. Determination of *Ki.* Fast reactions–Stopped flow, temperature jump method with examples of enzymes.	
Unit II:		**08**
2.1	**Enzyme Catalyzed Reactions**	
2.1.1	Bisubstrate enzyme catalysed reactions–Cleland's notation with examples for ordered, ping pong, and random.	
2.1.2	General rate equation. Primary and secondary plots. Mechanisms of enzyme catalysis–Active site structure and its investigation.	
2.1.3	Methods of determining active site structure–isolation of ES/EI complex, affinity labeling, chemical modification studies.	

Unit III:		
3.1	**Enzyme Catalysis and Cooperativity**	
3.1.1	Nature of enzyme catalysis: Transition state theory, proximity and orientation, orbital steering, acid base catalysis, covalent catalysis, metal ion catalysis, nucleophilic and electrophilic catalysis, intramolecular catalyses, entropy effects.	**12**
3.1.2	Effect of temperature and pH on enzyme catalyzed reactions.	
3.1.3	Oligomeric proteins and Cooperativity: Binding of ligands to macromolecules–Scatchard plot, Positive and Negative cooperativity. Oxygen binding to hemoglobin.	
3.1.4	Hill equation, homotropic and heterotropic effectors. Allosteric enzyme–Aspartyl transcarbamylase.	

Unit IV:		
4.1	**Multienzyme Complex and Coenzymes**	
4.1.1	Mechanisms of action of specific enzyme: Chymotrypsin zymogen activation, acid–base catalysis, charge relay net work. Lysozyme, alcohol dehydrogenase, ribonuclease, Carboxypeptidase–A, RNA as enzyme, coenzymic action of NAD+ FAD, TPP, PLP, biotin, CoA, folic acid and lipoic acid.	**12**
4.1.2	Multienzyme complexes: Isoenzymes, eg. LDH. Multifunctional enzyme (DNA polymerase) multi enzyme complex (PDC)	
4.1.3	Metabolic regulation of enzyme activity–Feedback regulation.	

References

[1] Fundamentals of Enzymology; 3rd Edn. Nicholas C. Price and Lewis Stevens, Oxford University Press (2012).
[2] Enzymes; Trevor Palmer, East − West Press Pvt. Ltd., Delhi (2004).
[3] Enzymes: A Practical Introduction to Structure, Mechanism, and Data Analysis; Robert A. Copeland, Wiley-VCH Publishers (2000).
[4] Enzyme Kinetics and Mechanism; Paul F. Cook, W. W. Cleland, Garland Science (2007).
[5] Enzyme Kinetics; Roberts, D.V. (1977), Cambridge University Press.
[6] The Enzymes; Boyer, Academic Press, (1982).
[7] Principles of Enzymology for Food Sciences; Whitaker, Marcel Dekker (1972) Academic Press.
[8] Introduction to Enzyme and Co-enzyme Chemistry. Ed. T. Bugg, (2000), Blackwell Science.

Course Code	Title of the Course	Credits
BCA250	CHEMICAL PRINCIPLES AND BIOCHEMICAL REACTIONS	4

COURSE OUTCOME(S):

CO1 Specify in details with examples chemical principles and bonding

CO2 Write down in depth thermodynamics

CO3 Learn in details with application, if applicable, stereochemistry

CO4 Deliberate in depth secondary metabolites

		No. of Lectures
Unit I:		**16**
1.1	**Chemical Principles and Bonding**	
1.1.1	Chemical principles: Acids and bases, Buffers. Buffering capacity. Ionic strength- Molarity, Normality, Mole concept, Avogadro number, structure and special properties of water.	
1.1.2	Bonding: Covalent bond, ionic bond, Coordinate bond. Coordinate bond formation by transition metals in biological complex structures.	
1.1.3	Crystal field theory, ligand field theory, valence bond theory.	
1.1.4	Bonding of iron in hemoglobin and cytochromes, cobalt in Vit B12, and Mg2+ in chlorophyll. Chelates and complexes.	

Unit II:		**08**
2.1	**Thermodynamics**	
2.1.1	Physiological importance of electrolytes: Osmotic pressure, vapour pressure, vapour pressure osmometer, Donnan membrane equilibrium.	
2.1.2	Introduction to thermodynamics: I, II and III law. Enthalpy, entropy and free energy. Free energy and chemical equilibrium	
2.1.3	Electrodes: Hydrogen electrode, oxygen electrode, oxidation and reduction reactions, redox potential.	

Unit III:		**12**
3.1	**Stereochemistry and Heterocyclic Compounds**	
3.1.1	Importance of Stereochemistry, position and order of groups around carbon. Geometric and optical isomerism, absolute and relative configuration. Symmetry view of	
3.1.2	chirality, relation between chirality and optical activity, representation of chiral structures by Fischer.	
3.1.3	Structure and stereochemistry of glucose–anomers, epimers and sterioisomers, D and L, + and – R and S notations.	
3.1.4	Heterocyclic Compounds: Chemistry, biological	

	occurrence of furan, indole, thiazole, pterine, pteridine, isoalloxazine, pyrrole.	

Unit IV:		
4.1	**Organic Reactions and Secondary Metabolites**	
4.1.1 4.1.2 4.1.3	Mechanism of Organic Reactions: Classification of organic reactions. Reaction intermediates, reaction energetics, rate, order and molecularity of reactions. Mechanisms and stereochemistry of substitution, addition, and elimination. Rearrangements reactions. Mechanisms of ester hydrolysis. Aromaticity and resonance structure. Hydrogenation- homogenous and heterogenous hydrogenation Secondary metabolites: Phytochemicals, terpenes, polyphenols, procyanidins, flavonoids, xanthones, alkaloids and pigments.	**12**

References

[1] Basic principles of organic chemistry- Robers and Caserio
[2] Organic chemistry, Hendrickson, Cram and Hammonal.
[3] Organic chemistry, I. L. Finar, Longman group Ltd.
[4] Organic chemistry, Morrison and Boyd, 4th edition Allyn and Bacon Inc.

Course Code	Title of the Course	Credits
BCA250	PLANT BIOCHEMISTRY	4

COURSE OUTCOME(S):

CO1 Specify in details with examples Photosynthetic pathways and its regulations

CO2 Write down in depth plant growth hormones in the agriculture

CO3 Learn in details with application, if applicable, Medicinal plants

CO4 Deliberate in depth secondary metabolites of plants and its significance

		No. of Lectures
Unit I:		**12**
1.1	**Plant Cell and Photosynthesis**	
1.1.1	Plant cell–Structure and functions of subcellular organelles, plant cell wall, Mechanism of water absorption, Ascent of sap. Transpiration - types, stomatal opening, Mechanism and factors affecting transpiration.	
1.1.2	Photosynthesis–Photosynthetic pigments, Photo synthetic apparatus, Light reactions, cyclic and non cyclic Phosphorylation. Calvin cycle, Hatch–Slack cycle, CAM plants.	
1.1.3	Regulation of photosynthesis, Photorespiration. □	

Unit II:		**12**
2.1	**Cycles of elements**	
2.1.1	Nitrogen cycle, Biochemistry of symbiotic and non symbiotic nitrogen fixation, Sulphur cycle, Phosphorus cycle.	
2.1.2	Plant nutrition–Biological functions of micro and macro nutrients in plants and their deficiency symptoms.	

Unit III:		**16**
3.1	**Growth Regulators**	
3.1.1	Plant growth regulators–chemistry, biosynthesis, mode of action, distribution and physiological effects of Auxins, Gibberellins, Cytokinins, ABA and Ethylene.	
3.1.2	Biochemistry of seed dormancy, Seed germination,	
3.1.3	Fruit ripening and Senescence.	

Unit IV:		
4.1	**Medicinal Importance**	**08**
4.1.1	Medicinal value of different parts of plants.	
4.1.2	Basic methods to identify the secondary metabolites. Role of secondary metabolites in Ayurvedha and Siddha treatment.	
4.1.3	Medicinal value of Amla, Stevia, Aswagandha, Turmeric and other Indian medicinal plants. □	

References

[1] Plant physiology, Verma, 7th Revised edition, Emkay Publications 2001.
[2] Plant Physiology, S. N. Pandey and B.K. Sinha, Vikas Publishing House Pvt. Ltd, 3rd edition, 1999.
[3] Plant Biochemistry and Molecular Biology, Peter Jhea, Richard C. Leegood,
[4] Introduction to plant physiology, William. G.Hopkins, Norman. P.A. Hunger, 3rd edition
[5] A Handbook of Medicinal Plants –Prajapathi, Purohit,Sharma, Kumar
[6] Medicinal Plants –a compendium of 500 species.

Course Code	Title of the Course	Credits
BCA250	MICROBIAL BIOCHEMISTRY	4

COURSE OUTCOME(S):

CO1 Specify in details with examples staining techniques used for the identification of microbes

CO2 Write down in depth Molecular biology of prokaryotes

CO3 Learn in details with application, if applicable, Operon systems in gene regulation of bacteria

CO4 Deliberate in depth antimicrobial drugs are used for the microbial infections

		No. of Lectures
Unit I:		**10**
1.1	**Pure Culture, Staining Technique and Growth**	
1.1.1	Principles of microbial nutrition: Nutritional requirements, different kinds of media, factors affecting growth.	
1.1.2	Enrichment culture techniques for isolation of chemoautotroph's, chemoheterotroph's and photosynthetic microorganisms. Modes of reproduction,	
1.1.3	Biosynthesis of cell wall components, enumeration, growth curve, generation time, synchronous growth, Chemostat. Adaptation to stationary phase, heat and cold shock, osmolarity and salinity, oxidative stress.	
1.1.4	Gram, Acid fast & flagellar staining. Mechanism of bacterial motility.	

Unit II:		**14**
2.1	**Regulation of Genes in Bacteria**	
2.1.1	Nucleic Acids as Carriers of Genetics Information, Arrangement and Organization of Gene in Prokaryotes:	
2.1.2	Operon Concept, Catabolite Repression, Instability of Bacterial RNA, Inducers and Co repressors E. coli Lac Operon: Negative Regulation and Positive Regulation, E. Coli Arabinose Operon: Regulation by Attenuation, His and Trp Operons: Anti-termination,	
2.1.3	Genetic Transfer: Conjugation, Transformation and Transduction.	

Unit III:		
3.1	**Virology and Biological Nitrogen Fixation**	
3.1.1	Introduction to Virus, Classification, Assay Methods, Properties and Characteristic of Bacterial, Plant and Animal Viruses	**16**
3.1.2	Virus Host Interaction, Acute Virus Infections, Persistent of Virus Infection, Influenza, Herpes, Hepatitis A and B.	
3.1.3	Nitrogen Metabolism: Mechanism and Regulation of Utilization of Ammonia, Nitrate and other Nitrogen Source	
3.1.4	Nitrogen Fixation: Mechanism and Regulation of Nitrogen Fixation, Symbiotic and Asymbiotic Nitrogen Fixation and Biochemistry of Nitrogenase.	

Unit IV:		
4.1	**Antimicrobial Agents**	
4.1.1	The Development of Antimicrobial Agents, Past, Present and Future, Selection of Antimicrobial Agents	**08**
4.1.2	Synthetic Organic Antimicrobials, β-Lactam Antibiotics, Amino glycoside Antibiotics, Antifungal Drugs, Antiviral Drugs	
4.1.3	Resistance to Antimicrobial Drugs	

References

[1] Microbial physiology, 2nd Edn. I.W. Dawes and I.W. Sutherland (1991) Blackwell Scientific.
[2] Microbial physiology, 4th Edn. Albert G. Moat, John W. Foster and Michael P. Spector, Wiley-Liss (2002).
[3] Biology of Microorganisms, Brock Prentice Hall (1996).
[4] Microbiology: Lansing M. Prescot, Hartley and Klein, 5th Edn. McGraw Hill (2002).
[5] General Microbiology, Stainer *et al.,* 4th Edn. McMillan (1975).
[6] Microbiology, Pelczer, Reid and Kreig Tata McGraw Hill (1996).

Course Code	Title of the Course	Credits
BCB040	ANALYTICAL BIOCHEMISTRY–II	4

COURSE OUTCOME(S):

CO1 Identify in details with application, if applicable, flow cytometry

CO2 Specify the characteristics of biosensor technology

CO3 Understand in details with examples spectroscopy

CO4 Write down the details of x-ray crystallography

		No. of Lectures
Unit I:		**08**
1.1	**Flow Cytometry and Model Systems**	
1.1.1	Flow Cytometry: Principle and design of flow cytometer, cell sorting.	
1.1.2	Animal models: Choice of animals, types of studies, mutant organisms, cultured cells, plant as models and tissue culture models.	

Unit II:		**16**
2.1	**Biosensor Technology and Radioactivity**	
2.1.1	Concept and design of biosensors, types and uses of biosensors.	
2.1.2	Principle and applications of biosensors for glucose, triglyceride, uric acid, cholesterol and oxalate.	
2.1.3	Units of radioactivity. Detection and measurement of radioactivity–solid and liquid scintillation counting, scintillation cocktails and sample preparation. Cerenkov counting. Applications of radioisotopes in biology. Radiation hazards.	
2.1.4	Principle and Applications of Autoradiography	

Unit III:		**10**
3.1	**Spectroscopy**	
3.1.1	Principle, instrumentation, working and application of– Spectrofluorimetry, Flame Spectrophotometry, Atomic Absorption Spectrometry.	
3.1.2	IR spectroscopy: Physical basis of IR spectroscopy. Instrumentation, use of IR in structure determination, Fourier Transfer–IR spectroscopy.	
3.1.3	NMR: Principle, effect of atomic, identity on NMR, chemical shift, spin coupling NMR, measurement of NMR spectra, biochemical application of NMR.	
3.1.4	ESR: Principle, measurement of ESR spectra, biochemical application of ESR.	
3.1.5	Principle, instrumentation and applications of ORD and CD	

Unit IV:		
4.1	**Mass spectroscopy, X-ray Crystallography and Nanoparticles**	
4.1.1	Theory and construction of mass spectrometer. Ionization, fragmentation, *m/z*, time of flight, MALDI and ESI.	**14**
4.1.2	Other methods: MS/MS, LC/MS, GC/MS, Peptide mapping, post translation modification analysis, determination of disulfide bridges	
4.1.3	X-ray crystallography–Bragg's law, Unit cell, Isomorphous replacement, Fibre pattern of DNA.	
4.1.4	Introduction to Nanoscience: Importance and fundamental science behind nanotechnology.	
4.1.5	Applications of Nanoparticles: Tools to make nanostructures, Nanoscale lithography, E–beam lithography, molecular synthesis, self assembly. Drug and Gene delivery for human health, Biosensors and sensors, cleaning environment (for heavy metal & Bioremediation).	

References

[1] Analytical techniques in Biochemistry and Molecular Biology; Katoch, Rajan. Springer (2011)

[2] Basic Methods for the Biochemical Lab; Martin Holtzhauer, Springer, (2007).

[3] Principles and Techniques of Biochemistry and Molecular Biology 7th Edn. Keith Wilson and John Walker, Cambridge University Press, (2010).

[4] Biochemistry LabFax, Ed. J.A.A. Chambers and D. Rickwood,, Blackwell Science, (1993),

[5] Protein Purification Applications, S.L.V. Harris and Angal IRL Press, (1990)

[6] Laboratory Techniques in Biochemistry and Molecular Biology, Work and Work Vol. I & II, North Holland, (1969).

[7] Basic Mathematics for Biochemists; Cornish Bowden, Oxford University Press (1998),.

[8] Biophysical Tools for Biologists *In Vivo* Techniques; John Correia H. Detrich, III Elsevier (2008).

[9] Practical Biochemistry by Keith Wilson and Walker 5th ed. Cambridge.

[10] Biophysical chemistry, Upadhyaya, A., Upadhyaya, K. and Nath, N. Himalayan Publishing House.

[11] Practical biochemistry- Principles and Techniques. Wilson and Walker. J.Cambride Uni. Press.

[12] Physical Biochemistry-David Freifelder, 2nd Edition.

[13] Principles of Instrumental Analysis. 5th Ed. Douglas A Skoog, James Holler and Timothy A Nieman.

Course Code	Title of the Course	Credits
BCB050	CHEMISTRY AND METABOLISM OF CARBOHYDRATES AND LIPIDS	4

COURSE OUTCOME(S):

CO1 Understand the classification and characteristics of chemistry of carbohydrates

CO2 Deliberate the classification and characteristics of bioenergetics

CO3 Write down the characteristics of chemistry of lipids

CO4 Learn in depth metabolism of lipids

		No. of Lectures
Unit I:		**10**
1.1	**Chemistry of Carbohydrates**	
1.1.1	Classification, monosaccharides (aldoses & ketoses) Configuration and conformation of monosaccharides (pyranose & furanose, chair & boat).	
1.1.2	Reducing and optical properties of sugars. Stability of glycosidic bond disaccharides, oligosaccharides.	
1.1.3	Structural polysaccharides–cellulose, hemicellulose, pectin, lignin, chitin, chitosan	
1.1.4	Storage polysaccharides: starch, glycogen, inulin Steric factors in polysaccharides folding, blood group polysaccharides and lectins. Glycosaminoglycans, mucopolysaccharides, hyaluronic acid Chondroitin sulfate, keratan sulfate, dermatan sulfate. Bacterial cell wall polysaccharides, proteoglycans (syndecan and agrecan)	

Unit II:		**14**
2.1	**Metabolism of Carbohydrates and Bioenergetics**	
2.1.1	Reactions and energy balance in Glycolysis, Gluconeogenesis, TCA cycle, HMP Shunt pathway, Pasteur and Crabtree effect, Anapleurotic reactions	
2.1.2	Glyoxylate cycle, Glucuronic acid cycle, Glycogen metabolism.	
2.1.3	Photosynthesis reactions for biosynthesis of glucose C3 and C4 cycle in plants	
2.1.4	Mitochondrial ETC–Organization of respiratory chain complexes, P/O ratio, ATP synthesis, Mitchell's hypothesis, uncouplers and inhibitors.	

Unit III:		**12**
3.1	**Chemistry of Lipids**	
3.1.1	Classification & biological significance of lipids, fatty acids and Steroids	
3.1.2	Bile acids and salts, Phospholipids, Oils, waxes, isoprene units, Lipoproteins, Glycolipids, Sphingolipids	

3.1.3	Cerebrosides, Gangliosides, Prostaglandins, Prostacyclins, Thromboxanes, Leukotrienes, cysteinyl leukotrienes	

Unit IV:		**12**
4.1	**Metabolism of Lipids**	
4.1.1	Fate of dietary lipids and Apo-lipoproteins Fatty acid biosynthesis, Desaturation of fatty acids Beta oxidation, breakdown of odd chain fatty acids, energy yields	
4.1.2	Regulation of β–oxidation, ώ–oxidation & α–oxidation Metabolism of phospholipids &Sphingolipids Regulation and Biosynthesis of cholesterol, action of statins	
4.1.3	Fate of acetyl CoA, formation of ketone bodies and ketosis	
4.1.4	Biosynthesis of prostaglandins, Prostacyclins, Thromboxanes, Leukotrienes, Action of aspirin	
4.1.5	Genetic defects in lipid metabolism, Medium chain acyl coenzyme A dehydrogenase deficiency MCAD, Long–chain 3–hydroxyacyl–CoA dehydrogenase (LCHAD) deficiency, Familial hypercholesterolemia	

References

[1] Lehninger Principles of Biochemistry 4th Ed By David L. Nelson and Michael M. Cox, WH Freeman and Company.

[2] Biochemistry by Lubert Stryer. WH Freeman and Co.

[3] Biochemistry: The Molecular Basis of Life by Trudy McKee and James R McKee. Publisher: McGraw-Hill Higher education.

[4] Biochemistry and Molecular biology By William H. Elliott and Daphne C. Elliott. Oxford University Press.

[5] Biochemistry 3rd Ed. By Donald J. Voet and Judith G. Voet. John Wiley and Sons.

[6] Biochemistry: Biomolecules, Mechanisms of Enzyme Action and Metabolism Vol 1 by D Voet. John Wiley and Sons.

Course Code	Title of the Course	Credits
BCB060	**EXPERIMENTS IN IMMUNOLOGY AND BIOCHEMICAL ESTIMATIONS**	4

COURSE OUTCOME(S):

CO1 Understand in details with examples antigen antibody reactions

CO2 Specify in details with application, if applicable, oils and fats estimation

CO3 Understand in depth acid value principle and determination

CO4 Identify in details with examples mitosis and meiosis

Group I:	1. Demonstration of Ag-Ab interaction: Radial immuno-diffusion and ODD. 2. Demonstration of direct agglutination reaction using human blood group antigens. 3. Demonstration of indirect agglutination reaction– latex agglutination. 4. Fluorescence emission of proteins and vitamins 5. UV–Vis spectra of proteins, nucleic acids and other aromatic compounds 6. Extraction of neutral lipids, phospholipids 7. TLC of lipids and estimation of phospholipids	
Group II:	8. Iodine No. of Oils/Fats 9. Saponification Value of Oils/Fats 10. Acid Value/Peroxide Value of Oils/Fats 11. Estimation of α-Keto-acid 12. Estimation of ascorbic acid 13. Estimation of Iron 14. Estimation of Calcium	
Group III:	15. Isolation of Starch from potato and purity determination 16. Colorimetric estimation of reducing sugars (DNS reagent method) 17. Estimation of reducing sugar: Hegedorn and Jensen Method 18. Estimation of Phosphate 19. Mitosis in onion root tips 20. Meiosis in *tradescantia/*grasshopper testis 21. Total and Differential Cell Counting of blood	

Group Study	Preparation of antigen adjuvant mixture, injection and raising antibodies in rat. Purification of antibodies Antibody titer and ELISA	

References

[1] Analytical techniques in Biochemistry and Molecular Biology; Katoch, Rajan. Springer (2011).
[2] Basic Methods for the Biochemical Lab; Martin Holtzhauer, Springer, (2007).
[3] Principles and Techniques of Biochemistry and Molecular Biology 7th Edn. Keith Wilson and John Walker, Cambridge University Press, (2010).
[4] Biochemistry LabFax, Ed. J.A.A. Chambers and D. Rickwood,, Blackwell Science, (1993),
[5] Protein Purification Applications, S.L.V. Harris and Angal IRL Press, (1990)
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[8] Modern Experimental Biochemistry R.F. Boyer [Ed.] (1986) Addition Wesley.
[9] Analytical Biochemistry; D.J. Holme and H. Pick Longman (1983).
[10] Principles and techniques of Biochemistry and Molecular Biology; Keith Wilson and John Walker; 6th Edn. (2005) Cambridge University Press.
[11] Biochemical Calculations, Irwin H. Segel (1976) 2nd Ed. John Wiley and Sons.
[12] Methods in Immunology and Immunochemistry; Curtis Williams, Academic Press (1971).
[13] Immuno Assay Hand Book; David Wild, Elsevier (2013).

Course Code	Title of the Course	Credits
BCB250	IMMUNOLOGY AND MICROBIOLOGY	4

COURSE OUTCOME(S):

CO1 Identify in details with examples antigens and antibodies

CO2 Understand the details of cellular basis of immunity

CO4 Identify the classification and characteristics of MHC Complex

CO4 Learn in depth basic concepts of microbiology

		No. of Lectures
Unit I:		**12**
1.1	**Antigens and Antibodies**	
1.1.1	Introduction: Historical development and milestones in immunology. Barriers to infection–skin, mucous membrane, Definitions–Antigenicity, Immunogenicity, primary and secondary lymphoid organs, self and non self discrimination. Innate and acquired immunity.	
1.1.2	Antigens and Antibodies: Haptens and determinants–Epitopes and paratopes. Antigenicity, carbohydrates, proteins, nucleic acids, and cells as antigens. Valency of antigen.	
1.1.3	Classes and subclasses of immunoglobulins, structure of immunoglobulins, hyper variable region, isotypic, allotypic and idiotypic variations.	
Unit II:		**12**
2.1	**Complement and Cellular Basis of Immunity**	
2.1.1	Complement: Structure, components, properties and functions of complement pathways, biological consequences of complement activation.	
2.1.2	Hyper sensitivity reactions (Type I, II, III and IV).	
2.1.3	Cellular basis of immunity: Primary and secondary immune response. Reticuloendothelial system. T, B and accessory cells. Subsets of T (T–helper cells, T–killer cells, T–suppressor cells) and B cells. Development of T and B cells. T and B cell receptors, antigen processing and presentation.	
2.1.4	Cytokines and co–stimulatory molecules–Lymphokines, interleukins structure and function of IL-2, TNFα. T and B interaction. Suppression of immune response, immunoglobulin, diversity of gene rearrangement, factors affecting diversity, class switching and clonal selection theory of Burnet.	

Unit III:		
3.1	**MHC, Transplantation, Tumor Immunology and Vaccines**	
3.1.1	MHC: MHC gene and its polymorphism, role of MHC in immune response.	**16**
3.1.2	Transplantation: Autograft, isograft, allograft and xenograft, Graft rejection, graft *Vs* host reaction, MHC in transplantation.	
3.1.3	Immunochemical techniques: Precipitation, agglutination, complement fixation, immunodiffusion, immunoelectrophoresis, immunofluorescence, RIA, ELISA.	
3.1.4	Tumor immunology: Tumor associated antigens, factors favoring tumor growth, immune surveillance. Tumor necrosis factors α and β Disorders of immunity: Immunological tolerance, auto immune disorders, AIDS, SCID, lupus erythematosus Vaccines: Adjuvants; vaccines and their preparations. Polyclonal and monoclonal antibodies–hybridoma technique.	
Unit IV:		
4.1	**Microbiology**	
4.1.1	Historical aspects - Discovery of microorganisms. Theory of spontaneous generation. Era of Louis Pasteur. Microbes and fermentation. Microbes and diseases-Koch's Postulates.	**08**
4.1.2	General characteristics: Morphology, nomenclature and classification of bacteria, virus, yeasts and fungi.	
4.1.3	Microbial nutrition-Factors influencing growth, growth curve of bacteria. Measurement of growth, continuous culture, synchronous culture and chemostat. Auxotrophs, autotrophs, heterotrophs. Methods of cultivations and preservation of microorganisms.	
4.1.4	Methods of control of microorganisms-Sterilization Techniques: Definitions of physical methods, heat (dry & moist) filtration, radiation; chemical agents-phenols, alcohols, halogens, heavy metals, aldehydes, quaternary ammonium compounds & gases.	

References

[1] Antibodies–A Laboratory Manual; E. D. Harlow, David Lane, 2nd Edn. CSHL Press (2014).
[2] Basic and Clinical Immunology; Stites *et al.,* [Ed] (1982) Lange.
[3] Roitt's Essential Immunology; Ivan, M. Roitt & Peter J Delves (2001) Blackwell Science.
[4] Immunology: Roitt *et al.,* Mosby (2001),
[5] Kuby Immunology; Oven, Punt, Stranford, 7th Edn. W. H. Freeman (2013).
[6] Immune System; M. C. Connel et al., Eds. (1981) Blackwell Science.
[7] Immunology at a Glance: J.H.L. Playfare [ed.] Blackwell Science, (1987).
[8] Immunology; Jan Klein [Ed.], Blackwell Science (1990).
[9] Introduction to Immunology; Kim Bell [Ed.,] 3rd Edn. McMillan (1990).

Course Code	Title of the Course	Credits
BCB260	HUMAN PHYSIOLOGY AND NUTRITION	4

COURSE OUTCOME(S):

CO1 Specify the classification and characteristics of blood and respiratory systems

CO2 Identify in depth digestive and excretory systems

CO3 Learn in details with application, if applicable, concepts of nutrition

CO4 Specify the details of vitamins and minerals

		No. of Lectures
Unit I:		**12**
1.1	**Blood and Respiratory System**	
1.1.1	Blood–Composition, cells. Erythrocytes–structure and function, WBC–types and functions.	
1.1.2	Platelets and their function. Buffer systems; hemostasis–blood volume, blood pressure and its regulation. Blood clotting, Dissolution of clot; anticoagulants. CSF–composition and function.	
1.1.3	Respiratory System–Mechanism of gas exchange, oxygen binding by hemoglobin and factors affecting oxygenation. Acid–base balance and its regulation.	

Unit II:		**12**
2.1	**Hepatobiliary, Digestive and Excretory System**	
2.1.1	Hepatobiliary system–Anatomy of the liver, blood supply; cells–hepatocytes, endothelial cells, Kupffer cells and paranchymal cells.	
2.1.2	Secretory and excretory function; detoxification and formation of bile	
2.1.3	Digestive system–GI tract, digestion and absorption of carbohydrates, proteins and lipids. Mechanism of HCl production in the stomach. Gastrointestinal hormones.	
2.1.4	Excretory System–Ultra structure of the nephron, glomerular filtration, tubular reabsorption and tubular secretion, formation of urine.	

Unit III:		**16**
3.1	**Nutrition, Carbohydrates, Proteins and Fats**	
3.1.1	Nutrition–Concepts of macro and micro nutrients, essential nutrients and their classification. Food groups, proximate analysis of foods, chemical and biological analysis for nutrients.	
3.1.2	Food as source of energy, methods of determining energy value of foods, calorimetry, physiological fuel values and daily requirement of energy, high and low	

	calorie diets. Basal metabolic rate (BMR), factors affecting BMR, specific dynamic action of foods.	
3.1.3	Carbohydrates–dietary sources, dietary fiber essentiality of carbohydrates.	
3.1.4	Proteins–Evaluation of nutritive value of dietary protein PER, BV, essential amino acids, nutritional classification of proteins, supplementary value of proteins, protein calorie malnutrition–Kwashiorkor and Marasmus.	
3.1.4	Fats–Sources, invisible fat, essential fatty acids, PUFA.	

Unit IV:		
4.1	**Vitamins and Minerals**	
4.1.1	Vitamins–Fat soluble and water soluble vitamins, provitamins, antivitamins, dietary sources, structure, daily requirements and functions.	**08**
4.1.2	Deficiency symptoms of B complex members and fat soluble vitamins, hypervitaminosis, vitamin like compounds.	
4.1.3	Minerals–Macro and micronutrients, sources, requirements, functions and deficiency symptoms.	
4.1.4	Water metabolism–distribution in body, function and factors affecting water balance.	
4.1.5	Recommended daily allowances, special nutrition for infants, children, during pregnancy, lactation and old age.	

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[2] Text Book f Biochemistry with Clinical correlations; Thomas Devlin [Ed.] (1997), Wiley –Liss.
[3] Lehninger- Principles of Biochemistry; DL Nelson and MM Cox [Eds), 6th Edn. Macmillan Publications (2012).
[4] Principles of Human Physiology; 4th Edn. Cindy L. Stanfield Pearson, (2010).
[5] Human Biochemistry, Orten and Neuhans , 10th Edn. Mosbey International, (1983).
[6] Human Physiology: The mechanisms of Body functions. A.J. Vander, et. Al.,(1985) McGraw-Hill.
[7] Molecular Cell Biology, Baltimore et. al. (1995) Scientific American Publication.
[8] Harper's Review of Biochemistry, Murray et. al., (1997) 24th Edn., Lange
[9] Molecular Biology of Cell; Albertis *et. al.* (2002) Garland Science.
[10] Biochemistry Ed. Donald Voet & Judith G. Voet, John Wiley & Sons, Inc. (2010).
[11] Mammalian Biochemistry; White, Handler and Smith, McGraw-Hill, (1986).
[12] Textbook of human Physiology by Guyton, 11th ed.Elesvier.
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[14] Nutrition: Everyday Choices, 1st Edition; Mary B. Grosvenor, Lori A. Smolin Wiley (2006).
[15] Bioactive Food as Dietary Interventions for Liver and Gastrointestinal Disease; Watson Elsevier (2012).
[16] Nutrition and Metabolism, 2nd Edn., Lanham S, Mac Donald I and Roche H. The Nutrition Society, London, UK, (2012).
[17] Introduction to Human Nutrition, 2nd Edn., Gibney M, Lanham S, Cassidy A and Vorster H. The Nutrition Society, London, UK, (2012).

Course Code	Title of the Course	Credits
BCB260	RESEARCH METHODOLOGY AND BIOSTATISTICS	4

COURSE OUTCOME(S):

CO1 Specify the classification and characteristics of research methodologies and the experimental designs

CO2 Identify in depth statistical analysis

CO3 Learn in details with application, if applicable, scientific write-up

CO4 Specify the details of Interpretation of data

		No. of Lectures
Unit I:		
1.1	**Research Methodology and Design**	
1.1.1	Research Methodology: Meaning of research, Objectives of research, Motivation in Research, Types of Research, and Research approaches.	
1.1.2	Research methods vs. Research Methodology, Research process–scientific method, Criteria for good research, Defining the research problem.	**12**
1.1.3	Research Design: Meaning and need for research design, features of good design. Preparation of Scientific report, presentation of a review.	

Unit II:		
2.1	**Scientific Writing**	
2.1.1	Mechanical and stylistic aspects of scientific writing- Precision and clarity of language, writing style, writing process, presentation of numerical data and scientific figures.	
2.1.2	Constraints on scientific writing–audience, format and mechanics (grammar, word choice, punctuation, tenses).	**12**
2.1.3	Objectives and design of experiment–experimental unit, identifying variables, replications & controls, power analysis in planning experiments, treatment structure and design structure.	
2.1.4	Graphical analysis of data and presentation of results.	

Unit III:		
3.1	**Statistical Significance Analysis**	
3.1.1	Significance and limitations of statistical calculations, Sampling techniques.	
3.1.2	Probability theory, random variables and distribution functions, Point and interval estimation, linear regression. Statistical evaluation of results–Hypothesis testing, interpretation of statistic for analysis of error.	**16**
3.1.3	Measures of central tendency and dispersion	

Unit IV:		**08**
4.1	**Testing Methods**	
4.1.1	ANOVA, F-test, t-test, z-test, chi-square, correlation coefficient.	

References

[1] Research Methodology: Methods & Techniques By CR Kothari. Publisher: New Age International

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[3] The Craft of Scientific Writing (3rd Edition) By Michael Alley. Publisher: Springer-Verlag.

[4] Writing Scientific Research Articles: Strategy and Steps (Hardcover) By Margaret Cargill and Patrick O.Connor. Publisher: WileyBlackewell.

[5] The Mayfield Handbook of Technical and Scientific Writing By Leslie Perelman and Edward Barrett. McGraw-Hill NY

[6] Scientific Style and Format: The CBE Manual for Authors, Editors, and Publishers(Hardcover) 6th Ed By Edward J. Huth. Publisher: Cambridge University Press.

[7] The Handbook of Technical Writing, Eighth Edition (Handbook of Technical Writing Practices) (Hardcover) By Gerald J. Alred, Charles T. Brusaw and Walter E. Oliu, St. Martin's Press.

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[9] The Elements of Technical Writing (Elements of Series) (Paperback) By Gary Blake and Robert W. Bly. Publisher: Longman.

[10] Technical Writing: Principles, strategies and readings (7th Edition) By Diana C. Reep. Publisher: Longman.

[11] Biostatistics By PN Arora and PK Malhan, Himalaya Publishing House.

[12] Experimental Design and Data Analysis for Biologists By Gerry P. Quinn and Michael J. Keough. Publisher: Cambridge University Press.

[13] Principles of Biostatistics (with CD-ROM) (Hardcover) By Marcello Pagano and Kimberlee Gauvreau. Publishers: Duxbury Press

[14] Biostatistics: Experimental Design and Statistical Inference (Hardcover) By James F. Zolman. Oxford University Press.

[15] Intuitive Biostatistics By Harvey Motulsky. Publisher: Oxford University Press

Course Code	Title of the Course	Credits
BCB260	CLINICAL RESEARCH METHODS AND INDUSTRIAL BIOCHEMISTRY	4

COURSE OUTCOME(S):

CO1 Specify the classification and characteristics of clinical practice and clinical research

CO2 Identify in depth fermentation technology and downstream processing

CO3 Learn in details with application, if applicable, clinical research methods

CO4 Specify the details of steps involved in drug discovery

		No. of Lectures
Unit I:		
1.1	**Introduction to Clinical Research**	
1.1.1	Introduction to Clinical Research, Terminologies and definition in Clinical Research, Origin and History of Clinical Research	
1.1.2	Difference between Clinical Research and Clinical Practice, Types of Clinical Research, Phases of clinical research	**10**
1.1.3	Clinical Trials in India–The National Perspective, Post marketing surveillance	
1.1.4	Pharmaceutical Industry–Global and Indian Perspective Clinical Trial market, Career in Clinical Research	

Unit II:		
2.1	**Clinical Research Methods**	
2.1.1	Design of experiments, factorial experiments, randomization, interaction among factors.	
2.1.2	Types of studies: Cohort studies, double blind, placebo control, cross over and double dummy.	
2.1.3	Introduction to Good Clinical Practices, Clinical Trial Development: Protocol Design and Development, Case Report Form Design and Development, Principals of Data Management, Clinical Trial Management: Maintaining and Managing Essential Documents, Recording and Reporting Non–Serious and Serious Adverse Events.	**14**

Unit III:		
3.1	**Drug Discovery Concepts and Biostatistics**	
3.1.1	Proof of concept, target identification and validation. Identifying the lead compound, optimization of lead compound, mechanism of action, drug target and validation of target.	**12**
3.1.2	Safety pharmacology, pharmaco–kinetics and	

	pharmaco–dynamics, acute and chronic toxicity Development of new drug/molecules and elucidation of their mechanisms of actions, formulations, factors affecting drug efficacy, drug resistance, traditional medicines; biotransformation.	
3.1.3	Statistical concept: Data structure, sampling methods, collection, classification and tabulation of data, graphical and diagrammatic representation, histogram, frequency polygon, frequency curve, bar graph, pie chart.	
3.1.4	Measure of central tendency: Mean, median, mode,mean deviation, standard deviation, standard error Types of distribution of data: Normal, binomial, Poisson,	
3.1.4	Z-test, t-test and ANOVA. Correlation and regression.	
Unit IV:		
4.1	**Bioprocess Methods**	
4.1.1	Basics of chemical engineering, mass transfer, heat generation and removal, fluid dynamics:	
4.1.2	Bernoulli's principle, viscosity, hydraulic conductivity, capillary flow, control and applications of industrial processes, process evaluation and development, over production of metabolites and methods;	**12**
4.1.3	Fermentation–Submerged and solid state fermentation Fermentor design, Industrial use of microbes. Strain improvement, Inocula preparation, Downstream processing–Recovery and purification of intracellular and extra cellular products. Methods to maximize the yield.	

References

[1] Basic Test for Drugs, WHO-GENEVA 1998 edition
[2] Who Expert Committee on Specification for Pharmaceutical Preparation WHO-GENEVA, 2005 edition
[3] Who Expert Committee on Biological Standardization WHO-GENEVA 2003 edition
[4] Clinical Research Fundamental and Practice –Vishal Bansal Parar Medical Publisher, 2010 edition
[5] Introduction to Pharmacopoeia CBS Publishers and Distributors 1991 edition
[6] Essential of Clinical Research –Dr. Ravindra B. Ghooi and Sachin C. Itkar Nirali Prakashan 2010 edition
[7] Basic Principle of Clinical Research and Methodology, Jaypee Brothers Medical Publishers (P) Ltd. 2009 ed.
[8] A Comprehensive Clinical Research Manual-Samir Malhotra, Nusrat Shafiq, Promila Pandhi Jaypee Brothers Medical Publishers (P) Ltd, 2008 edition
[9] Industrial microbiology, A.H. Patel
[10] Principles of Fermentation technology, Stanburry. P. Whitaker and S.J. Hall, 1995
[11] Biotechnology–U. Sathyanarayana. □YLL

Course Code	Title of the Course	Credits
BCC070	CELL BIOLOGY, ENDOCRINOLOGY AND CELL SIGNALING	4

COURSE OUTCOME(S):

CO1 Specify in details with examples cellular organization

CO2 Learn the characteristics of endocrinology

CO3 Learn in depth cell signaling

CO4 Write down the characteristics of membrane biology

		No. of Lectures
Unit I:		**12**
1.1	**Cellular Organization, Division and Cytoskeletons**	
1.1.1	Cell types–organization of prokaryotic and eukaryotic cells.	
1.1.2	Cell division–mitosis and meiosis, cell cycle–phases of cell cycle, cyclins and cdks. Regulation of cell growth and cell cycle.	
1.1.3	Cell motility–molecular motors, microtubules, structure and composition. Microtubular associated proteins–role in intracellular motility.	
1.1.4	Cellular organelles–Nucleus–internal organization, traffic between the nucleus the nucleolus, and cytoplasm. Endoplasmic reticulum–protein sorting and transport, golgi apparatus and lysosomes, morphology and function of mitochondria, chloroplasts and peroxisomes, glyoxysomes.	

Unit II:		**12**
2.1	**Membrane Biology**	
2.1.1	Organization of lipid monolayer, bilayer, Physicochemical properties of biological membranes - compositions, supra molecular organization - Singer and Nicolson's model.	
2.1.2	Membrane asymmetry-lipids proteins and carbohydrates, lateral diffusion, biogenesis of lipids and proteins. Polarized cells, membrane domains- caveolae, rafts, Membrane lipid and protein turnover, intracellular targeting of proteins. Factors influencing fluidity of membrane	
2.1.3	Membrane transport - Laws of diffusion across membranes, simple diffusion, facilitated diffusion and active transport - glucose transporter Na+ K+ ATPase (Structure and mechanism of action), bacterial phosphotransferase system. Endocytosis, receptor mediated endocytosis, exocytosis, ion channels, aquaporin channel, ionophores. Patch clamp technique.	

Unit III:		
3.1	**ENDOCRINOLOGY**	
3.1.1	Endocrine System–Endocrine organs in man. Hierarchy and regulation of hormone release.	
3.1.2	Structure and control of hypothalamus, GRH, somatostatin, TRH, CRH, GnRH. Pituitary-anatomy and structure.	
3.1.3	Hormones of anterior, posterior and median lobes. Pro-opiomelanocortin. Thyroid, parathyroid, adrenals, gonads–Testes and ovaries. Menstrual cycle. Hypothalamus–pituitary target organ axis and regulation by feedback mechanism, Pineal gland, melatonin and circadian rhythm	**12**
3.1.4	Classification of hormones based on solubility and structure, mechanism of action of water soluble and lipid soluble hormones.	
Unit IV:		
4.1	**Cell Signaling**	
4.1.1	Nerve transmission–Central and peripheral nervous systems. Structure of neuron, axon, dendrites, synapse neuromuscular junction. Neurotransmitters- mechanisms of nerve conduction. α and β adrenergic neurons, nicotinic and muscarinic neurons.	
4.1.2	Muscle contraction–Skeletal muscle and smooth muscle contraction, muscle proteins–actin, myosin, tropomyosine, troponins, mechanisms of muscle contraction, role of calcium and calmodulin Biochemistry of vision	**12**
4.1.3	Cellular signaling: Extra cellular signaling–G Protein linked receptors ,Role of cyclic AMP, IP3, DAG, Ca2+ as a second messenger, receptos tyrosine kinases , MAP kinase pathway, NFkB pathway, apoptosis, Cell survival pathway, Jak/Stat pathway, TGF β Signaling. Multiple signaling path ways–Insulin receptor (regulation of blood glucose)	
4.1.4	Steroid hormone receptors, structural organization of receptor protein, hormone binding domain, antigenic domain and DNA binding domain.	

References

[1] The World of the cell by Becker, Kleinsmith and Harden Academic Internet Publishers; 5th edition (2006)

[2] The Cell: A Molecular Approach, Fourth Edition by Geoffrey M. Cooper and Robert E. Hausman.

[3] Cell and Molecular Biology by concepts and experiments by Gerald Karp (2005) John Wiley sons & Inc.

[4] Molecular cell Biology by Harvey Lodish. W. H. Freeman; 6th edition (2007)

[5] The Cell–Biochemistry, physiology and morphology by J. Brachet and A. E. Mirsky, Academic Press (1963)

Course Code	Title of the Course	Credits
BCC050	CLINICAL BIOCHEMISTRY	4

COURSE OUTCOME(S):

CO1 Identify in details with application, if applicable, specimen collection and analysis

CO2 Specify in details with application, if applicable, metabolic disorders

CO3 Write down the characteristics of hormonal disorders

CO4 Write down in details with application, if applicable, hematology

		No. of Lectures
Unit I:		
1.1	**Specimen Collection and Analysis**	
1.1.1	Concepts of accuracy, precision, reproducibility, reliability, and other factors in quality control.	
1.1.2	Normal values. Specimen collection and Processing: Collection of blood–venipuncture, skin puncture, arterial puncture. Anticoagulants. Collection and analysis of normal and abnormal urine–timed urine specimens, preservatives.	**10**
1.1.3	Clinical significance of sugars, proteins, ketone bodies, bilirubin and porphyrins. CSF–collection, composition and analysis. Amniotic fluid–Origin, collection, composition.	

Unit II:		
2.1	**Disorders**	
2.1.1	Disorders of carbohydrate metabolism: Diabetes mellitus, glycohemoglobins, hypoglycemias, galactosemia and ketone bodies.	
2.1.2	Various types of glucose tolerance tests. Glycogen storage diseases.	
2.1.3	Lipid profile, lipidosis and multiple sclerosis. Causes and diagnosis of the disorders of HDL–cholesterol, LDL–cholesterol and triglycerides.	**14**
2.1.4	Cancer: Etiology, diagnosis, treatment and prognosis. Carcinogens, oncogens, mechanism.	
2.1.5	Biochemistry of ageing: Cellular senescence, Role of Telomerase in aging, Alzheimer's disease, Parkinson's disease.	

Unit III:		
3.1	**Enzymes and Hormonal Disorders**	
3.1.1	Evaluation of organ function tests: Clinical assessment of renal, hepatic, pancreatic, gastric, intestinal and thyroid functions. Clinical importance of bilirubin.	**12**
3.1.2	Diagnostic enzymes: Principles of diagnostic enzymology. Clinical significance of aspartate aminotransferase, alanine aminotransferase, creatine	

	kinase, aldolase and lactate dehydrogenase.	
3.1.3	Enzyme tests in determination of myocardial infarction. Enzymes of pancreatic origin and biliary tract.	
3.1.4	Hormonal disorders: Protein hormones (anterior pituitary hormones, posterior pituitary hormones), steroid hormones, adrenocorticosteroids, and reproductive endocrinology. Disorders of thyroid hormones.	

Unit IV:		
4.1	**Hematology**	
4.1.1	Biochemical aspects of hematology: Total cell count, differential count, hematocrit.	**12**
4.1.2	Disorders of erythrocyte metabolism, hemoglobinopathies, thalassemias, thrombosis, porphyrias and anemias. Laboratory tests to measure coagulation and thrombolysis.	
4.1.3	Doping	
4.1.4	Detoxification in the body: Enzymes of detoxification, polymorphism in drug metabolizing enzymes. Mechanism of drug action and channels of its excretion.	
4.1.5	Test for lung function: Chest X-ray, Spirometry. Test for Brain function: EEG, MRI, CT.	

References

[1] Textbook of Medical Biochemistry by MN Chatterjea and Rana Shinde, Jaypee Brothers.

[2] Lehninger Principles of Biochemistry 5th Ed by David L. Nelson and Michael M. Cox, WH Freeman and Company.

[3] Davidson's Principles and Practice of Medicine: A Textbook for Students and Doctors (Hardcover) 15th Ed by LSP Davidson, J MacLeod and CRW Edwards. Publisher: Churchill Livingstone.

[4] Medical Biochemistry (Paperback) by John W. Baynes and Marek Dominiczak. Publisher: Mosby.

[5] Clinical Biochemistry: An Illustrated Colour Text (Paperback) 3rd Ed By Allan Gaw, Michael Murphy, Robert Cowan, Denis O'Reilly, Michael Stewart and James Shepherd. Publisher: Churchill Livingstone.

[6] Review of Medical Physiology (Lange Basic Science) (Paperback) By William F. Ganong. Publisher: McGraw-Hill Medical

[7] Harper's Biochemistry (Lange Medical Books) (Paperback) By Robert K. Murray, Daryl K. Granner, Peter A. Mayes and Victor W. Rodwell. Publisher: Appelton and Lange.

[8] Clinical Biochemistry by Richard Luxton. Scion Publishing Ltd.

[9] Principles of Medical Biochemistry: With STUDENT CONSULT Online Access (Paperback) by Gerhard Meisenberg and William H. Simmons. Publisher: Mosby.

Course Code	Title of the Course	Credits
BCC060	**EXPERIMENTS IN CLINICAL BIOCHEMISTRY AND MOLECULAR BIOLOGY**	**4**

COURSE OUTCOME(S):

CO1 Specify the details of urine and blood analysis

CO2 Specify the characteristics of determination of enzyme activity

CO3 Identify the classification and characteristics of DNA quantification and analysis

CO4 Deliberate the details of isolation of nucleic acids from plant, animal and microbial sources

Group I:	**Urine analysis** 1. Qualitative analysis of urine for normal organic and inorganic constituents 2. Qualitative analysis of urine for abnormal constituents- Glucose, albumin, Ketone bodies. 3. Quantitative estimation of Creatine and Creatinine, Urea Uric acid Sulphate Chloride 4. Titrable acidity **Blood analysis** 5. Quantitative estimation of Urea Uric acid Creatine Cholesterol HDL–C and LDL–C 6. Blood glucose and GTT	
Group II:	**Determination of Enzyme activity of** 7. Alkaline phosphatase 8. SGOT 9. SGPT 10. LDH 11. Electrophoresis of lipoproteins: Serum proteins. 12. Albumin/Globulin Ratio. 13. Fractionation of serum proteins-Ammonium sulphate precipitation. 14. Isolation of DNA and RNA from biological sources. 15. Quantitative determination of DNA and RNA.	
Group III:	16. Determination of melting temperature of DNA (Tm) 17. Sub-cellular fractionation of rat liver by differential centrifugation and marker analysis 18. Determination of activities of marker enzymes 19. Preparation of erythrocyte ghosts 20. Kinetics of uptake of glucose by erythrocytes 21. Viability of cells by trypan blue dye exclusion 22. Study of morphology of *Drosophila melanogaster*	

	23. Study of mutants of *Drosophila melanogaster* 24. Study of polytene chromosomes of *Drosophila melanogaster*	

Group Study	Isolation of plasmid DNA, Restriction digestion of plasmid DNA, ligation of DNA fragment into a plasmid vector, preparation of competent cells, *E.Coli* transformation and amplification of DNA by PCR.	

References

[1] Practical Clinical Biochemistry, ed. Harold Varley, 4th edn. CBS Publishers (1988).
[2] Practical Clinical Biochemistry: Methods and Interpretation, ed. Ranjna Chawla, Jaypee Brothers Medical Publishers (1996).
[3] Practical and Clinical Biochemistry for Medical Students, ed. T.N. Pattabhiraman, Gajana Publishers (1994).
[4] Hawk's Physiological Chemistry, ed. Oser, 14th Edn.(1976), Tata-McGrawHill.
[5] Biochemistry, ed. Plummer Tata-McGraw Hill, (1971).
[6] Molecular Biology Techniques; Sue Carson, Heather Miller and D. Scott Witherow, Academic Press (2011).
[7] Principles and Techniques of Biochemistry and Molecular Biology; 7th Edn. Keith Wilson and John Walker (2012).
[8] Principles of Gene Manipulations; 6th Edn. S.B. Primrose, R.M. Twyman, and R.W. Old, Blackwell Science (2012).
[9] Gene Cloning and DNA analysis- An Introduction; T. A. Brown, 5th Edition, Wiley-Blackwell (2006).
[10] Laboratory methods in Enzymology; Part-A; Jon Lorsch, Academic Press (2014).
[11] Gene Cloning Laboratory Manual 4th Edn. Michael R. Green and Joseph Sambrook, CSHL Press (2014).
[12] Current Protocols in Molecular Biology; S Gallaghar, Wiley Interscience (2008).

Course Code	Title of the Course	Credits
BCC220	GENOMICS, PROTEOMICS AND BIOINFORMATICS	4

COURSE OUTCOME(S):

CO1 Specify the details of DNA sequencing methods

CO2 Specify the characteristics of determination of Proteins

CO3 Identify the classification and characteristics of microarray data

CO4 Deliberate the details of bioinformatics in biological databases and sequencing analysis

		No. of Lectures
Unit I:		**12**
1.1	**Structural Organization of Genome and Sequencing**	
1.1.1	Structural organization of genome in Prokaryotes and Eukaryotes, Organelle DNA–mitochondrial, chloroplast,	
1.1.2	DNA sequencing–principles and translation to large scale projects, Recognition of coding and non–coding sequences and gene annotation. Tools for genome analysis–RFLP, DNA fingerprinting, RAPD, PCR, Linkage and Pedigree analysis–physical and genetic mapping.	
1.1.3	Microbes, plants and animals, Accessing and retrieving genome project information from web, Comparative genomics, ESTs and SNPs.	

Unit II:		**12**
2.1	**Proteomics**	
2.1.1	Protein analysis (includes measurement of concentration, amino-acid composition, N-terminal sequencing),	
2.1.2	2–D electrophoresis of proteins, Microscale solution isoelectricfocusing, Peptide fingerprinting,	
2.1.3	LC/MS-MS for identification of proteins and modified proteins, MALDI-TOF	
2.1.4	SAGE and Differential display proteomics, Protein-protein interactions, Yeast two hybrid systems.	

Unit III:		**08**
3.1	**Functional Genomics, Proteomics and Metabolomics**	
3.1.1	Analysis of microarray data, Protein and peptide microarray–based technology; PCR–directed protein *in situ* arrays	
3.1.2	Structural proteomics	
3.1.3	Metabolomics	

Unit IV:		
4.1	**Biological Databases and Sequence Analysis**	
4.1.1	Introduction biological databases: Types (relational & object–oriented). Primary, secondary & specialized databases.	**16**
4.1.2	Types of databases–Nucleotide sequence database, EMBL, Genebank, Unigene, Genome biology, Protein dBase (Swiss–prot & Trembl and Motif) and 3D structure databases (PDB, SCOP, Cath, Genecards, SRS & Entrez).	
4.1.3	Computational approaches for gene identification, ORF and Human Genome Project.	
4.1.4	Basics of sequence analysis: Alignments using BLAST and FASTA, Multiple Sequence Alignment (CLUSTAL–X and CLUSTAL–W), Application of multiple sequence alignment	
4.1.5	Protein Structure Prediction in Bioinformatics–*Ab initio* based methods, Homology based methods, secondary structure prediction.	
4.1.6	Protein structure comparison–intermolecular and intramolecular methods. Phylogenetic construction by distance based methods	

References

[1] Voet D, Voet JG & Pratt CW, Fundamentals of Biochemistry, 2nd Edition. Wiley 2006
[2] Brown TA, Genomes, 3rd Edition. Garland Science 2006
[3] Campbell AM & Heyer LJ, Discovering Genomics, Proteomics and Bioinformatics, 2nd Edition. Benjamin Cummings 2007
[4] Primrose S & Twyman R, Principles of Gene Manipulation and Genomics, 7th Edition, Blackwell, 2006.
[5] Glick BR & Pasternak JJ, Molecular Biotechnology, 3rd Edition, ASM Press, 1998.
[6] Essential Bioinformatics (Paperback) byJin Xiong. Cambridge University Press.
[7] Bioinformatics: Methods & Protocols by Stephen Misener and Stephen A. Krawetz,
[8] Humana Press.
[9] Essentials of Bioinformatics by Irfan Ali khan and Atiya Khanum. Publisher: Ukaaz Publications.
[10] Bioinformatics: Sequence and Genome Analysis (Hardcover) by David W. Mount. Cold Spring Harbor Laboratory Press
[11] Introduction to Bioinformatics (Paperback) by Arthur M. Lesk. Oxford Univ Press.
[12] Introduction to Bioinformatics: A Theoretical and Practical Approach (Paperback) by David Womble, Stephen A. Krawetz and David D. Womble. Humana Press Inc., U.S.
[13] Applied Bioinformatics: An Introduction (Paperback) y Paul M. Selzer, Richard
[14] Marhofer and Andreas Rohwer. Publisher: Springer-Verlag Berlin and Heidelberg GmbH & Co. K.

Course Code	Title of the Course	Credits
	BIOTECHNOLOGY AND RESEARCH METHODOLOGY	**4**

COURSE OUTCOME(S):

Upon completion of the course, the student is able to

CO1	Understand the concepts of biotechnology
CO2	Provide examples of current applications of biotechnology
CO3	Explain the concept and application of enzyme technology
CO4	Explain the general principles of generating transgenic plants, animals and microbes
CO5	Understand the concepts of research methods, tools and ethics

		No. of Lectures
Unit I:		**12**
1.1	**Tissue culture and transgenesis**	
1.1.1	Techniques of tissue culture–culturing explants and haploids, protoplasts fusion and embryoids.	
1.1.2	Methods of gene transfer to plants, animals and bacteria-Ca transfection, electroporation, shotgun and others.	
1.1.3	Transgenic plants, gene knockouts and transgenic animals.	

Unit II:		**16**
2.1	**Industrial Biotechnology**	
2.1.1	Fermentors: principle, types product recovery and purification of ethanol, citric acid, vitamin B12, streptomycin.	
2.1.2	Enzyme biotechnology–production and uses of industrially important enzymes such as protease, immobilization of enzymes and their applications	
2.1.3	Waste treatment, bioenergy, biogas production, biopesticides and bioleaching.	

Unit III:		
3.1	**Biosafety and Bioethics**	
3.1.1	Biotechnology–potential hazards, biological weapons, biosafety of GM foods and GMOs–substantial equivalence and safety testing.	**08**
3.1.2	Human genome research–the objectives and approaches, genomics and genome prospecting–the controversies, issues of biotechnology-social and scientific, technology protecting systems and the terminator.	
3.1.3	IPR, its concepts and conditions–patenting of genes, cells and life forms, evaluation of life patenting.	

Unit IV:		
4.1	**Research Methodology**	
4.1.1	Types of Research: Academic, Industrial, Clinical, Basic and Applied research. Research objectives, review of literature and hypothesis formulation.	**12**
4.1.2	Information, types and sources. PubMed as a resource. Research Design: Types of studies-cohort, double blind, placebo and cross-over.	
4.1.3	Statistical Methods: Error and significance, sample size and data collection, presentation of data, parametric and non-parametric tests	
4.1.4	Ethical issues: ICMR guidelines of ethical issues, IPR and Plagiarism	

References

[1] Fermentation Biotechnology O.P. Ward. 1989 Prentice Hall.
[2] Biotechnology J.E. Smith Cambridge University Press 1996.
[3] Introduction to Biotechnology Brown, Campbell and Priest Blackwell Science 1987.
[4] A Textbook on Biotechnology H.D. Kumar 2nd edition East West Press 1998.
[5] Molecular Biotechnology Glick and Pasternak, Panima Publ.
[6] From Genes to clones Winnaecker VCH Publication.
[7] Elements of Biotechnology P.K. Gupta, Rastogi Publication, 1998.
[8] Molecular Biology and Biotechnology. Walker and Gingold. 3rd ed. Panima Publ. 1999.
[9] Plant Biotechnology. Ignacimuthu, Oxford, IBH.
[10] Recombinant DNA Technology, Watson, Scientific American Publ.
[11] Principles of Genome analysis, Primrose, Oxford University Press, 1998.
[12] Handbook of Research Methodology: A compendium for scholars and researchers, Dr. Shanti Bhushan Mishra Dr. Shashi Alok, EDUCREATION PUBLISHING, 2019
[13] Research Methodology: A step-by-step Guide for Beginners, 3rd Edition, Ranjit Kumar, SAGE Publications, 2011

Course Code	Title of the Course	Credits
BCC220	PHARMACEUTICAL BIOCHEMISTRY	4

COURSE OUTCOME(S):

CO1 Identify the details of ADME mechanism of drugs

CO2 Learn in details with application, if applicable, Drug receptor interactions

CO3 Deliberate in details with application, if applicable, Mode of action of anti cancer drugs

CO4 Write down in depth Drug tolerance and abuse

		No. of Lectures
Unit I:		**10**
1.1	**Drugs**	
1.1.1	Drugs: History of Drugs Classification of drugs, routes of drug administration, absorption and distribution of drugs.	
1.1.2	Factors influencing drug absorption and elimination of drugs. □	

Unit II:		**14**
2.1	**Drug Receptor and Metabolism**	
2.1.1	Drug-Receptor interactions involvements of binding forces in drug receptor interaction, drug action not mediated by receptors.	
2.1.2	Drug metabolism: Mechanism of phase I and II enzyme reactions, biochemical importance of xenobiotic metabolism. □	

Unit III:		**12**
3.1	**Anticancer Drugs**	
3.1.1	Cancer: Cancer and principles of cancer chemotherapy, mode of action of anti cancer drugs.	
3.1.2	Antimetabolites, antibiotics, alkylating agents and other agents, □	

Unit IV:		**12**
4.1	**Adverse Drug Reactions**	
4.1.1	Adverse drug reactions and drug induced side effects.	
4.1.2	Biological effects of drug abuse and drug dependence.	
4.1.3	Drug tolerance and intolerance. □	

References

[1] The Pharmacology volume I and II –Goodman and Gillman
[2] Basic Pharmacology –Foxter Cox
[3] Oxford text book of Clinical Pharmacology and Drug Theraphy ,D.G Grahme Smith and J.K.Aronson
[4] Pharmacology and Pharmatherapeutics – R.S.Satoskar,S.D.Bhandhakarand
[5] Essentials of Pharmacotherapeutics ,Barav.F.S.K
[6] Lippincotts illustrated review Pharmacology, Mary.J.Mycek,Richards ,Pamela

Course Code	Title of the Course (Open Elective)	Credits
BCC630	NUTRITION AND HEALTH	4

COURSE OUTCOME(S):

CO1 Identify the details of basic concepts of nutrition

CO2 Learn in details with application, if applicable, nutrients

CO3 Deliberate in details with application, if applicable, nutrition associated problems

CO4 Write down in depth social health problems

		No. of Lectures
Unit I:		**10**
1.1	**Basic Concepts in Nutrition**	
1.1.1	Understanding relationship between food, nutrition, health and food pyramid.	
1.1.2	Functions of food: Physiological, psychological and social Basic food groups and concept of balanced diet	
1.1.3	Energy: Functions, sources and concept of energy balance.	
1.1.4	Nutritional requirements: Physiological considerations and nutritional concerns for the following life stages: Adult man / woman Preschool children Adolescent children Pregnant woman, Nursing woman and infant Geriatrics	

Unit II:		**14**
2.1	**Nutrients**	
2.1.1	Functions, Recommended Dietary Allowances, dietary sources, effects of deficiency and/ or excess consumption on health of the following nutrients: Carbohydrates and dietary fibre Lipids Proteins Fat soluble vitamins: A, D, E and K Water soluble vitamins: Thiamin, Riboflavin, Niacin, Pyridoxine, Folate, Vitamin B12 and Vitamin C Minerals: Calcium, Iron, Zinc and Iodine	
2.1.2	Gut Microbiome	

Unit III:		
3.1	**Nutritional problems, their implications and related nutrition programmes**	
3.1.1	Etiology, prevalence, clinical features and preventive strategies of Undernutrition: Protein energy malnutrition, nutritional anemia's, vitamin A deficiency and iodine deficiency disorders Overnutrition: Obesity, Coronary Heart Disease and Diabetes	**14**
3.1.2	National Nutrition Policy and Programmes: Integrated Child Development Services (ICDS) Scheme Mid day Meal Programme (MDMP) National programmes for prevention of Anemia Vitamin A deficiency and Iodine Deficiency Disorders	

Unit IV:		
4.1	**Social health problems**	
4.1.1	Smoking Alcoholism AIDS including AIDS Control Programme	
4.1.2	Nutrition for special conditions: Nutrition for physical fitness and sport, BMI Feeding problems in children with special needs Considerations during natural and man-made disasters e.g. floods, war. Basic guidelines in disaster management	**10**

References

[1] Text Book f Biochemistry with Clinical correlations; Thomas Devlin [Ed.] (1997), Wiley –Liss.

[2] Harper's Review of Biochemistry, Murray et. al., (1997) 24th Edn., Lange

[3] Bryan Derrickson, Gerard J Tortora Principles of Anatomy and Physiology , twelfth Ed, 2011, Wiley & Sons Limited.

[4] Bamji MS, Krishnaswamy K and Brahmam GNV (Eds) (2009). Textbook of Human Nutrition, 3rd edition. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.

[5] Mudambi, SR and Rajagopal, MV. Fundamentals of Foods, Nutrition and Diet Therapy; 2012; New Age International Publishers

[6] Wardlaw GM, Hampl JS. Perspectives in Nutrition; Seventh Ed; 2007; McGraw Hill.

[7] Swaminathan M. Handbook of Foods and Nutrition; Fifth Ed; 1986; BAPPCO.

[8] Suri S. and Malhotra A. Food Science, Nutrition & Food Safety Pearson India Ltd. 2014.

[9] Edelstein S, Sharlin J (ed). Life Cycle Nutrition- An Evidence Based Approach; 2009; Jones and Barlett Publishers.

[10] ICMR (1989) Nutritive Value of Indian Foods. National Institute of Nutrition, Indian Council of Medical Research, Hyderabad.

[11] ICMR (2011) Dietary Guidelines for Indians – A Manual. National Institute of Nutrition, Indian Council of Medical Research, Hyderabad

[12] World Health Organization (2006). WHO Child Growth Standards: Methods and development: Length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age (d).

[13] Lakra P, Singh MD. Textbook of Nutrition and Health; First Ed; 2008; Academic 14 Excellence

Course Code	Title of the Course	Credits
BCD010	MOLECULAR BIOLOGY AND GENE REGULATION	4

COURSE OUTCOME(S):

CO1 Write down the characteristics of DNA characteristics and replication

CO2 Write down in depth Transcription and regulation

CO3 Learn in depth translation

CO4 Identify in depth translational regulation

		No. of Lectures
Unit I:		14
1.1	**DNA Replication and Gene Expression**	
1.1.1	Introduction: Historical perspective, types of RNA, Central dogma of molecular biology.	
1.1.2	DNA Replication: Nearest neighbor base frequency analysis. Replication of DNA semiconservative model-Meselson and Stahl experiment. Direction of replication of *E.coli*, discontinuous replication–Okazaki fragments.	
1.1.3	Composition and properties of DNA polymerase I, II and III. of *E.coli* DNA ligase, fidelity of replication. DNA topoisomerases and gyrases.	
1.1.4	Replication in viruses single stranded DNA virus, ϕX174, rolling circle model. Replication of mitochondrial DNA.	
1.1.5	Organization of prokaryotic and eukaryotic gene–promoters, introns, exons, other regulatory sequences, enhancers, silencers, function of introns.	
1.1.6	Regulation of Gene expression in prokaryotes: Operon model–Lac operon–structure and regulation; Galactose operon–role of two promoters; Arabinose operon–positive control; tryptophan operon–attenuation control.	
1.1.7	Regulation of gene expression at the level of DNA structure: Super coiling, DNA methylation, role of nucleosome structure of eukaryotic DNA in gene expression–eg. glucocorticoid gene, chromatin remodeling	

Unit II:		
2.1	**Transcription and Regulation**	
2.1.1	Transcription: RNA biosynthesis in prokaryotes and eukaryotes- initiation, elongation and termination. RNA polymerase I, II and III. RNA dependent RNA synthesis - RNA replicase of QB virus.	**10**
2.1.2	Processing of eukaryotic mRNA–cap addition, poly A tail addition, intron splicing, RNA editing. Processing of t–RNA.	
2.1.3	Regulation at the level of transcription: Transcription factors, TF II. Formation of initiation complex. Role of enhancers	
2.1.4	Regulation at the level of RNA processing: RNA export and RNA stability. Factors affecting RNA stability. RNA degradation.	
Unit III:		
3.1	**Translation**	
3.1.1	Translation: Genetic code, triplet codon, Universality features of the genetic code, assignment of codons studies of Khorana, Nirenberg, triplet binding techniques, degeneracy of codons, wobble hypothesis, evolution of genetic code and codon usage, variation in the codon usage.	
3.1.2	3D structure of prokaryotic and eukaryotic ribosomes, Translation: initiation, elongation and termination. Role of m–RNA and t–RNA; aminoacyl t–RNA synthetase and its role in translation accuracy, signal sequence, translational proof-reading, translational inhibitors.	
3.1.3	Post translational modification of proteins–signal peptide cleavage, disulphide bond formation, O–and N–Glycosylation, folding of nascent protein, role of chaperones, attachment of glycosyl anchor, and other modifications.	**12**

Unit IV:		
4.1	**Translational Regulation**	
4.1.1	Regulation at the level of translation: Secondary structure in the 5' and 3' untranslated region–eg. Regulation of Ferritin and Transformation of m-RNA. Role of upstream AUG codons. (eg. GCN 4 gene regulation), transplicing and translational introns, protein splicing introns.	**12**
4.1.2	Role of ribosomes in the regulation of translation: Proof–reading mechanism. Ribosomal optimization of translation. Regulation at the level of ribosome assembly. Regulation at the level of post-translational modification, protein stability, N–end rule, PEST and other sequences	

References

[1] Molecular Biology of the Cell, Alberts et al., Garland Publications, (2012).
[2] Molecular Biology, David Freifelder, Narosa Publishers, (1997).
[3] Molecular Biology Robert F. Weaver, McGraw Hill (2012).
[4] Molecular Biology of Gene; Watson, J.D. et al., 5th Edn. Pearson Education; (2004).
[5] Principles of Virology; S.J. Flint et al., ASM Press (2000).
[6] Biochemistry and Molecular Biology; 5th Edn. D.Papachristodoulou, A. Snape, W.H. Elliott, and D. C. Elliott Oxford University Press (2014)
[7] Chromatin structure and Gene Expression; 2nd Edn. Sarah Elgin, Jerry Workman, Oxford University Press (2000)
[8] Molecular Cell Biology; Harvey Lodish 5th Edn. (2010)
[9] Biochemistry 5th Edn. Jeremy M. Berg, John L. Tymoczko, Lubert Stryer (2011).
[10] Genome Stability: DNA Repair and Recombination; James Haber, Garland Science (2013)

Course Code	Title of the Course	Credits
BCD070	GENETICS AND GENETIC ENGINEERING	4

COURSE OUTCOME(S):

Upon completion of the course, the student is able to

CO1	Understand the importance of plasmids and viruses to genetic engineering.
CO2	Understand the principle of Mendelism and gene development
CO3	Describe how mutations occur and scope of population genetics
CO4	Explain the principle of genetic engineering
CO5	Understand the value of and the processes involved in the amplification of DNA

		No. of Lectures
Unit I:		**12**
1.1	**Mendelism and Gene Organization**	
1.1.1	Basic principles of Mendelism–Laws of inheritance, dominance, codominance, epistasis, (eg. Comb shape in chickens). Pleiotropism. Cytoplasmic inheritances (eg. Shell Coiling)	
1.1.2	Organisation of genes in chromosomes–Single copy gene, gene families, tandemly repeating genes, pseudo genes	
1.1.3	Chromosome number–Ploidy, karyotyping, sex chromosome and dosage compensation. Mobile genetic elements,	
1.1.4	Chromosomal basis of human diseases–Extra or missing chromosome, abnormality in chromosome structure–deletion duplication, inversion and translocation.	
1.1.5	Gene and development–Model systems for studying development in Drosophila, genetic control of development in Drosophila, anteroposterior axis, specification role of maternal genes, segmentation of larval body, gap genes, pair rule genes, homeotic genes, complex gene interaction in development, sequential gene action.	

Unit II:		
2.1	**Population Genetics and Mutations**	
2.1.1 2.1.2 2.1.3	Population Genetics–Genetic variation, Hardy–Weinberg Law, genetic frequency, migration, genetic equilibrium Mutations- nature of mutations–spontaneous and induced mutation, conditional lethal (eg. Temperature sensitive) mutation. Biochemical basis of mutation. Point mutation, base substitution mutation, missense, nonsense and silent mutations. Mutation rates. Chemical mutagens, radiation induced mutation, reverse mutations and suppressor mutations–intergenic and intragenic suppression, reversion as a means of detecting mutagens - Ames test Repair Mechanism–DNA repair mechanisms. Reciprocal recombination, site specific recombination, *E. coli* rec system. Holliday model of recombination, SOS repair.	**16**

Unit III:		
3.1	**Tools of Genetic Engineering**	
3.1.1 3.1.2 3.1.3 3.1.4 3.1.5	Basic principles–mechanism of natural gene transfer by Agrobacterium, generation of foreign DNA molecules. Restriction enzymes, their types and target sites, cutting and joining DNA molecules, linkers, adapters, homopolymers, enzymes used in genetic engineering. Cloning vehicles and their properties, natural plasmids, in vitro vectors, cosmids and T-DNA based hybrid vectors. Cloning strategies–cloning with single strand DNA vectors, cDNA cloning and gene libraries, recombinant selection and screening methods, expression of cloned genes–problems and solutions, shuffle vectors. DNA sequencing strategies–Sanger's and Maxam–Gilbert's methods and NGS.	**12**

Unit IV:		
4.1	**Amplification & Applications of Genetic Engineering**	
4.1.1 4.1.2 4.1.3 4.1.4	Amplification of DNA by PCR technique and applications. *Insitu* hybridization, analysis of DNA, RNA and protein by blotting techniques. Marker and Reporter genes. Applications of genetic engineering: Transgenic plants and animals, DNA vaccines and Gene therapy	**8**

References

[1] Singh, J.S., Singh, S.P. and Gupta, S. (2006) Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi

[2] Wilkinson, D.M. (2007). Fundamental Processes in Ecology. An Earth System Approach. Oxford.

[3] Daubenmier, R.F. (1970). Plants and Environment: A text book of Plant Autoecology, Wiley Eastern Private Limited

[4] Daubenmier, R.F. (1970), Plant Communities, Wiley Eastern Private Limited

[5] Odum, E. (2008) Ecology. Oxford and IBH Publisher.

[6] Sharma, P.D. (2010) Ecology and Environment, (8th Ed.) Rastogi Publications, Meerut.

[7] Tom Strachan & Andrew P.Read 1999. Human Molecular Genetics (2nd Edition), John Wiley & Sons.

[8] Ricki Lewis, 1998. Human Genetics-Concepts & Applications (3rd Edition), McGraw-Hill.

[9] T. A. Brown, 1999. Genomes, John Wiley & Sons (Asia) PTE Ltd.

[10] Scott Freeman & Jon C. Herron, 2001. Evolutionary Analysis (2nd Edition), Prentice Hall.

[11] Garner E.J, Simmons, M.J. & Snustad, D.P.1991. Principles of Genetics, John Wiley & Sons Inc, N.Y

[12] Watson, J.D., Hopkins, N. H., Roberts, J. W. Steitz & Weiner, A. M., 1987. Molecular Biology of the Genes, The Benjamin/Cummings Publishing Company Inc., Tokyo.

Course Code	Title of the Course	Credits
BCD060	PROJECT WORK OR DISSERTATION	8

COURSE OUTCOME(S):

CO1 Identify the classification and characteristics of literature survey

CO3 Learn in depth define of objective of project work

CO3 Write down the classification and characteristics of design of experimental methods

CO4 Understand the details of result analysis and interpretation

BLUE PRINT OF QUESTION PAPER FOR C1 & C2 COMPONENT

JSS Mahavidyapeetha

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE

(Autonomous) B N Road, Mysuru - 25

M.Sc. Biochemistry

I/II/III/IV Semester First/Second Internal Assessment Test (Component 1/2)

Title of the Course & Code

Duration: 1hr **Max Marks: 20**

A) Answer any FOUR of the following **4X2=08**

1.
2.
3.
4.
5

B) Answer any ONE of the following **1X4=04**

1.
2.

C) Answer any ONE of the following **1X8=08**

1.
2.

BLUE PRINT OF QUESTION PAPER FOR C3 COMPONENT

JSS Mahavidyapeetha

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE

(Autonomous), Ooty Road, Mysuru – 570025

M.Sc Degree

I/II/III/IV Semester Examination, _____

BIOCHEMISTRY

Course Title & QP Code

Time: 3 Hours Max. Marks: 70

Instructions to Candidates: **Answer any Five questions from Part – A**
Any Four questions from Part – B
Any Three questions from Part – C

Part – A 5X2=10

1.
2.
3.
4.
5.
6.
7.

Part – B 4X6=24

8.
9.
10.
11.
12.
13.

Part – C 3X12=36

14.
15.
16.
17.
18.

CHOICE BASED CREDIT SYSTEM AND
CONTINUOUS ASSESSMENT AND GRADING PATTERN

SYLLABUS FOR

MASTER'S DEGREE PROGRAM
IN
BIO-TECHNOLOGY
(2018-19 ONWARDS)

JSS COLLEGE OF ARTS COMMERCE AND SCIENCE
(An Autonomous College of University of Mysore; Re-Accredited by NAAC with 'A' Grade)

POSTGRADUATE DEPARTMENT OF STUDIES IN BIO-TECHNOLOGY
Ooty Road, Mysore – 570 025, India

POSTGRADUATE DEPARTMENT OF STUDIES IN BIOTECHNOLOGY

Choice Based Credit System and Continuous Assessment and Grading Pattern Syllabus

M.Sc., PROGRAM IN BIOTECHNOLOGY

Scheme of Study – 2018-19 onwards

Credit matrix for Master's Degree Program in Biotechnology

Credits to be earned	I Sem	II Sem	III Sem	IV Sem	Total Credits
Hard Core Course	12	12	12	16	52
Soft Core Course	08	08	04	–	20
Open Elective Course	–	–	04	–	04
Semester Total	**20**	**20**	**20**	**16**	**76**

I SEMESTER			
Course title	**Hard Core(HC)/ Soft Core(SC)**	**Credit pattern (L:T:P)**	**Credits**
Biomolecules and Bioenergetics	HC	3:1:0	4
Bioanalytical Techniques	HC	3:1:0	4
Lab – I	HC	0:0:4	4
Choose any TWO from the following 1. Molecular Genetics 2. Microbiology 3. Cancer Biology 4. Cell Biology	SC	3:1:0	4
	SC	3:1:0	4
NON CREDIT COURSES			
Communication Skills			
		Total credits	**20**

II SEMESTER			
Course title	**Hard Core(HC)/ Soft Core(SC)**	**Credit pattern (L:T:P)**	**Credits**
Molecular Biology	HC	3:1:0	4
Immunology and Immunotechnology	HC	3:1:0	4
Lab – II	HC	0:0:4	4
Choose any TWO from the following 1. Cell Signalling and communication 2. Metabolomics 3. Food and Environmental Biotechnology 4. Pharmaceutical Biotechnology	SC	3:1:0	4
	SC	3:1:0	4
NON CREDIT COURSE			
Employability Skills			
		Total credits	**20**

III SEMESTER			
Course title	**Hard Core(HC)/ Soft Core(SC)/ Open Elective(OE)**	**Credit pattern (L:T:P)**	**Credits**
Bioprocess Engineering and Technology	HC	3:1:0	4
Genetic Engineering	HC	3:1:0	4
Lab – III	HC	0:0:4	4
Choose any ONE from the following 1. Biostatistics, Bioinformatics and Bioentrepreneurship 2. Clinical and Advanced Techniques in Biotechnology	SC	4:0:0	4
Applied Biotechnology * **(For other discipline students)**	OE	4:0:0	4
		Total credits	20
IV SEMESTER			
Course title	**Hard Core(HC)**	**Credit pattern (L:T:P)**	**Credits**
Plant Biotechnology	HC	3:1:0	4
Animal Biotechnology	HC	3:1:0	4
Project Work/Dissertation	HC	0:4:4	8
		Total credits	**16**
		Total credits to be earned for M.Sc. Biotechnology	**76**

∗ Open Elective Course shall be from different discipline of study

1. A student opting I, II and III semester has to appear for at least 12 credits. (Soft core course may be studied any time).
2. Minimum number of students per Soft core course is 15.

L – Lecture – 1 credit = 1 hour

T – Tutorial – 1 credit = 2 hours

P – Practical – 1 credit = 2 hours

ASSESSMENT:

Continous Assessment: C1 – 15% & C2 – 15% (at the end of 8th and 16th week respectively)

Assessment	**IA Test (20 Marks)**	**Assignment (5M)**		**Total (25 Marks)**	**Total reduced to 15 Marks**
		a - Collection of material - 2.5 Marks	b - Prepartion of report - 2.5 Marks		
C1					
C2					

Semester End Assessment: C3 – 70% – By written exam.

Conversion of grades in to credits should be based on relative evaluation calculations.

Program: M.Sc. Biotechnology

Program outcomes (PO):

PO1: To make the students develop interpersonal skills, written and oral communication and also to improve their body language and eye contact during presentations.

PO2: To train the students in group discussions to develop leadership qualities and to respect the others idea and take the decisions for the welfare of society.

PO3: To teach the students not to demoralize the others ideas and not to differentiate the intelligent and the ignorant, poor and the rich and to uphold the moral values in the society.

PO4: Upon completion of course students will have the ability to design the experiments to solve the current problems in the society related to health, environment and industries.

PO5: To make the students competent enough to write the research papers, project proposals and application of mathematics in understanding biological science.

Program Specific Outcomes (PSO):

PSO1: To make the students understand the nature, bio-molecules, their analysis and application in day to day life, so that we are transforming knowledge from nature to lab and lab to beside.

PSO2: Higher studies like M.Phil and Ph.D can be pursued to attain research positions.

PSO3: Various examinations such as CSIR-NET, ARS-NET GATE, ICMR, DBT and many other opens channels for career development.

PSO4: Students have various opportunities in different industrial sector.

PSO5: Several career opportunities are available for students with biotechnology background abroad

PSO6: In practical we teach the students to follow the standard operating procedures of the equipment, troubleshooting the problems and analyse and interpretation of data.

PSO7: To train the students regarding bio-safety in handling corrosive, explosive and radioactive and bio-hazardous compounds.

I SEMESTER

BIOMOLECULES AND BIOENERGETICS (HARD CORE) - 48 Hrs

COURSE CODE: BTA040

Course Outcome

CO1-Study of different biomolecules

CO2-Metabolism and their regulation

CO3-Enzymes and their role in metabolism

CO4- Application of thermodynamics to understand the basic concepts of life.

Unit – I **12 Hrs**

Chemical basis of life; Composition of living matter; Water – properties, pH, ionization and hydrophobicity; Emergent properties of biomolecules in water; Biomolecular hierarchy; Macromolecules; Molecular assemblies; Structure-function relationships

Amino acids – structure and functional group properties; Peptides and covalent structure of proteins; Ramchandran's plot; Elucidation of primary and higher order structures; Evolution of protein structure; Structure-function relationships in model proteins like ribonuclease A, myoglobin, hemoglobin and chymotrypsin.

Unit – II **12 Hrs**

Enzyme catalysis – general principles of catalysis; Quantitation of enzyme activity and efficiency; Enzyme characterization and Michaelis-Menten kinetics; activation, inhibition (reversible & irreversible) and covalent modification; Single substrate enzymes; Bisubstrate reaction (ping-pong and sequential), Applications of enzymes (food& Pharmacy).

Unit – III **12 Hrs**

Sugars - mono, di, and polysaccharides; Suitability in the context of their different functions-cellular structure, energy storage, signaling; Glycosylation of other biomolecules - glycoproteins and glycolipids; Lipids - structure and properties of important members of storage and membrane lipids; lipoproteins

Unit – IV **12 Hrs**

Bioenergetics-basic principles; Equilibria and concept of free energy; Coupled processes; Glycolytic pathway; Kreb's cycle; Oxidative phosphorylation; Photophosphorylation; Elucidation of metabolic pathways; Logic and integration of central metabolism; entry/ exit of various biomolecules from central pathways; Principles of metabolic regulation; Regulatory steps;

Nucleosides, nucleotides, nucleic acids - structure, diversity and function

Texts/References

1. V.Voet and J.G.Voet, Biochemistry, 3rd edition, John Wiley, New York, 2004.
2. A.L. Lehninger, Principles of Biochemistry, 4th edition, W.H Freeman and Company, 2004.
3. L. Stryer, Biochemistry, 5th edition, W.H. Freeman and Company, 2002.

BIOANALYTICAL TECHNIQUES (HARD CORE) - 48 HRS

COURSE CODE: BTA050

Course Outcome

CO1-To understand the separation of molecules by different chromatography, centrifugation and electrophorotic techniques

CO2-Analysis and characterization of molecules by spectroscopy techniques

CO3-Use of radioactive material in understanding metabolic pathways

Unit- I **12 Hrs**

Basic Techniques

Buffers; Methods of cell disintegration; Enzyme assays and controls; Detergents and membrane proteins; Dialysis, Ultrafiltration and other membrane techniques

Spectroscopy Techniques

UV, Visible and Raman Spectroscopy; Theory and application of Circular Dichroism; Fluorescence; MS, MALDI-TOF; NMR and Plasma Emission spectroscopy; Protein crystallization; Theory and methods; API-electrospray; Peptide Synthesis.

Imaging techniques: Compound microscope, fluorescent, phase contrast, TEM, SEM, cryo-electron microscope

Unit-II **12 Hrs**

Chromatography Techniques

TLC and Paper chromatography; Chromatographic methods for macromolecule separation - Gel permeation, Ion exchange, Hydrophobic, Reverse-phase and Affinity chromatography; HPLC and FPLC; Criteria of protein purity

Electrophorotic techniques

Theory and application of Polyacrylamide and Agarose gel electrophoresis; Capillary electrophoresis; 2DElectrophoresis; Gradient electrophoresis; Pulsed field gel electrophoresis

Unit- III **12 Hrs**

Centrifugation

Basic principles; (RCF, Sedimentation coefficient etc); Types of centrifuge -Microcentrifuge, High speed & Ultracentrifuges; Preparative centrifugation; Differential & density gradient centrifugation; Applications (Isolation of cell components); Analytical centrifugation; Determination of molecular weight by sedimentation velocity & sedimentation equilibrium methods

Unit- IV **12 Hrs**

Radioactivity

Radioactive & stable isotopes; Pattern and rate of radioactive decay; Units of radioactivity; Measurement of radioactivity; Geiger-Muller counter; Solid & Liquid scintillation counters (Basic principle, instrumentation & technique); Brief idea of radiation dosimetry; Cerenkov radiation; Autoradiography; Measurement of stable isotopes; Falling drop method; Applications of isotopes in biochemistry; Radiotracer techniques; Distribution studies; Isotope dilution technique; Metabolic studies; Clinical application; Radioimmunoassay

Texts/References

1. Freifelder D., Physical Biochemistry, Application to Biochemistry and Molecular Biology, 2nd Edition, W.H. Freeman & Company, San Fransisco, 1982.
2. Keith Wilson and John Walker, Principles and Techniques of Practical Biochemistry, 5th Edition, Cambridge University Press, 2000.

3. D. Holme& H. Peck, Analytical Biochemistry, 3rd Edition, Longman, 1998.
4. R. Scopes, Protein Purification - Principles & Practices, 3rd Edition, Springer Verlag, 1994.
5. Selected readings from Methods in Enzymology, Academic Press.

LAB – I (HARD CORE)

COURSE CODE: BTA060

Course Outcome

CO1 - Course objective is to introduce the students to the fundamental experiments in the field of Biochemistry, Microbiology and Genetics.

CO2 - Students get the insight to operate simple equipments like colorimeter and spectrophotometer.

CO3 - Identification of microorganisms by morphology and staining techniques. Study of growth kinetics.

CO4 - In genetics students are exposed to know about culture and maintenance of *Drosophila melanogaster* (model organism), Study of mutants, salivary gland chromosome and karyotyping techniques.

Practicals/ Experiments

1. Good laboratory practices
2. Measurement of pH
3. Preparation buffers and solutions
4. Determination of pKavalues of amino acids
5. Estimation of reducing sugar by DNS method
6. Estimation of proteins by Lowry's method
7. Ascending, descending and circular paper chromatography for separation of amino acids (1D & 2D)
8. TLC of amino acids/lipids (1D & 2D)
9. HPLC
10. Estimation of ascorbic acid by DNPH method
11. Estimation of urea
12. Estimation of Phosphate
13. Gel electrophoresis- native and SDS-PAGE and determination of molecular weight of proteins
14. Salivary amylase assay, time kinetics, specific activity, determination of optimum temperature and pH; Effect chloride ions on salivary amylase activity
15. Determination of Km and Vmax. and activation energy for an acid phosphatase (from potato)
16. Effect of inhibitors on enzyme activity
17. Purification of amylase from sweet potatoes: Extraction, ammonium sulphate fractionation, gel filtration. Monitoring of enzyme activity, % activity and % recovery during purification
18. Preparation of liquid and solid media for growth of microorganisms
19. Isolation and maintenance of organisms by plating, streaking and serial dilution methods, slants and stab cultures, storage of microorganisms
20. Isolation of pure cultures from soil and water
21. Growth, growth curve; measurement of bacterial population by turbidometry and serial dilution methods. Effect of temperature, pH, carbon and nitrogen sources on growth.
22. Microscopic examination of bacteria, yeast and molds and study of organisms by gram stain, acid fast stain and staining for spores.
23. Assay of antibiotics and demonstration of antibiotic resistance.
24. Culture of Drosophila melanogaster and Observation of drosophila mutants
25. Isolation of salivary gland chromosomes
26. Biotech Industry and/ or R & D institution visit/s

MOLECULAR GENETICS (SOFT CORE) – 48 Hrs

COURSE CODE: BTA230

Course Outcome

CO1- To understand the molecular mechanism of inheritance

CO2-Mutation and DNA repair mechanism

CO3-Gene mapping and study of chromosomal abnormalities

CO4-Phylogenetics and micro-evolution

CO4-Development of an organism

Unit- I **12 Hrs**

Laws of inheritance in haploid organisms- *Chlamydomonas* and *Neurospora*, uniparental, maternal and cytoplasmic inheritance in yeast, *Neurospora*, paramecium and plants

Genomic organization: Prokaryotes, eukaryotes, viral genome, extrachromosomal genome-plasmids, mitochondria & chloroplast, repetitive elements- LINES and SINES, simple sequence repeats

Mobile genetic elements: discovery, insertion sequence in prokaryotes, complex transposons (Tn10, Tn5, Tn9 and Tn3 as examples), mechanisms, control, consequences and applications of transposition by simple and complex elements.

Unit – II **12 Hrs**

Mutation: Types, causes and detection, mutant types – lethal, conditional, biochemical, loss of function, gain of function, germinal verses somatic mutants, Molecular basis of mutations,insertional mutagenesis

Recombination: Homologous and non-homologous recombination, Holliday model, site-specific recombination

DNA Repair: Mechanism of genetic repair- direct repair, photo reactivation, excision repair, mismatch repair, post-replicative recombination repair, SOS repair

Unit-III **12 Hrs**

Gene mapping methods: Linkage maps, tetrad analysis, mapping with molecular markers, mapping by using somatic cell hybrids, development of mapping population in plants.

Microbial genetics: Methods of genetic transfers – transformation, conjugation, transduction and sex-duction, mapping genes by interrupted mating, fine structure analysis of genes.

Quantitative genetics: Polygenic inheritance, heritability and its measurements, QTL mapping.

Unit-IV **12 Hrs**

Genes and development: Model systems for studying development- *Drosophila, Caenorhabditis, Arabidopsis*.Genetic control of development in Drosophila: anterioposterior axis specification, role of maternal genes, segmentation of larval body, gap genes, pair rule genes, homeotic genes, complex gene interaction in development, sequential gene action. Floral meristems and floral development in *Arabidopsis.*

Human Genetics: Human chromosomes, karyotype – construction, characteristics, staining techniques and nomenclature; chromosomal abnormalities – sex chromosomal and autosomal, inherited disorders, genetic counselling, gene therapy; Human Genome Project, Human Genome Map.

Population Genetics: Genetic variation, Hardy-Weinberg Law, random mating, genetic frequency, natural selection, genetic drift, migration, genetic equilibrium.

Evolution:Molecular basis of evolution, Molecular clock, Molecular phylogenetics

Reference Books

1. Genetics. Strickberger, M. W., Prentice Hall of India Pvt. Ltd.
2. Genetics – A Molecular Approach. Brown, T. A. Chapman and Hall.
3. Genes VII. Lewin, B. Pearson Education International. 2003.
4. Genetics- A Conceptual Approach. Benjemin A Pierce.

CANCER BIOLOGY (SOFT CORE) – 48 Hrs

COURSE CODE:

Course Outcome

CO1**-**Understanding the normal and cancerous cell

CO2-Protooncogens, tumor suppressor genes and apoptotic genes – regulation

CO3-Diagnosis and treatment of cancer

Unit-I

Cancer Biology: **12 Hrs**

Introduction, historical perspective, classification, Carcinogenesis, cancer initiation, promotion and progression, Cancer cell cycles, Genomic instability, Apoptosis, Genes and proteins as players in apoptosis, DNA viruses/ cell immortalization.

Unit-II **12 Hrs**

Cancer Genes I: Oncogenes and signal transduction

Cellular proto-oncogenes, oncogene activation, Growth factors, growth factor receptors, signal transduction , Transcription, Transcription factors and cancer, Retroviral oncogenes, Tumor suppressor, Tumor suppressor gene pathways, DNA methylation, epigenetic silencing of suppressor genes.

Unit-III **12 Hrs**

Understanding Cancer as a Disease: natural history of cancer development

Free radicals, antioxidants and metabolic oxidative stress and cancer, Epidemiology of selected cancers, Gene rearrangements, detecting oncogene abnormalities in clinical specimens, Cell: cell interactions, cell adhesion, angiogenesis, invasion and metastasis, Antiangiogenic therapy of cancer.

Unit-IV **12 Hrs**

Current concepts in cancer therapy

Strategies of anticancer chemotherapy, Strategies of anticancer gene therapy/translating therapies from the laboratory to the clinic, Gene discovery in cancer research, cancer genome anatomy project , Cancer immunity and strategies of anticancer immunotherapy, stem cells and their applications in cancer therapy.

Reference Books

1. Molecular Biology of the Cell. Bruce Alberts

MICROBIOLOGY (SOFT CORE) – 48 Hrs

COURSE CODE: BTA240

Course Outcome

CO1- To understand the microbial taxonomy

CO2-Handling, preservation and sterilization of microbes

CO3-Microbial interactions with different hosts

CO4-Application of microorganisms in the field of agriculture, environment and health sciences

Unit-I **12 Hrs**

Microbial Diversity & Systematics

The beginning of microbiology: The discovery of the microbial world – Hook, Anton van Leeuwenhoek and Cohn; Contribution of Pasteur and Koch. Development of pure culture methods; the enrichment culture methods. Methods in Microbiology: Pure culture techniques; the theory and practice of sterilization.

Classical and modern methods and concepts; Domain and Kingdom concepts in classification of microorganisms; Criteria for classification; Classification of Bacteria according to Bergey's manual; Molecular methods such as Denaturing Gradient Gel Electrophoresis (DGGE), Temperature Gradient Gel Electrophoresis (TGGE), Amplified rDNA Restriction Analysis and Terminal Restriction Fragment Length Polymorphism (T-RFLP) in assessing microbial diversity; 16S rDNA sequencing and Ribosomal Database Project.

Unit-II **12 Hrs**

Microbial Growth & Physiology

Ultrastructure of Archaea (Methanococcus); Eubacteria (*E.coli*); Unicellular Eukaryotes (Yeast) and viruses (Bacterial, Plant, Animal and Tumor viruses); Microbial growth: Batch, fed-batch, continuous kinetics, synchronous growth, yield constants, methods of growth estimation, stringent response, death of a bacterial cell. Factors affecting growth like temperature, acidity, alkalinity, water availability and oxygen. Microbial physiology: Physiological adoption and life style of Prokaryotes; Unicellular Eukaryotes and the Extremophiles (with classical example from each group)

Unit-III **12 Hrs**

Microbial Interactions and Infection

Host–Pathogen interactions; Microbes infecting humans, veterinary animals and plants; Pathogenicity islands and their role in bacterial virulence. Chemotherapy/antibiotics: Types, mode of action, resistance to antibiotics.

Unit-IV **12 Hrs**

Microbes and Environment

Role of microorganisms in natural system and artificial system; Influence of Microbes on the Earth's Environment and Inhabitants; Ecological impacts of microbes; Symbiosis (Nitrogen fixation and ruminant symbiosis); Microbes and Nutrient cycles; Microbial communication system; Quorum sensing; Microbial fuel cells; Prebiotics and Probiotics.

Texts/References

1. Pelczar MJ Jr., Chan ECS and Kreig NR., Microbiology, 5th Edition, Tata McGraw Hill, 1993.
2. Maloy SR, Cronan JE Jr., and Freifelder D, Microbial Genetics, Jones Bartlett Publishers, Sudbury, Massachusetts, 2006.

3. Crueger and A Crueger, (English Ed., TDW Brock); Biotechnology: A textbook of Industrial Microbiology, Sinaeur Associates, 1990.
4. G Reed, Prescott and Dunn's, Industrial Microbiology, 4th Edition, CBS Publishers, 1987.
5. M.T. Madigan and J.M. Martinko, Biology of Microorganisms, 11th Edition, Pearson Prentice Hall, USA, 2006.

CELL BIOLOGY (SOFT CORE) – 48 Hrs

COURSE CODE:

Course Outcome

CO1-Understanding the structure and function of bacterial, plant and animal cell

CO2-Cell signalling and communication

CO3-Study of growth factors and their function

CO4-Tumor biology of a cell

Unit-I **12 Hrs**

Membrane and membrane phenomenon: Membrane structure and principles of organization, Membrane proteins, glycoproteins and glycolipids, specialization of plasma membrane, transport across cell membrane – types of transport, ion channels, active transport and ion pumps, symport, antiport, plant and prokaryotic membrane transport proteins. Cell organelle and membrane proteins: Mechanism and regulation of vesicular transport, Golgi and post golgi storing, receptor mediated endocytosis.

Unit-II **12 Hrs**

Microfilament, cell motility and cell shape: actin, actin architecture and assembly, myosin, muscle contraction, microtubules structure and dynamics, microtubule associated protein, cilia, flagella, intermediate filaments.

Multicellularity: Extracellular matrix, hyaluronan and proteoglycan, matrix proteins and their receptors, adhesive proteins, cell junctions, structure and function of plant cell wall.

Cellular signaling: Extra cellular signaling, G-protein linked receptors, role of cAMP, receptor tyrosine kinases, Ca^{2+} as a second messenger, multiplex signaling pathways, insulin receptor and regulation of blood glucose, regulation of cell surface receptors and transcription factors in signaling pathways, Chemical messenger – peptide and steroid hormones, mechanism of hormone action.

Unit-III **12 Hrs**

Growth factor: Growth factor structure (PDGF, VEGF), mechanism of action (PDGF, VEGF), receptors, signal transduction, plant growth factors and hormones – auxins, cytokinins and other

Cell Cycle: General strategy of cell cycle, discrete cell cycle events, cell cycle control, early embryonic cell cycle, yeast cell cycle, molecular genetics of cell cycle control, cyclins, cyclin dependent kinase, inhibitors, cell division control in multicellular organism, apoptosis.

Unit-IV **12 Hrs**

Tumor biology: Retroviruses, retro viral transformation of host, development and causes of cancer, proto-oncogene, conversion from proto-oncogene to oncogene, tumor suppressor gene, role of p53 in cancer, cell culture uses in research, molecular medicine and cancer.

Nerve cells: Action potential, voltage gated ion channels, nicotinic acetylcholine receptor, other neurotransmitters and their transporters, sensory transduction – the visual and olfactory system.

Reference Books

1. Molecular Biology of the Cell. Alberts, B., *et al.,* 4th Edition. Garland Publ. Inc.
2. Molecular Cell Biology. 5th Edn. Lodish, H., *et al.,* W H Freeman.
3. Genes VII. Lewin, B. Pearson Education International.
4. Cell and Molecular Biology. Karp, J. John Wiley and Sons Inc.

NON CREDIT COURSE

COURSE CODE:

Course Outcome

CO1-Interpersonal skills (body language, eye contact)
CO2-Presentation skills
CO3-Writing emails, research papers and proposals and business reports

Communication Skills Module

Business Etiquette – Video Conferencing (VC): Introduction to Video Conferencing; Concept & uses of VC; VC Etiquette

Business Communication: Seven Cs of communication: Complete, Courteous, Considerate, Clear, Concise, Concrete, Correct; Verbal/ Nonverbal Communication

Writing Process: Identifying objective; Categorizing Information; Organizational Patterns; Designing document; Memo writing; Revision checklist; Releasing document

Business Proposal & Report Writing: Types of Proposals; Top-Down & Bottom-Up Approach; Study of Technical Bid & Cost Bid; Transmittal Letters; Formal Reports (Short and Long); Types of graphics & illustrations; Business Report Templates; Study of Sample Proposals;

Project Report Writing: Project Charter; Project Plan; Gant Chart; Activities List; Resources List; Risks List, Project Status Report; Project Closure Report; Types of graphics & illustrations; Study of Project Report Templates

Email Writing: Problems resulting out of emails; Contents of email, Importance of a good subject line; Dos and Don'ts; Using your email software to its maximum; Setting up signatures; Setting up accounts; Creating HTML stationary; Creating email templates for common emails; Using short mails for internal communication; Importance of acknowledging emails; Creating folder structure for easily accessing emails; Care to be taken while deleting emails, Archiving emails; Comparison of emails and letters; Writing typical emails, sending point-wise reply to emails

Cross-Cultural Training: Cross-Cultural Sensitivity; American, European, Australian, Middle-east and South-East Asian countries culture training; Cultural Foundations; Cross Cultural Communication; Communication Styles; Comparative Values (American – Indian); Regional Dialects; Cross-Cultural Customer Attitude & Expectations

Interpersonal Skills: Introduction & Importance of Interpersonal Skills; Cost of Poor interpersonal skills; Standing up for self assertiveness; Strategies to achieve self-assertiveness; Managing conflicts, disputes; Dealing with Diversity Interpersonal Relationship and influence

II SEMESTER

MOLECULAR BIOLOGY (HARD CORE) – 48 Hrs

COURSE CODE: BTB020

Course Outcome

CO1- The student will get an idea about the genomic organization of prokaryotes and eukaryotes.

CO2-Obtain in depth knowledge of genetic code, DNA replication and transcription.

CO3-Understand principles, concepts of translation, post translation mechanism

CO4-Regulation of gene expression in prokaryotes and eukaryotes

CO5-Gain the insight into molecular mechanism of antisense molecules, inhibition of splicing and application of antisense and ribozyme technologies.

Unit-I **12 Hrs**

Genome organization:Organization of bacterial genome; Structure of eukaryotic chromosomes; Role ofnuclear matrixin chromosome organization and function; Matrix binding proteins; Heterochromatin and Euchromatin; DNA reassociation kinetics (Cot curve analysis); Repetitive and unique sequences; Satellite DNA;DNA melting and buoyant density; Nucleosome phasing; DNase I hypersensitive regions

DNA topology: Closed and super coiled DNA, DNA topoisomerases,

DNA replication: Enzymes in DNA replication, DNA Pol I, II III, replication in single stranded DNA viruses, replication in prokaryotes, eukaryotic DNA replication, eukaryotic polymerases, role of other proteins and enzymes in replication, fidelity of replication, replication of mitochondrial DNA, inhibitors of replication.

Unit- II **12 Hrs**

Genetic code: Elucidation, Contributions of Khorana and others, triple binding assay, Wobble hypothesis.

Transcription: Transcription unit, RNA polymerase in prokaryotes, mechanism of transcription-initiation, elongation and termination. Eukaryotic transcription - eukaryotic RNA polymerase, transcription factors, initiation, elongation and termination of transcription, inhibitors of transcription; post transcriptional modifications – capping, polyadenylation, splicing, introns and exons. Structural organization of mRNA, tRNA and rRNA, nuclear export of mRNA and mRNA stability

Unit-III **12 Hrs**

Translation: Molecular anatomy and biogenesis of ribosome, partial reconstitution experiments; Amino acid activation- amino acylation of tRNA; prokaryotic and eukaryotic translation– mechanism of initiation, elongation and termination, inhibitors of translation, post translational modifications, protein glycosylation.

Protein localization: Synthesis of secretory proteins and membrane proteins; import into nucleus, mitochondria, chloroplast and peroxisomes.

Regulation of gene expression in Prokaryotes: Basic control circuits, positive and negative regulation; Operon concept – *lac*, *ara* and *trp* operons- catabolite repression, regulatory elements in prokaryotes, attenuation, antitermination, regulation of gene expression in Bacteriophage.

Unit-IV **12 Hrs**

Regulation of gene expression in Eukaryotes: *cis* control elements – promoters, enhancers, *trans* acting factors, DNA binding motifs of transcription factors, mechanism of regulation by transcription factors, NFkB histone acetyl transferase and deacylase, hormonal regulation of gene expression, post transcriptional control.

Antisense RNA and ribozymes: Molecular mechanism of antisense molecules, inhibition of splicing, disruption of RNA structure, hammerhead, hairpin ribozymes, Application of antisense and ribozyme technologies. RNA interference, RNA induced gene silencing.

Reference Books

1. Molecular Biology. Freifelder, D. Narosa Pub House.
2. Advance Molecular Biology. Twyman, R. M. Viva Book Pvt. Ltd.
3. Molecular Biology. JD Watson
4. Molecular Biology of the Cell. Bruce Alberts.
5. Genes, Benjamin XII ,2017

IMMUNOLOGY AND IMMUNOTECHNOLOGY (HARD CORE) – 48 Hrs

COURSE CODE: BTB050

Course Outcome

CO1- Study basic concepts of immunology

CO2- MHC and their role in transplantion

CO3-Cytokines and their role in immune system

CO4-Tumor immunology

CO5-Autoimmune diseases

CO6-Hypersensitivity

CO7-Vaccine production.

Unit-I **12 Hrs**

Immune system: Structure, functions and organization of cells and organs involved in immune systems – T cells, B-cells, macrophages, Eosinophils, Neutrophils, Mast cells; bone marrow, spleen, thymus, lymph node, peyer's patch; Infections and immune responses – Innate immunity, acquired immunity; clonal nature of immune response; Immunohaematology – blood groups antigens, blood transfusion and Rh incompatibilities.

Antigens: Types, haptens, adjuvants, antigenic specificity.

Antibodies:Structure of immunoglobulins, heterogeneity, sub-types – iso-, allo- and idio- types and their properties

Unit-II **12 Hrs**

Complements: Structure, components, properties and functions of complement pathways, biological consequences of complement activation; Immunological diversity;

Effector mechanism: T-cell cloning, mechanism of antigen recognition by T-cells and B-lymphocytes and their properties, receptors and related diseases.

Role of class II MHC molecules in T-cell cloning, antigen specific and alloreactive T-cell cloning, applications of T-cell cloning in understanding relevant antigens and T-cell subtypes; T-cell cloning in vaccine development

MHC and Tumor immunology: Structure and function of MHC and the HLA system; regulation of Ir-genes; Tumor immunology– Tumor specific antigens, Immune response to tumors, theory of surveillance, immune diagnosis of tumor; Tumor markers – Alpha fetofoetal proteins, carcinoembryonic antigen

Unit-III **12 Hrs**

Immune responses and Transplantation: HLA and tissue transplantation; Tissue typing methods for organ and tissue transplantation in humans; Graft versus host rejection, Host versus graft rejection; Xenotransplantation; Immunosuppression theory; Autoimmune diseases – Hashimoto's disease, Systemic lupus erythematosis, Multiple sclerosis, Myasthenia gravis, Rheumatoid arthritis and the remedies.

Allergy: Type I – Antibody mediated – Anaphylaxis, Type II – antibody dependent – Cytolytic and Cytotoxic, Type III – Immune complex mediated reactions**–** Arthus reaction, serum sickness, Type IV– Cell mediated hypersensitivity reaction– Tuberculin type.

Unit-IV **12 Hrs**

Lymphokines and Cytokines– assay methods, related diseases; Immunological tolerance; production of interleukins and interferons– applications.

Immunizations: Conventional vaccines, sub-unit vaccines, DNA vaccines, toxoids, antisera; common immunization – small pox, DPT, hepatitis, polio, measles

Reference Books

1. Immunology. Roitt, Gower Medical Publisher.
2. Fundamental Immunology. Paul W E Raven Press.
3. Immunology. Kuby
4. Immunology, JanewasTraves, Walpart, SHlomehik. Churchill Livingstone.
5. An introduction to Immunology. Rao, C. V. Nasora pub house.
6. Immunology – A short course. Coico, R., Sunshine, G. and Benjamini, E. John Wiley and sons.
7. Cellular Interactions and Immunobiology. BIOTOL series. Butterworth-Heinemann.

LAB – II (HARD CORE)

COURSE CODE: BTB060

Course Outcome

CO1-Students are trained to get the skills in the field of Molecular biology and Genetic engineering

CO2- , Isolation and purification of nucleic acids and their quantification

CO3-Study of antigen and antibody interactions.

CO4 -Preparation of wine and analysis of food samples

Practicals/ Experiments

1. Identification of normal and abnormal human karyotype
2. Localization of Barr bodies
3. Estimation of free fatty acids by titrametric method
4. Saponification value for commercial oil samples
5. Determination of iodine value of an oil
6. Determination of total carbohydrates by phenol-sulphuric acid method
7. Estimation of cholesterol
8. *In vitro* transcription
9. Total RNA extraction
10. Estimation of DNA by Diphenylamine (DPA) method
11. Estimation of RNA by orcinol method
12. Isolation of DNA different samples: plant leaves, coconut endosperm, yeast, animal tissues
13. Determination of purity and concentration of isolated DNA using spectrophotometer
14. Agarose gel electrophoresis of DNA
15. Analysis of microbial quality of foods – Litmus test, catalase test and dye reductase test in milk, estimation of lactic acid in milk
16. Preparation of wine
17. Estimation of percentage of alcohol in wine
18. Chemical method to differentiate between ethanol from methanol
19. Estimation of total acids in wine
20. Conjugation
21. Phage titration
22. Preparation of antigen and antibody production
23. Purification of IgG/IgY
24. Slide agglutination test/blood grouping
25. Antibody labeling
26. Immunoprecipitation test- ODD
27. ELISA for quantification of an antigen
28. Lymphocyte preparation
29. Rossette assay
30. Rocket immunoelectrophoresis

Biotech Industry and/ or R & D institution visit

CELL SIGNALLING AND COMMUNICATION (SOFT CORE) – 48 Hrs

COURSE CODE: BTB220

Course Outcome

CO1- Understanding the multi-cellularity of organisms

CO2-role of extracellular matrix in signalling

CO3-various signalling pathways from the cell surface to the nucleus

CO4-cell signalling in plants

CO5-microbe-plant and insect-plant interaction.

Unit-I **12 Hrs**

Multicellularity: Role of Extracellular matrix - hyaluronan and proteoglycan. Matrix proteins and their receptors, adhesive proteins and cell junctions in multicellularity. Structure and function of plant cell wall

The importance of the matrix in signal transduction: Cell surface receptors as reception of extra-cellular signals, Amplification of signal during transmission - a quantitative study,Tyrosine kinase and tyrosine phosphatase, Cell membrane components and adapter proteins required for signal transmission, Upstream and downstream signal transduction without cell surface receptor activation, G-protein coupled signaling; the secondary messengers in signal transduction pathways cAMP, Ca^{2+}, Reactive Oxygen Species and Hypoxia Signalling, Apoptosis Signaling Transduction Pathway, PI3K/AKT Cell Survival Pathway.

Unit-II **12 Hrs**

Various signal transduction pathways from cell surface to nucleus: MAP kinase pathway, SAP/JNK pathway, p38 pathway, ERK pathway, NFkB pathway, Cell survival pathway, Wnt signaling pathway, Jak/Stat pathway, Smad pathway,TGF β Signaling, EGFR, VEGF And their Signalling, Cytoskeleton And Cell Signalling, Carbohydrate Recognition Signaling, MMPs And Cell Signalling, Cross talk among cell surface receptors, Cross talks among cytoplasmic components, Translocation of signal components during signal transmission, From cytoplasm to cell membrane, NF-κB Signaling from cytoplasm to nucleus, Cell cycle and its Signalling.

The end point of signal transduction--- gene transcription: Nuclear receptors and transcription factors in signalling, Signalling from single gene expression to multiple gene expression: Super array as a tool for the study of multiple gene transcription, Practical application of the signal transduction research, RNA Interference And Cell Signalling, Senescence and Its Signaling Pathways.

Unit-III **12 Hrs**

Signal transduction in plants: Cross-talk with the environment- wound and mechanical signalling - fatty acid signalling, peptide signalling, oligosaccharide signalling; protein kinases and signal transduction. Abiotic stresses - Dehydration-stress, salt-stress, cold acclimation, heat-stress

Role of active oxygen species (AOS) in plant signal transduction: AOS in plants, AOS as signal molecules, AOS-part of a signalling network.

Action of phytohormones: Multiple signals regulating growth and development of plant organs and their adaption to environmental stresses.

Unit-IV **12 Hrs**

Symbiotic plant-microbe interaction: Rhizospheric signals (PGPR) and early molecular events in the ectomycorrhizal symbiosis; Lipo-chito-oligosaccharides (LCO) signalling in the interaction between rhizobia and legumes; endophytes.

Recognition and defencesignalling in plant-microbe interaction: Resistance genes - gene-for-gene resistance; co-evolution and specificity of R genes; the TIR domain, the NBS domain; genetic organization of resistance genes; quorum sensing.
Plant-insect interaction: Induction of direct and indirect defence

Reference Books

1. Animal Cell Biotechnology – Methods and Protocols. Nigel Tenkins.
2. Molecular biology of the Cell –Alberts et al.
3. Molecular Cell Biology. 5th Edn. Lodish, H, et al., W H Freeman
4. Cell and Molecular Biology. Karp, J.JohnWiey and Sons In.
5. The Cell-Molecular approach. 4th Ed. Geoffrey M Cooper and Robert E Hausman.
6. Cell Biology- A Laboratory Handbook. 3rd Ed, 4th Vol, Julio E Celis

METABOLOMICS (SOFT CORE) – 48 Hrs

COURSE CODE:

Course Outcome

CO1-Understanding the basic metabolism of plants

CO2-Different pathways involved in secondary metabolite production

CO3-Altering the metabolic pathways by changing the precussors

CO4-Purification of useful secondary metabolites and their kinetics and dynamics

CO5-Applications in food and pharmaceutical industries

Unit-I **12 Hrs**

Plant Metabolomics: Developments and history of plant metabolomics, Nature and prospecting of metabolism-related secondary plant products, tools and techniques, production in culture: optimization; selection, hormonal kinetics for secondary metabolites, production, mechanism and control.

Unit-II **12 Hrs**

Production of secondary metabolites: Induction, Alkaloids, antitumor compounds, food additives, steroids and saponins, detoxification of secondary metabolites, production of secondary metabolites by bioconversion, genetic transformation for production of secondary metabolites, large-scale production in bioreactors, Metabolomics-assisted breeding.

Unit-III **12 Hrs**

Microbial metabolomics: Systems biology of microbial metabolism; microbe sensors, *In silico* metabolomes, Food and Applied metabolomics, Biomarker discovery. Experimental Approaches-Genome sequencing, Gene expression arrays, Nuclear Magnetic Resonance, Mass spectroscopy, Capillary electrophoresis, Two dimensional gel electrophoresis, Gene expression arrays, Pathway analysis, HPLC, Protein sequencing, Bench-scale fermentation, AFLP/RLFP analysis.

Unit-IV **12 Hrs**

Pharmacometabolomics: personalized medicine and future of health system, Pathways discovery and disease pathophysiology, Bioinformatics analysis of targeted metabolomics; Environmental metabolomics, Bioactive compounds and Pharmacognosy, Clinical Applications of Metabolomics, Nutrigenomics and Metabolomics, Novel Technologies for Metabolomics, Data Handling for Metabolomics.

Reference Books

1. V.Voet and J.G.Voet, Biochemistry, 3rd edition, John Wiley, New York, 2004.
2. A.L. Lehninger, Principles of Biochemistry, 4th edition, W.H Freeman and Company, 2004.

FOOD AND ENVIRONMENTAL BIOTECHNOLOGY (SOFT CORE) – 48 Hrs

COURSE CODE: BTB210

Course Outcome

CO1-Comprehensive insight into the fermented foods and enzymes in food industry

CO2-Obtain knowledge of functional foods, genetically modified foods and nutraceuticals.

CO3-Students will be able to understand current status of biotechnology in environment protection.

CO4-Understand the principles of bioremediation and significance of GMO to the environment.

Unit-I **12 Hrs**

Fermented foods, milk-based products, fermented vegetables, fermented meats, fish, beverages, vinegar, mould fermentation - tempeh, soysauce, rice wine.

Enzymes in dairy industry, cheese making and whey processing, impact of enzyme technology (protein hydrolysates, bioactive peptides), Enzymatic processing of fruit juices; role of enzymes in baking, meat and meat processing, phytase in animal feeds, DNA-based methods for food authentication, comparative methods of toxicity testing in (novel) foods, biological approach to tailor-made foods, application of generic technologies in food and nutritional sciences; anti-cancer components in foods.

Unit-II **12 Hrs**

Functional foods and Biotechnology: applying molecular, biochemical, cellular and bioprocessing concepts, use of specific phenolic metabolites from botanical species. Pre- and Pro-biotics, single cell protein, single cell lipids. Manipulation of fruit ripening process.

Food processing, principles and practices, food ingredients and processing aids from biotechnological processes, corn sweeteners, bacterial starter cultures, Food spoilage, preservation, mycotoxins in food commodities. Genetically modified foods, designer foods, Nutraceuticals, detection of GM foods.

Unit-III **12 Hrs**

Renewable and non-renewable resources, current status of biotechnology in environment protection. Characterization of waste. Waste water management: Bioreactors for waste-water treatment, Aerobic biological treatments, anaerobic biological treatments, treatment of industrial effluents-dairy, distillery, paper and sugar industries. Membrane-based waste water treatment.

Oil pollution – treatment with microorganisms.

Unit-IV **12 Hrs**

Bioremediation: Concepts and principles, bioremediation using microbes, in situ and ex situ bioremediation, biosorption and bioaccumulation of heavy metals.

Xenobiotics: Degradation capabilities of microorganisms with reference to toxicology, pesticides, herbicides, polyaromatic hydrocarbons.

Renewable energy: Relevance of GMO to the environment.

Solid waste management: Waste as a source of energy, biotechnology in paper and pulp industry, production of oil and fuels from wood waste, anaerobic and aerobic composting, vermiculture, biofuels.

Reference Books

1. Food Microbiology. Frazier, W. C. and Westhoff, D. C. Tata McGraw Hill.
2. Agriculture Bio-technology. Purohit. Agrobios India.
3. Food Bio-technology. Knorr, D. Marcel Dekker Inc.
4. Environmental Bio-technology. Jogand, S. N. Himalaya Publishing House, New Delhi.

PHARMACEUTICAL BIOTECHNOLOGY (SOFT CORE) – 48 Hrs

COURSE CODE:

Course Outcome

CO1-Rules and regulation regarding development of drugs

CO2- Study of Pharmacodynamics and pharmacokinetics of drugs

CO3-Different phases of clinical trials and drug toxicity studies.

CO4-GMP and GLP in production management and quality control and assessment

Unit- 1 **12 Hrs**

Introduction to pharmaceuticals and Drug development process: Introduction to pharma industry, history of the pharmaceutical industry, traditional pharmaceuticals of biological origin (animal, plant and microbial)biopharmaceuticals and pharmaceutical biotechnology, age of biopharmaceuticals, biopharmaceuticals: current status and future prospects.

Steps involved in drug development process, drug delivery systems, preclinical studies and principles practices, phases of clinical trials. Regulatory authorities in India, USA and Europe and Japan, prescription, non- prescription drugs and orphan drugs.-

Unit-II **12 Hrs**

Drug Receptors, Pharmacodynamics and pharmacokinetics.: Different types of drug receptors, second messengers (cAMP, Ca2+ and phosphoinositides) and their signalling mechanism, relation between drug concentration and respose, concentration effect curves, concentration- effect curves, relation between drug dose and clinical responses.Volume of distribution of drug, clearance, drug accumulation, bioavailability, alternative routes of administration and the first pass effect, therapeutic drug monitoring

Unit-III **12 Hrs**

Drug biotransformation and drug toxicity:The role of biotransformation in drug disposition, phase I metabolism (microsomal oxidation, hydroxylation, dealkylation), phase II metabolism (Drug conjugation pathway) CYP families, clinical relevance of drug metabolism, drug-drug interaction.

Mechanisms of toxicity, production of toxic metabolites, harmful immune response, idiosyncratic toxicity, contexts of drug toxicity, drug overdose, drug- drug interactions, pathology of drug toxicity. Cellular toxicity, organ and tissue toxicity.

Unit-IV **12 Hrs**

The drug manufacturing process and drugs of biopharmaceutical origin: Guides to good manufacturing practice, manufacturing facility. Clean rooms, cleaning, decontamination and sanitations (CDS), CDS of the general manufacturing area, CDS of the Process equipment, generation of purified water, water for injection, documentation, specifications, Concept and testing of pre- formulations & their parameters. Tablets: Compressed, granulation, coatings, pills and capsules, parenteral preparations, herbal extracts, oral liquids, Ointments. Processing and packing instructions.

Therapeutic enzymes: asparginase, DNAse, Glucocerebrosidase, galactosidase and urate oxidase, superoxide dismutase, Lactase.

Reference Books

1. Textbook of Pharmaceutical Biotechnology. Chandrakant Kokate, Pramod H.J, SS Jalalpure. Elsevier Health Sciences, 2012
2. Pharmaceutical Biotechnology: Concepts and Applications. Gary Walsh. John Wiley & Sons, 2013
3. Pharmaceutical Biotechnology, Second Edition. Michael J. Groves. Taylor & Francis, 2005

NON CREDIT COURSE

EMPLOYABILITY SKILLS MODULE

COURSE CODE:

Course Outcome

CO1- Concepts of corporate communication
CO2- English grammar skills
CO3- Develop strategies for negotiation and marketing
CO4- Personality development and interview skills
CO5- This course will enable students to learn about the project management, entrepreneurship.

Campus to Corporate: Transition from College to Corporate world; Perceptions v/s Real Corporate life; Working in Teams; Basics of corporate communication

Corporate & Office Etiquette: Elements of a good handshake; Visiting cards exchange & How to manage business cards; Small Talk & Networking; Basics dining etiquette

English Grammar: A quick round up: Nouns, Pronouns, Adjectives, Verbs, Adverbs, Tenses, Prepositions, Clauses, Subject and Predicate, Punctuations, Subject- verb agreement, Confusing prepositions, Missing Articles, Editing paragraphs

Negotiation Skills: Introduction to Bargaining and Negotiation; The Negotiation Process: Four Stages; An Analytical framework of Negotiation; Bargaining Approaches; Strategy for Value Added Negotiation

Selection & Interviewing Skills: Current market for talent & methods for attracting & sourcing; Best practices for different hiring situations - Campus, Market, Head hunter agencies; Selection process design & assessment centers; Effective interview

Personality Development: Self assessment: SWOT; Understanding Personality - Identifying different personalities; Levels of Human Learning; Change v/s Transformation; Sensitivity - Sharpen your senses; Creativity and Lateral thinking; Developing Positive Mental Attitude; Emotional Quotient; Handling Criticism; Positive Health; Food habits and Meditation; Goal setting - Creative Visualization - Law of Attraction; Living a created life - Personal Leadership

III Semester

BIOPROCESS ENGINEERING AND TECHNOLOGY (HARD CORE) – 48 Hrs

COURSE CODE:

Course Outcome

CO1-To have the **c**omprehensive insight into the different type of fermenter
CO2-To obtain knowledge of media design and industrial culture
CO3-Students will be able to understand different type of fermenter and bioreactor.
CO4-Understand the principles of downstream processing
CO5- To understand the enzyme technology and their applications in industry.

Unit-I **12 Hrs**

Basic principle of Biochemical engineering and Microbial Growth Kinetics:

General Introduction to metabolic pathways involved in microbial products, concepts of over production, primary and secondary metabolites, estimation of biomass. Isolation, screening and maintenance of industrially important microbes; Microbial growth kinetics, Strain improvement for increased yield and other desirable characteristics.

Batch culture, continuous culture, fed batch culture, the growth cycle, effect of nutrients, growth rate and cell cycle.

Unit II **10 Hrs**

Media design and industrial cultures: Introduction, typical media, Oxygen requirement, antifoams, media formulation, energy sources, carbon and nitrogen source, other components, media optimization , Media sterilization, Batch process (thermal death kinetics), continuous sterilization process. Sterilization of fermenter and other ancillaries, filter sterilization of air and media. Rheological properties of medium. Screening for industrial useful metabolites, maintenance of stock cultures

Unit III **10 Hrs**

Types of fermenters and bioreactors: design, control system, operation, optimization, control and monitoring of variables such as temperature, agitation, pressure, pH, online measurements and control, Scale up of bioreactors. Bubble column, airlift reactor, packed bed, fluidized bed, trickle bed, Membrane reactor, Photobioreactor, Solid state fermenter, Animal and plant cell bioreactors. Scale up and Scale down studies of bioreactors. Biosensor

Unit IV **16 Hrs**

Downstream processing (Recovery and purification of products) of biologicals: Separation of cells, foam separation, disintegration of micro organism, mechanical and non mechanical methods,flocculation, filtration, plate filters, rotary vacuum filters, centrifugation, Stoke's law, continuous centrifugation, basket centrifuge, bowl centrifuge, , membrane filtration, ultra filtration and reverse osmosis, chromatographic techniques, absorption, spray drying, drum drying, freeze drying.

Enzyme Technology: production, recovery, stability and formulation of bacterial and fungal enzymes-amylase, protease, penicillin acylase, glucose isomerase; Immobilised Enzyme and Cell based biotransformation steroids, antibiotics, alkaloids.

Texts/ References

1. Jackson AT., Bioprocess Engineering in Biotechnology, Prentice Hall, Engelwood Cliffs, 1991.
2. Shuler ML and Kargi F., Bioprocess Engineering: Basic concepts, 2nd Edition, Prentice Hall, Engelwood, Cliffs, 2002.

3. Stanbury RF and Whitaker A., Principles of Fermentation Technology, Pergamon press, Oxford, 1997.
4. Baily JE and Ollis DF., Biochemical Engineering fundamentals, 2nd Edition, McGraw-Hill Book Co., New York, 1986.
5. Aiba S, Humphrey AE and Millis NF, Biochemical Engineering, 2nd Edition, University of Tokyo press, Tokyo, 1973.
6. Comprehensive Biotechnology: The Principles, Applications and Regulations of Biotechnology in Industry, Agriculture and Medicine, Vol 1, 2, 3 and 4. Young M.M., Reed Elsevier India Private Ltd, India, 2004.
7. Mansi EMTEL, Bryle CFA. Fermentation Microbiology and Biotechnology, 2nd Edition, Taylor & Francis Ltd, UK, 2007.

GENETIC ENGINEERING (HARD CORE) - 48 Hrs

COURSE CODE:

Course Outcome

CO1-To have the **c**omprehensive insight into the different enzymes used in Genetic engineering lab

CO2-To obtain knowledge of construction of vectors

CO3-Students will be able to understand different type ofcloning methods.

CO4-Understand the principles of PCR& types

CO5- To know the different sequence methods

Unit I **10 Hrs**

Basics Concepts: DNA Structure and properties; Restriction Enzymes; DNA ligase, Klenow enzyme, T4 DNA polymerase, Polynucleotide kinase, Alkaline phosphatase; CRISPR- cas9, Cohesive and blunt end ligation; Linkers; Adaptors; Homopolymeric tailing; Labeling of DNA: Nick translation, Random priming, Radioactive and non-radioactive probes, Hybridization techniques: Northern, Southern and Colony hybridization, Fluorescence in situ hybridization; Chromatin Immunoprecipitation; DNA-Protein Interactions-Electromobility shift assay; DNaseI footprinting; Methyl interference assay

Unit II **10 Hrs**

Cloning Vectors: Plasmids; Bacteriophages; M13 mp vectors; PUC19 and Bluescript vectors, Phagemids; Lambda vectors; Insertion and Replacement vectors; Cosmids; Artificial chromosome vectors (YACs; BACs); Animal Virus derived vectors-SV-40; vaccinia/bacculo & retroviral vectors; Expression vectors; pMal; GST; pET-based vectors; Protein purification; His-tag; GST-tag; MBP-tag etc.; Intein-based vectors; Inclusion bodies; Methodologies to reduce formation of inclusion bodies; Baculovirus and pichia vectors system, Plant based vectors, Ti and Ri as vectors, Yeast vectors, Shuttle vectors

Unit III **6 Hrs**

Cloning Methodologies: Insertion of Foreign DNA into Host Cells; Transformation; Construction of libraries; Isolation of mRNA and total RNA; cDNA and genomic libraries; cDNA and genomic cloning; Expression cloning; Jumping and hopping libraries; Southwestern and Far-western cloning; Protein-protein interactive cloning and Yeast two hybrid system; Phage display; Principles in maximizing gene expression

Unit IV **22 Hrs**

PCR and Its Applications: Primer design; Fidelity of thermostable enzymes; DNA polymerases; Types of PCR – multiplex, nested, reverse transcriptase, real time PCR, touchdown PCR, hot start PCR, colony PCR, cloning of PCR products; Tvectors; Proof reading enzymes; PCR in gene recombination; Deletion; addition; Overlap extension; and SOEing; Site specific mutagenesis; PCR in molecular diagnostics; Viral and bacterial detection; PCR based mutagenesis, Mutation detection: SSCP, DGGE, RFLP, Oligo Ligation Assay (OLA), MCC (Mismatch Chemical Cleavage, ASA (Allele-Specific Amplification), PTT (Protein Truncation Test)

Sequencing methods: Enzymatic DNA sequencing; Chemical sequencing of DNA; Automated DNA sequencing; RNA sequencing; Chemical Synthesis of oligonucleotides; Introduction of DNA into mammalian cells; Transfection techniques; Gene silencing techniques; Introduction to siRNA; siRNA technology; Micro RNA; Construction of siRNA vectors; Principle and application of gene silencing; Gene knockouts and Gene Therapy; Creation of knock out mice; Disease model; Somatic and germ-line therapy- in vivo and ex-vivo; Suicide gene therapy; Gene replacement; Gene targeting; Transgenics; cDNA and intragenic arrays; Differential gene expression and protein array.

Text/References

1. S.B. Primrose, R.M. Twyman and R.W.Old; Principles of Gene Manipulation. 6th Edition, S.B.University Press, 2001.
2. J. Sambrook and D.W. Russel; Molecular Cloning: A Laboratory Manual, Vols 1-3, CSHL, 2001.
3. Brown TA, Genomes, 3rd ed. Garland Science 2006
4. Selected papers from scientific journals.
5. Technical Literature from Stratagene, Promega, Novagen, New England Biolab etc.
6. Genes, Benjamin XII , 2017

LAB-III (HARD CORE)

COURSE CODE:
Course Outcome
CO1 -
CO2 -
CO3 -
CO4 -
CO5 -

Practicals/ Experiments

1. Animal cell culture: preparation of media, culture and maintenance of cell lines, trypsinization
2. Culture of transformed cells
3. MTT assay for cytotoxicity
4. Western blotting and detection
5. Study of fermenter (demo)
6. Immobilization of yeast by calcium alginate, gel entrapment and assay for enzyme *invertase*
7. Assay of catalase.
8. Study of alcohol fermentation – alcohol from different substrates – estimation of alcohol content
9. Solid state fermentation
10. Determination of the activity of enzyme protease
11. Determination of the activity of enzyme amylase
12. Estimation of Vitamin E
13. Estimation of Vitamin C
14. Estimation of aminoacid by ninhydrin method
15. Preparation of MS media
16. Induction of callus
17. Micropropagation
18. Suspension culture- production of secondary metabolites
19. Preparation of synthetic seeds
20. Database search for nucleotide and aminoacid sequences using BLAST
21. Study of sequence alignment
22. Construction of trees/dendrogram using sequence analysis
23. Structure prediction using homology searches
24. RAPD
25. Transformation
26. Bacterial gene expression
27. RFLP mapping
28. Isolation of plasmid DNA from *E.coli*
29. Restriction digestion of DNA
30. DNA ligation
31. production of citric acid by *A.niger* by submerged fermentation.
32. Estimation of citric acid by titrametric method
33. PCR
34. Isolation of antibiotic producing actinomycetes from soil sample

CLINICAL AND ADVANCED TECHNIQUE IN BIOTECHNOLOGY (SOFT CORE) – 48 Hrs

COURSE CODE:

Course Outcome

CO1**-**Diagnosis of diseases using enzymes as markers
CO2-analysis of blood and urine sample to interpret the diseases
CO3-Study of metabolic disorders and their diagnosis
CO4- Clinical trails of designed drugs/ biomolecules
CO5-Tools of Histopathalogy, Immunotechnology, microarray and DNA chips in understanding the diseases

Unit I **16 Hrs**

Diagnostic Enzymology: Mechanisms of elevated enzyme activities. Some important enzymes – alkaline phosphates, creatine kinase, LDH, AST, ALT – isozyme changes

Blood: Composition, cells, functions of plasma proteins and lipo proteins in diseases. Disorders of hemoglobin – Thalassemia, sickle cell anemia. Anemias – Microcytic, normocytic and macrocytic.

Advanced methods in clinical analysis: Blood, urine and quantitative determination of metal ions in body fluids

Liver: Biochemical indices of hepatobiliary diseases. Bile pigments – formation of bilirubin, urobilinogen bile acids, jaundice – pre-hepatic, hepatic and post-hepatic; liver function tests, diseases of the liver – hepatitis, cholestasis, cirrhosis, Gallstones.

Unit II **8 Hrs**

Kidney: Assessment of renal function – creatine clearance, renal calculi, uremia, laboratory investigation of kidney disorders.

Cardiovascular Disorders: major cardio vascular system – Atherosclerosis – risk factors, pathogenesis. Diagnosis and prognosis

Disorders of Amino Acid and nucleotide metabolism: Gout Lesch – Nyhan syndrome, orotic acid urea phenyl ketonuria, alkaptonuria, maple-syrup urine.

Clinical trails of designed drugs/biomolecules.

Molecular detection of diseases, Amniocentesis

Unit III **12 Hrs**

Microscopy: Phase Contrast Microscopy, Fluorescence Microscopy, Confocal and Inverted Microscopy), Electron Microscopy (Transmission Electron Microscopy, Scanning Electron Microscopy)

Diagnostics and immunological techniques: applications of immunological and molecular diagnostic methods (RIA, ELISA, PCR, DNA finger printing) in forensic science and disease diagnosis. *In vitro* antigen-antibody reactions, Coombs' test, complement titration test (Direct and indirect), Immunoflourescence, Immuno-enzymatic and ferritin technique, Immuno-electromicroscopy. Immuno-electrophoresis, Western blot analysis. Hybridoma technology – Monoclonal and polyclonal antibodies and their application

Unit IV **12 Hrs**

Nanobio-technology: Introduction, types and synthesis of nanomaterial, protein – based nano structures, DNA-based nano structures. Applications of nanomaterials, nano biosensors, drug and gene diversity, disease diagnostics, cancer therapy, risk potential of nanomaterials.

DNA chip technology and micro arrays: Types of DNA chips and their production, hybridization, application of micro arrays on DNA chips.

Genomic research: Methods for whole genome sequencing, genome sequence data, e-PCR, genome sequence to annotation- methods for annotation of genome sequence.

Reference Books

1. Biochemistry – With Clinical Correlations. Devlin.
2. Clinical Biochemistry. Latner.
3. Principles of Instrumental Analysis. 5th Ed. Douglas A Skoog, James Holler and Timothy A Nieman.
4. Analytical and Preparative Separation Methods of Biomacromolecules. Hassan Y Aboul – Enein.
5. Microbiology – Principles and Explorations. 5th Ed. Jacquelyn G Black.
6. Genetic Engineering: Primose, S. B.
7. An introduction to molecular Bio-technology (Ed.) Wink.
8. Principles of gene manipulation and genomics. Primose, S. B. and Twyman, R. M.
9. Gene cloning and DNA analysis an Introduction. Brown, T. A. Blackwell Science Company.
10. Molecular Biology and Biotechnology. Walker, J. M. and Rapley, R. Panima Publishing Corporation.
11. Molecular Biotechnology – Principles and application of Recombinant DNA. Glicks, R. Bernard and Pasternak, J. Jack. Panima Publishing Corporation.
12. Molecular Biomethods Hand Book. Rapley, R and Walker, M. Jhon. Humana Press.
13. Genes (VIII edition) Benjamin Lewin, Pearson Education International

BIOSTATISTICS, BIOINFORMATICS AND BIOENTREPRENEURSHIP (SOFT CORE) – 48 HRS

COURSE CODE:

Course Outcome

CO1-Application of statistics to understand and analyse the experimental results of biological sciences
CO2-retrival of biological data
CO3-phylogenetic analysis
CO4-primer designing
CO5-drug discovery and molecular docking

Unit I **12 Hrs**

Statistical concept: Data structure, sampling methods, collection, classification and tabulation of data, graphical and diagrammatic representation, histogram, frequency polygon, frequency curve, bar graph, pie chart.

Measure of central frequency: **Mean, median, mode, mean deviation, standard deviation, standard error**

Types of distribution of data: Normal, binomial, Poisson, Z-test, t-test and ANOVA.

Correlation and regression

Unit II **18 Hrs**

Bioinformatics: Introduction, history, internet and bioinformatics, knowledge, discovery and data mining, problems faced in bioinformatics area, opportunities in bioinformatics, human genome project.

Biological databases and their management: database concept, introduction, history of databases, databases management systems, types of database, Codd rules, data normalization biological databases – introduction, application and its importance, biological database and their functioning, types of biological database, microbiological database, primary sequence database, carbohydrate database, RNA database, genome database, organism database, biodiversity.

Sequence database: Introduction, nucleotide sequence database, protein sequence database, the EMBL nucleotide sequence database, structure databases.

Bioinformatics software: Clustal V Multiple sequence alignment, Clustal W Version 1.7, Ras Mol, Oligo, Mol script, TREEVIEW, ALSCRIPT, genetic analysis software, Phylip.

Computational biology: Introduction, data mining and sequence analysis, database similarities searches, practical aspects of multiple sequence alignment, phylogentic analysis, predictive methods using nucleic acid and protein sequences, submitting DNA sequences to the databases.

Unit III **10 Hrs**

Innovation: Idea to enter into business, Designing and development of new products as per market demands and their future prospective. Needs of customer, branding, distribution, promotion and advertising.

Types of bio-industries and IPR: biopharma, bioagri and bioservices. IP protection & commercialization strategies- freedom to operate.

Accounting and Finance : Business plan preparation, contracts, partnerships, business feasibility analysis by SWOT, socio-economic costs benefit analysis; funds/support from Government agencies like MSME/banks and private agencies like venture capitalists:/angel investors for bio entrepreneurship; business plan proposal for virtual start up company. statutory and legal requirements for starting a company/venture; basics in accounting practices: concepts of balance

sheet, profit and loss statement, Valuation, Cash flow, double entry. Information technology for business administration and expansion. Technology transfer.

Incubation centres: Govt. (C-CAMP, KBITS, CFTRI) and Private incubation centres for start-ups.

Unit IV **8 Hrs**

Marketing : Market conditions, segments, prediction of market changes; identifying needs of customers; Market linkages, branding issues; developing distribution channels - franchising; policies, promotion, advertising; branding and market linkages for virtual start-up company.

Business Strategy & HR: Entry and exit strategy; pricing strategy; negotiations with financiers, bankers, government and law enforcement authorities; dispute resolution skills; external environment/ changes; avoiding/managing crisis; broader vision–global thinking; mergers & acquisitions.

Regulatory understanding:- GLP, GMP, GCP, PCB, IBSC, ISO

Bioentrepreneurship and case study: Importance of entrepreneurship; advantages of being entrepreneur - freedom to operate; introduction to bioentrepreneurship – biotechnology in a global scale; Scope in bioentrepreneurship; innovation – types, out of box thinking; skills for successful entrepreneur – creativity, leadership, managerial, team building, decision making, Risk assessment, opportunities for bioentrepreneurship- development programs of public and private agencies (MSME, DBT, BIRAC, Start-up & Make in India).

References:

1. Singh Narendra, Project management and control, (Himalaya publishing house)
2. Prasanna Chandra, Projects: Planning, Analysis, selection, implementation& review (Tata McGrow Hill)
3. P. GopalaKrishna& V.E. Rama Moorthy, Project management (Mac Millan India)
4. Chandra prasanna, proect preparation, Appraisal and Implementation (Tata Mcgrow Hill)
5. A. N. Desai, The dynamics of Entrepreneurial development and management (Himalaya publishing house)
6. Biostatistical Analysis. Zar J. H. Printice-Hall International.
7. Methods in Biostatistics. Mahajan, B. K. Smt. Hindu Mahajan
8. Bioinformatics. David W. Mount.
9. Bioinformatics A Practical Guide to the Analysis of Genes and Proteins Andreas D. Baxevanis and B. F. Francis Ouellette. A John Wiley & Sons, Inc., Publication.
10. Biostatistics. Daniel.
11. Handbook of Biostatistics A Review and Text. Christopher and Carvounis.

APPLIED BIOTECHNOLOGY (OPEN ELECTIVE) – 48 Hrs

Unit I **12 Hrs**

Scope of Biotechnology in India and Karnataka.

Structure of plant,animal and bacterial cells. Biomolecules and their importance.

Enzyme Biotechnology

Introduction to application of enzymes in industry: Food & beverage, detergent, textile pharmaceutical and leather.

Unit II **14 Hrs**

Applications of Plant Cell and tissue culture technology

Improvement of hybrids, encapsulated seeds, production of disease resistant, stress resistant plants, secondary metabolites from cell cultures

Transgenic plants for crop improvement, molecular farming from transgenic plants, edible vaccines. Bioethics in plant genetic engineering**.**

Unit III **10 Hrs**

Animal Cell Culture Techniques

Manipulation of reproduction in animals: Artificial insemination,embryo transfer, embryo splitting, embryo sexing

In vitro fertilization technology(IVF): Embryo cloning, embryonic stem cells Invitro-fertilization and embryo transfer in humans. Transgenic animals

Valuables products from animal cell culture (Tissue plasminogen activator, Blood factor VIII, erythropoietin.)

Hybridoma technology: Production of monoclonal and polyclonal antibodies and their applications. Bioethics in animal genetic engineeringcryopreservation, quantitation of cells, cytotoxicity assays.

Unit IV **12 Hrs**

Industrial and microbial biotechnology

Growth media, sources of nutrition, sterilization, design of fermenter, batch, fed batch and continuous culture.

Production of primary metabolites (vitamins, organic acids, alcohols and aminoacids). Production of secondary metabolites (antibiotics)

Biopesticides (Biological control of plant pathogens, pests and weeds.).

Biofertilizers (microbial inoculants)

Food Biotechnology – Genetically modified foods, Nutraceuticals, detection of genetically modified foods. Production of single cell proteins and mycoproteins.

Reference Books

1. Biotechnology. B. D. Singh
2. Biotechnology. R. C. Dubey

OPEN ELECTIVE –FUNDAMENTALS OF BIOINFORMATICS

Contact Hours/ Week	:	4	Credits	:	4
Total Lecture Hours	:	48			

Course Outcomes:

- Ability to use popular bioinformatics tools to generate biologically meaningful results
- Ability to interpret biological results generated by a bioinformatics tool
- Application of some basic models and algorithms
- The students will gain an understanding of the computational challenges (and their solutions) in the analysis of large biological data sets; they will understand how some of the commonly used bioinformatics tools work, how to use these tools effectively

Unit I **12 Hrs**

Introduction to Bioinformatics and Biological Database:

Introduction to bioinformatics, Review of Central Dogma, Genome organization -Prokaryotic and Eukaryotic. Overview of Genome Projects – Human genome project. Introduction to DNA and protein databases and their classification, file formats, information retrieval tools – Entrez, SRS, ARSA. Nucleotide and Protein sequence and structure databases (NCBI, EMBL, DDBJ and PDB). Focus on GenBank, UniProt, and Gene Ontology.

Unit II **12 Hrs**

Sequence Alignment and Database Similarity Searching:

Pairwise alignment: Alignment algorithm: Pairwise: Dot matrix method, Dynamic programming Method (Needleman-Wunsch & Smith Waterman), Scoring Matrices – PAM and BLOSUM, Database Similarity Searching: FASTA and BLAST. BLAST variants, Statistical parameters for BLAST output – e value, p value and Bit Score.

Unit III **12 Hrs**

Multiple sequence alignment:

Iterative, Progressive alignment. Application of MSA – 1. Phylogenetics – Phylogenetics Basics, Terminologies, Gene versus species phylogeny, Forms of tree representation: Maximum Parsimony and Distance methods 2. Gene prediction: Gene prediction in prokaryotes and eukaryotic 3. Protein Motif and Domain Prediction: Identification of Motif and Domains in MSA – PSSM and Profile HMMs.

Unit IV **12 Hrs**

Protein sequence analysis:

Analysis of Scalar parameters: Protparam and pepstats: Hydropathy analysis (Membrane protein prediction): Kyte-Doolittle plot, Helical Wheel representation. Secondary structure prediction, Protein structure building-Homology modelling (Comparative modelling only) – SWISS MODEL server and MODELLER, Protein Structure Visualization: Rasmol, Pymol, CN3D, Swiss PDB viewer, Chimera and Discovery studio visualizer

Applications of Bioinformatics: Bioinformatics in pharmacy: overview of drug discovery process, structure based and ligand-based drug design (CADD). Pharmacokinetics: absorption, distribution, metabolism, excretion and toxicity of drugs.

REFERENCE BOOKS:

1	David W Mount	"Bioinformatics sequence and Genome analysis", Cold Spring Harbor Laboratory Press, 2nd Edition, 2013, 9989332257358
2	Jin Xiong	Essentials Bioinformatics, Cambridge university press,3rd Edition, 2006, 9789335657325
3	Neil C. Jones and Pavel A. Pevzner	An Introduction to Bioinformatics Algorithms, MIT Press,5th Edition, 2005, 8789432449328
4	Steffen Schulze-Kremer	Molecular Bioinformatics: Algorithms and Applications, Walter de Gruyter, 4th Edition, 1996, 9789432449327
5	Attwood T K, D J Parry-Smith	Introduction to Bioinformatics, Pearson Education, 3rd Edition, 2005, 9789332447329
6	Michael R Barnes and Ian C grey	Bioinformatics for Geneticists, John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex PO19 8SQ, England
7	Rui Jiang, Xuegong Zhang. Michael Q. Zhang	Basics of Bioinformatics, Springer Heidelberg New York Dordrecht London,
8	Supratim Choudhuri	Bioinformatics for Beginners, Academic Press.
9	Peter Lake and Paul Crowther	Concise Guide to Databases. Springer London Heidelberg New York Dordrecht
10	Arthur M. Lesk	Introduction to Bioinformatics, Oxford University Press Inc., New York
11	Mahmood A. Mahdavi	Bioinformatics –Trends and Methodologies, InTech Janeza Trdine 9, 51000 Rijeka, Croatia
12	Catherine Hack and Gary Kendal	Bioinformatics: Current Practice and Future Challenges for Life Science Education: Biochemistry and Molecular Biology Education Vol. 33, No. 2, pp. 82–85, 2005
13	Teresa K. Attwood	The Babel of Bioinformatics, SCIENCE, Volume 290, Number 5491, Issue of 27 Oct 2000, pp. 471-473.

IV SEMESTER

PLANT BIOTECHNOLOGY (HARD CORE) – 48 Hrs

Unit I **10 Hrs**

Plant tissue culture-General: Historical background: Requirements for in-vitro culture- Tissue culture laboratory, Preparation of media, sterilization. Conventional plant breeding and plant tissue culture.

Cell and Tissue Culture Technology: **Role of hormones in growth and development of plants, tissue-specific hormones. Callus Induction, Organogenesis, Somatic embryogenesis, cell suspension culture and synthetic seeds**

Somaclonal variations: Isolation of somoclonal variants, Factors affecting somoclonal variants – applications

Micropropagation: Propagation from pre-existing meristem, shoot apical meristem, shoot and node culture, micropropagation stages and applications

Unit II **15 Hrs**

Germplasm preservation: cryopreservation, cryoprotectant, warming rate and recovery, gene banks, applications.

Seed Health Technology

Introduction: Importance of Seed health, important seed-borne diseases; Seed Health diagnostics; Management of seed-borne diseases.

Haploid Technology: Methods of haploid culture, Factors affecting anther and microspore cultures, applications. Cytoplasmic male sterility in Indian Mustard.

Protoplast Technology: Isolation, purification and culture of protoplasts, protoplast fusion and somatic hybridization, applications of somatic hybrids/ cybrids.

Secondary metabolite production: Induction of secondary metabolites by plant cell culture, technology of plant cell culture for production of chemicals, biotransformation using plant cell culture. Bioreactor systems and models for mass cultivation of plant cells.

Unit III **7 Hrs**

Plant transformation techniques: Methods of gene transfer in plants, *Agrobacterium* mediated transfer- mechanism of DNA transfer, general features of Ti and Ri plasmids, role of *vir* genes, design of expression vectors, use of promoters and reporter genes; viral vectors, direct gene transfer methods- electroporation, microinjection, particle bombardment, selection of transformants, screening and field trials.

Unit IV **16 Hrs**

Transgenic plants: Herbicide resistance, resistance against biotic stress- bacterial, viral, fungal and insect resistance, abiotic stress, improved crop productivity, improved nutritional quality, transgenic plants for floriculture, Qualitative trait loci and marker studies.

Growth- promoting bacteria in plants: Biological nitrogen fixation, genetic manipulation for nitrogen fixation. Biocontrol of phytopathogens.

Molecular farming: Transgenic plants as production systems-production of alkaloids, steroids, colouring agents, flavoring agents, biodegradable plastics, industrial enzymes, therapeutic proteins, biopharmaceuticals, edible vaccines, plantibodies.

Intellectual Property Rights (IPR): IPRs and agricultural technology- implications for India, WTO, WIPO, GATT, TRIPS. Plant Breeder's Rights, legal implications, commercial exploitation of traditional knowledge, protection. Ethical issues associated with consumption of GM food, labelling of GM crops and foods.

Reference Books

1. Plant Signal Transduction. Scheel D and Wasterpack C. Oxford University Press.
2. Introduction to Plant Pathology. Strange R N. John Wiley and Sons Ltd.
3. Applied plant virology. Walkey. Chapman and Hall London.
4. Molecular Plant Pathology by Agrios.
5. Plant Tissue Culture Concepts and Laboratory Exercise. Trigiano R. N. and Gray, D. L. CRC Press.
6. Plant Tissue culture – Supplement-7. Lindsey, K. Springer International Edition.
7. Introduction to Plant Tissue Culture. Razdon, M. K. Oxford and IBH Publishing Co. Pvt Ltd.
8. Introductory to plant physiology. Noggle, R., Fritz, J. G. Prentice Hall of India Pvt. Ltd.
9. Plant Molecular Biology – A Practical Approach. Shaw, C. H. Panima Publishing Corporation.
10. A Laboratory Manual of Plant Biotechnology. Purohit. Publisher Agrobios.
11. Introduction to Plant Biotechnology. Chawla, H. S.
12. Practical Application of Plant Molecular Biology. Henry, R. J. Chapman and Hall.
13. Plant Biotechnology – Laboratory manual. Chawla, H. S. Oxford and IBH publishing Co. Pvt. Ltd.
14. Biotechnology. Gupta, P. K. Rastogi Publications.
15. Biochemistry and Molecular Biology of Plants. Buchanan, Gmissem and Jones.
16. Genetic Engineering of Crop Plants. Lyrett, G. W., Grierson, D.
17. Plant Molecular Biology. Grierson and S. N. Covey.

ANIMAL BIOTECHNOLOGY (HARD CORE) – 48 Hrs

Unit I **10 Hrs**

Culture of animal cells: Advantages and limitations of tissue culture, aseptic handling, facilities required, media and cell lines. Primary culture: Isolation of mouse and chick embryos, human biopsies, methods for primary culture, nomenclature of cell lines, sub culture and propagation, immoretalization of cell lines, cell line designation, selection of cell line and routine maintenance.

Cloning and Selection: Cloning protocol, stimulation of plating efficiency, suspension cloning, isolation of clones, isolation of genetic variants, interaction with substrate, selective inhibitors.

Unit II **16 Hrs**

Cell separation and characterization: Density based, antibody based, magnetic and fluorescence based cell sorting. Characterization of cells based in morphology, chromosome analysis, DNA content, RNA and protein, enzyme activity, antigenic markers, cytotoxicity assays, cell quantitation, cell culture contamination: monitoring and eradication, cryopreservation.

Culturing of specialized cells: Epithelial, mesenchymal, neuro ectodermal, hematopoietic gonad and tumor cells, Lymphocyte preparation, culture of amniocytes, fish cells, confocal microscopy. Stem cell culture and its applications

Organic and embryo culture: Choice of models, organ culture, histotypic culture, filter-well inserts, neuronal aggregates whole embryo culture eggs, chick and mammalian embryos.

Unit III **16 Hrs**

Cell and Tissue engineering: Growth factors for *in situ* tissue regeneration, biomaterials in tissue engineering, approaches for tissue engineering of skin, bone grafts, nerve grafts. Hemoglobin based blood substitutes, bio antificial or biohybrid organs. Limitations and possibilities of tissue engineering.

In vitro **fertilization and Embryo transfer:** *In vitro* fertilization in Humans, Embryo transfer in Humans, Super ovulation and embryo transfer in farm animals e.g: Cow.

Cloning of Animals: Methods and uses. Introduction, nuclear transfer for cloning, cloning from-embryonic cells, adult and fetal cells. Cloning from short term cultured cells: cloning of sheep, monkeys, mice, pets, goats and pigs. Cloning from long term cultured cells: Cloning of cows from aged animals. Cloning efficiency, Cloning for production of transgenic animals, gene targeting for cloned transgenic animals, cloning for conservation, human cloning: ethical issues and risks.

Unit IV **6 Hrs**

Transfection methods and transgenic animals: Gene transfer or transfection, transfection of fertilized eggs or embryos, unfertilized eggs, cultured mammalian cells, targeted gene transfer. Transgenic animals and applications: mice and other animals, sheep, pigs, goats, cows and fish.

The legal and socio-economic impact of biotechnology at national and international levels, public awareness. Biosafety regulations- guidelines for research in transgenic animals, public awareness of the processes of producing transgenic organisms

Reference Books

1. Anthony Atala, Robert P Lanza. 2002, Methods of tissue engineering, Academic press
2. Ian Freshney R. 2005, Culture of animal cells–A manual of basic techniques, John Wiley and Sons Inc. Hoboken, New Jersey
3. Animal Cell Culture – A Laboratory Manual. Frushney.
4. Animal Biotechnology. Ballinic, C. A., Philip, J. P and Moo Young, M. Pergamon Press.
5. Genetic Engineering of Animals. Puhler, A. VCH Publisher.
6. Methods of Tissue Engineering. Anthony Atala, Robert P. Lanza.
7. Animal Cell Biotechnology – Methods and Protocols. Nigel Tenkins.

PROJECT WORK/DISSERTATION (HARD CORE)

COURSE CODE:

Course Outcome

CO1-Review of recent research articles published in high impact journals and presentation by students.

CO2-Students do conduct review of literature followed by hands on training to do piece of research work.

CO3-They would be skill full to understand the experiment and interpret the result.

CO4-They get an idea to compile the data and present in the form of dissertation.

- Includes exhaustive review of literature on the topic selected, design of work, standardization of techniques and execution of work
- Compiling of the data generated in the form of thesis. Interpretation of the result correlating with the advanced information available in the literature.
- Research Paper presentation.

JSS COLLEGE OF ARTS COMMERCE AND SCIENCE

(An Autonomous College of University of Mysore; Re-Accredited by NAAC with 'A' Grade)

OOTY ROAD, MYSURU- 25

PG DEPARTMENT OF BOTANY

Choice - Based Credit System (CBCS)

BOTANY

M.Sc. DEGREE SYLLABUS

2018-19 ONWARDS

(MODIFIED ON 2022)

JSS MAHAVIDYAPEETHA
JSS COLLEGE FOR ARTS, COMMERCE AND SCIENCE
(AUTONOMOUS) OOTY ROAD, MYSURU- 25

POST GRADUATE DEPARTMENT OF BOTANY

M.Sc., Botany Choice - Based Credit System (CBCS) Syllabus
(CBCS-CGPA-Modified (2018-19)
CORE SUBJECT: BOTANY – [POST GRADUATE]

DEGREE: M.Sc., BOTANY

1st and 3rd semester Changes made at BOS meeting held on 13.01.2022 (in %)
HC 1.3 Systematics of Angiosperms (5.17%)
HC 3.3 Plant Biotechnology (40.22%)
SC 3.3 Plant Propagation and Plant Breeding (1.7%)
OE 3.1 Plant Propagation Techniques (1.35%)
(CHANGES MADE ARE HIGHLIGHTED IN THE TEXT)

FIRST SEMESTER				**Credits: 22**
No.	**Course/Paper Code**	**Title of the Course/ Paper**	**Hrs/Week L:T:P**	**Credits**
1	**HARD CORE 1.1**	**Virology, Bacteriology, Mycology and Plant Pathology**	**2:2:2**	2:1:1
2	**HARD CORE 1.2**	**Phycology, Bryophytes, Pteridophytes and Gymnosperms**	**2:2:2**	2:1:1
3	**HARD CORE 1.3**	**Systematics of Angiosperms**	**2:2:2**	2:1:1+ (2 credits for submission of tour report) 2:1:3
4	**SOFT CORE 1.1****	**Fungal Biology and Biotechnology**	**2:2:2**	2:1:1
5	**SOFT CORE 1.2****	**Algal Biology and Biotechnology**	**2:2:2**	2:1:1
6	**SOFT CORE 1.3****	**Lichenology and Mycorrhizal Technology**	**2:2:2**	2:1:1
7	**SOFT CORE 1.4****	**Phytopathology**	**2:2:2**	2:1:1

*Field Study/Tour: The student shall undertake a field trip for a minimum of 2-3 days and shall submit the herbaria and tour report for evaluation-2 credits.
**Any two soft core papers shall be studied.

SECOND SEMESTER			Credits: 18	
No.	**Course/Paper Code**	**Title of the Course / Paper**	**Hrs/Week L:T:P**	**Credits**
1	**HARD CORE 2.1**	**Reproductive Biology of Angiosperms and Plant Morphogenesis**	**2:2:2**	2:1:1
2	**HARD CORE 2.2**	**Cell Biology and Genetics**	**2:2:2**	2:1:1
3	**HARD CORE 2.3**	**Plant Breeding and Evolutionary Biology**	**2:2:2**	2:1:1
4	**SOFT CORE 2.1***	**Plant Anatomy and Histochemistry**	**2:0:2**	2:0:1
5	**SOFT CORE 2.2***	**Ethno-Botany and Intellectual Property Rights (IPR)**	**2:0:2**	2:0:1
6	**SOFT CORE 2.3***	**Economic Botany**	**2:0:2**	2:0:1
7	**OPEN ELECTIVE 2.1**	**Medicinal Plants**	**2:2:0**	2:1:0
	** Any two soft core papers shall be studied.			

THIRD SEMESTER			Credits: 16	
No.	**Course/Paper Code**	**Title of the Course /Paper**	**Hrs/Week L:T:P**	**Credits**
1	**HARD CORE 3.1**	**Biochemistry and Plant Physiology**	**2:2:2**	2:1:1
2	**HARD CORE 3.2**	**Molecular Biology**	**2:2:2**	2:1:1
3	**HARD CORE 3.3**	**Plant Biotechnology**	**2:2:2**	2:1:1
4	**SOFT CORE 3.1***	**Molecular Genetics of Plants**	**2:2:2**	2:1:1
5	**SOFT CORE 3.2***	**Molecular Plant Pathology**	**2:2:2**	2:1:1
6	**SOFT CORE 3.3***	**Plant Propagation and Plant Breeding**	**2:2:2**	2:1:1
7	**SOFT CORE 3.4***	**Phyto-chemistry and Herbal Technology**	**2:2:2**	2:1:1
8	**OPEN ELECTIVE 3.1**	**Plant Propagation Techniques**	**2:2:0**	2:1:0
	* Any one soft core courses/papers shall be studied.			

FOURTH SEMESTER				Credits: 16
No.	**Course/Paper Code**	**Title of the Course /Paper**	**Hrs/Wk L:T:P**	**Credits**
1	**HARD CORE 4.1**	**Ecology, Conservation Biology and Phytogeography**	**2:2:2**	2:1:1
2	**HARD CORE 4.2**	**Project Work ***	**4:2:2**	8
3	**SOFT CORE 4.1***	**Seed Technology**	**2:2:2**	2:1:1
4	**SOFT CORE 4.2***	**Seed Pathology**	**2:2:2**	2:1:1
5	**SOFT CORE 4.3***	**Bio -Analytical Techniques**	**2:2:2**	2:1:1
6	**OPEN ELECTIVE 4.1**	**Plant Diversity and Human Welfare**	**2:2:0**	2:1:1
	***Project Work:** The student shall undertake a Project Work in the Department or in any other University or Institute under the guidance of a Research Supervisor and shall submit a Project Report duly signed by Student and Research Supervisor for Evaluation.			

Semester- Wise Credit Pattern:
I Semester= 22 [HC- 12+2=14 + 08 (SC)]
II Semester= 24 [HC- 12 + 08 (SC) + 04 (OE)]
III Semester= 18 (HC- 08 + 06 (SC) + 04 (OE)]
IV Semester= 20 (HC-12 +04 (SC) + 04 (OE)]

In total= 46 HC + 26 (SC) + 12 (OE)= The Department is offering 84 Credits of B.Sc. Honors/ M.Sc. Botany (CBCS) Course including three Open Elective Course to the outside Department Students/

Important Note:
Student is required to earn the credit for qualifying B.Sc. Honors/ M.Sc. Botany from Department of Botany as follows:

Hard Core offered by the Department= 46 (Against maximum of 56)
Soft Core offered by the Department = 26 (Against minimum of 16)
Minimum Open Elective to be earned by the Student (Outside the Department) = 04
A total of 76 Credit is required for qualifying B.Sc. Honors/ M.Sc. Botany Course.

SCHEME OF EXAMINATION/ASSESSMENT
MODEL QUESTION PAPER (THEORY)
JSS COLLEGE FOR ARTS, COMMERCE AND SCIENCE
(AUTONOMOUS) OOTY ROAD, MYSURU- 25
POST GRADUATE DEPARTMENT OF BOTANY
M.Sc., Degree ------Semester Examination May/June-20--
BOTANY
Course/Paper: ……
Course/Paper Code……..

Time: 3 Hrs **Max Marks: 70**

Instructions: 1) Answer all questions.
2) Draw neat and labelled diagrams wherever necessary.

I. Answer the following; (10MCQs of 1 Marks each) **10 X 1 = 10**
2 from Unit I
3 from Unit II
2 from Unit III
3 from Unit IV

II. Answer the following; **4 X 5 = 20**
2 from Unit I with internal choice
2 from Unit II with internal choice
2 from Unit III with internal choice
2 from Unit IV with internal choice

III. Answer the following; **4 X10 = 40**
2 from Unit I with internal choice
2 from Unit II with internal choice
2 from Unit III with internal choice
2 from Unit IV with internal choice

SCHEME OF PRACTICAL EXAMINATION/ASSESSMENT
MODEL QUESTION PAPER (PRACTICALS)

JSS COLLEGE FOR ARTS, COMMERCE AND SCIENCE
(AUTONOMOUS) OOTY ROAD, MYSURU- 25
POST GRADUATE DEPARTMENT OF BOTANY
M.Sc., Degree I Semester Examination May/June-2018
BOTANY
Course/Paper: ……
Course/Paper Code……..

Time: 3 Hrs **Max Marks: 70**

Q I. Conducting Experiment/Micro-preparation /Plant identification 15
Q II. Minor experiment/ Demonstrations/ Procedure Writing 10
Q III. Critically comments (3x5 Marks) 15
Q IV. Identification 5x2 Marks) 10
Q V. Viva-voce examination 10
Q VI. Class Records/ Submissions 10

PO M.SC. BOTANY

Sl. No.	PO
1.	Conduct investigations of complex problems by the use of research-based knowledge on an independent term project.
2.	Transfer of appropriate knowledge and methods from one topic to another within the subject.
3.	Carry out practical work, in the field and in the laboratory, with minimal risk.
4.	Able to think logically and organize tasks into a structured form and assimilate knowledge and ideas based on wide reading of text books and through the internet.
5.	Apply the scientific knowledge of basic science, life sciences and fundamental process of plants to study and analyse any plant form.
6.	Knowledge and understanding of the range of plant biology in terms of structure, function and environmental relationships.
7.	Apply reasoning informed by the contextual knowledge to assess plant diversity, and the consequent responsibilities relevant to the biodiversity conservation practice.

PSO M.SC. BOTANY

Sl. No.	COURSE	PSO
1.	Algal Biology and Biotechnology	Phylogeny, thallus organisation, economic and ecological importance of alagal community
2.	Biochemistry and Plant Physiology	Biomolecules, metabolic pathways and stress physiology in plants
3.	Cell Biology and Genetics	Cell originals and Mendelian principles
4.	Ecology, Conservation Biology and Phytogeography	Diversity of vegetation, distribution and its conservation
5.	Economic Botany	Economic values of different crop plants and their applications
6.	Major Project	Hands on experience in various fields of plant science
7.	Molecular Biology	Molecular level organisation in prokaryotes and eukaryotes with respect to various mechanisms involved
8.	Plant Anatomy and Histochemistry	Anatomical features and organisation of cells in plants
9.	Plant Breeding and Evolutionary Biology	Plant breeding methods, procedures and their application for crop improvement
10.	Plant Biotechnology	Tissue culture techniques and its application in development of resistant varieties
11.	Plant Propagation and Plant Breeding	Propagation methods and plant breeding procedures and their application in different fields
12.	Plant Propagation Techniques	Propagation methods and procedures and their application in different fields
13.	Phycology, Bryophytes, Pteridophytes and Gymnosperms	Distribution, classification and phylogeny of lower plant communities
14.	Phytopathology	Concepts of plant diseases defence mechanisms in plants and study of plant diseases
15.	Reproductive Biology of Angiosperms and Plant Morphogenesis	Embryological study of growth and development using plant models
16.	Seed Technology	Industrial scale processing of seeds up to marketing

17.	Systematics of Angiosperms	Angiospermic plant family study with their phylogeny
18.	Virology, Bacteriology, Mycology and Plant Pathology	Diversity, distribution of microorganism with respect to their economic aspects

CO M.SC. BOTANY

Sl. No.	COURSE	CO
1.	Algal Biology and Biotechnology	Specify in depth of thallus organization and phylogeny in algae
2.	Algal Biology and Biotechnology	Understand the details of toxins, blooms and distributions of algae
3.	Algal Biology and Biotechnology	Deliberate in depth about cultivation and marketing algae
4.	Algal Biology and Biotechnology	Specify the details of Algal products and uses
5.	Biochemistry and Plant Physiology	Learn in details with biomolecules and their function
6.	Biochemistry and Plant Physiology	Understand in depth about solute transport and photosynthesis in plants
7.	Biochemistry and Plant Physiology	Specify the details of metabolism of nitrogen, lipids and plant hormones
8.	Biochemistry and Plant Physiology	Understand in depth about Stress physiology
9.	Cell Biology and Genetics	Learn in detail about cell membranes transport and proteins
10.	Cell Biology and Genetics	Deliberate the Functions of cell organelles, programed cell death
11.	Cell Biology and Genetics	Specify the extensions of Mendelian principles
12.	Cell Biology and Genetics	Learn about Sex determination and dosage compensation
13.	Ecology, Conservation Biology and Phytogeography	Understand the diversity of ecosystem and types of ecosystems
14.	Ecology, Conservation Biology and Phytogeography	Learn the in details of pollution and environmental biology
15.	Ecology, Conservation Biology and Phytogeography	Study the importance of biodiversity and conservation biology
16.	Ecology, Conservation Biology and Phytogeography	Detailed study of phytogeography and crop distribution
17.	Economic Botany	Specify the details of cereals, millets, pulses, oil yielding plants and study of horticultural plants and floriculture
18.	Economic Botany	Deliberate the characteristics of sugar yielding plants, spices and condiments
19.	Economic Botany	Understand the importance of fibre, timber and gum yielding plant
20.	Economic Botany	Deliberate on the medicinal plants and their applications
21.	Major Project	Learn the details of literature survey and methodology in research
22.	Molecular Biology	Identify the characteristics of genetic materials and its replication
23.	Molecular Biology	Learn the details of molecular basis of mutation, repair and recombination
24.	Molecular Biology	Deliberate the details of RNA formation, processing of RNA and post-RNA
25.	Molecular Biology	Understand in depth of gene regulation in prokaryotes and eukaryotes
26.	Plant Anatomy and Histochemistry	Learn in details of primary vegetative body of the plants
27.	Plant Anatomy and Histochemistry	Deliberate in details of differentiation in vascular tissues and study of apical meristems in shoot and root
28.	Plant Anatomy and Histochemistry	Deliberate the characteristics of secondary growth
29.	Plant Anatomy and	Understand the details of plant histochemistry

	Histochemistry	
30.	Plant Breeding and Evolutionary Biology	Learn in depth about plant breeding methods and techniques
31.	Plant Breeding and Evolutionary Biology	Understand the details of breeding for specific purposes
32.	Plant Breeding and Evolutionary Biology	Learn the details of Nature of evolution
33.	Plant Breeding and Evolutionary Biology	Identify the characteristics of variation and speciation
34.	Plant Biotechnology	Understand in depth about plant tissue culture and its techniques
35.	Plant Biotechnology	Specify the genetic engineering and tools used in it
36.	Plant Biotechnology	Understand the details of genetic manipulation, transgenic approaches to produce resistant plants
37.	Plant Biotechnology	Learn the details of engineering of crop plants for production of secondary metabolites
38.	Plant Propagation and Plant Breeding	Learn the details of importance of plant propagation, vegetative propagation and micro propagation
39.	Plant Propagation and Plant Breeding	Understanding of basic concepts of plant breeding and genetics
40.	Plant Propagation and Plant Breeding	Study types, purposes of plant breeding
41.	Plant Propagation and Plant Breeding	Deliberate study of advanced breeding aspects
42.	Plant Propagation Techniques	Learn the details of importance of plant propagation
43.	Plant Propagation Techniques	Understand in depth about types of vegetative propagation
44.	Plant Propagation Techniques	Learn the techniques of budding and layering
45.	Plant Propagation Techniques	Deliberate in details with examples of micro propagation in forestry and horticulture plants
46.	Phycology, Bryophytes, Pteridophytes and Gymnosperms	Understand the details of diversity, distribution, pigmentation and life cycle of algae
47.	Phycology, Bryophytes, Pteridophytes and Gymnosperms	Deliberate in depth of Bryophytes life cycle, classification, phylogeny and Economic importance
48.	Phycology, Bryophytes, Pteridophytes and Gymnosperms	Understand the details of Pteridophytes life cycle, phylogeny, classification, economic importance and anatomy
49.	Phycology, Bryophytes, Pteridophytes and Gymnosperms	Write down in details with examples Gymnosperms history, reproduction, edconomic importance and interrelationship
50.	Phytopathology	Learn the details of the concept, causative agents and disease cycle of plant pathogens
51.	Phytopathology	Deliberate the details of defense mechanisms in plants and its genetics
52.	Phytopathology	Study of Management of plant diseases
53.	Phytopathology	Identify in details with examples of diseases in crop plants
54.	Reproductive Biology of Angiosperms and Plant Morphogenesis	Understanding the microsporogenesis and historical overview
55.	Reproductive Biology of Angiosperms and Plant Morphogenesis	Specify in details with examples about megasporogeneis, fertilization, endosperm and embryo
56.	Reproductive Biology of Angiosperms and Plant Morphogenesis	Specify the details of models and concepts of plant morphogenesis
57.	Reproductive Biology of Angiosperms and Plant Morphogenesis	Understand in details with examples of plant growth and development, photomorphogenesis
58.	Seed Technology	Understand the seed science and concepts
59.	Seed Technology	Study the seed production and processing methods

60.	Seed Technology	Learn about seed quality parameters and tests
61.	Seed Technology	Deliberate the procedure of seed certification
62.	Systematics of Angiosperms	Understand the principles and applications of Taxonomy of angiosperms
63.	Systematics of Angiosperms	Specify the details of taxonomic literature
64.	Systematics of Angiosperms	Deliberate in details with examples Dicot and monocot family and features of classification systems
65.	Systematics of Angiosperms	Specify in details molecular systematics with examples of softwares and databases
66.	Virology, Bacteriology, Mycology and Plant Pathology	Learn the classification and characteristics of viruses, viroids, prions and diseases of it
67.	Virology, Bacteriology, Mycology and Plant Pathology	Deliberate in details with examples of Bacteria, archeabacteria, actinomycetes and mycoplasma and its economic importance
68.	Virology, Bacteriology, Mycology and Plant Pathology	Specify the Fungal diversity, life cycle and economic importance of fungi
69.	Virology, Bacteriology, Mycology and Plant Pathology	Understand in details of etiology, distribution and management of plant disease

BOTANY: I SEMESTER- HARD CORE 1.1

VIROLOGY, BACTERIOLOGY, MYCOLOGY AND PLANT PATHOLOGY

Theory-32 Hrs

Unit-1: Virology: Origin and evolution of viruses; Classification of viruses-ICTV and Baltimore Systems; Genome diversity in viruses; Methods of cultivation of viruses; Purification and detection of viruses; Transmission of viruses; Mechanism of replication of DNA and RNA viruses; Viroids - Structure and multiplication; Prions - structure and multiplication; Prion diseases.

Unit-2: Bacteriology: Introduction and classification of Bacteria by Bergey's Manual of Determinative and Sytematic Bacteriology; C. R. Woese- Three domain classification of Bacteria; Archaebacteria and Eubacteria - diversity and evolution; Nutritional types of bacteria; Bacterial growth; Recombination in bacteria (conjugation transformation, and transduction); Brief account on actinomycetes; Structure and multiplication of Mycoplasma and Phytoplasmas; Economic importance of bacteria.

Unit -3: Mycology: Present status of fungi; Outline classification of fungi (Ainsworth-1973). Vegetative organization in fungi; Nutrition in fungi (saprotrophs, biotrophs, necrotrophs; symbiotrophs); Methods of reproduction in fungi - Asexual and sexual methods; Spore liberation in fungi; Evolution of sex in fungi; Heterothallism and parasexuality; Life cycle pattern and phylogeny of Myxomycotina, Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina; Fungi and their economic importance.

Unit-4: Plant Pathology: Concepts and scope of plant pathology; Plant diseases and crop losses; Classification of plant diseases; Parasitism and disease development; Effect on physiology of host; Host range of pathogens; Defence Mechanisms in Plants; Plant Disease epidemics and plant disease forecasting; Methods of plant disease management; Study of plant diseases- Sandal Spike, Citrus Canker, Bacterial Blight of Paddy, Late Blight of Potato, Downy Mildew of Bajra, Tikka Disease of Ground nut, Grain Smut of Sorghum. Phloem Necrosis of Coffee, Root Knot Disease of Mulberry.

Practicals-32 Hrs

1) Laboratory guidelines, design, tools, equipments and other requirements for studying microorganisms.
2) Measuring the dimensions of microorganisms using Micrometry.
3) Determining total count of microbes using Haemocytometer.
4) Gram and special staining of bacteria.
5) Preparation of NA, PDA, sterilization, pouring, inoculation and culturing of bacteria/fungi.
6) Staining of fungi including VAM fungi.
7) Identification of fungi.
8) Measurement of bacterial growth by Spectrophotometer.
9) Recording environmental factors (Temperature, RH, and Rainfall and wind velocity).
10) Splash liberation of spores from diseased tissue.
11) Estimation of total phenols in diseased and healthy plant tissues.
12) Study of the following diseases: Sandal Spike, Citrus canker, Bacterial Blight of paddy, Late Blight of Potato. Downy Mildew of Bajra, Tikka disease of ground nut, Grain smut of Sorghum, Phloem Necrosis of Coffee, Root Knot disease of Mulberry.

References

1) Madigan, M .T. 2012. Brock Biology of Microorgasms, 13t edn. Benjamin Cummings.
2) Willey, J, Sherwood, L. and Woolverton, C.J. 2013. Prescott`s Microbilogy 9th edn. Mc Graw- Hill Educations.
3) Wagner, E.K, and Hewlett, M.J. 2009. Basic Virology. Blackwell Science Ltd. 2nd edn. USA.
4) Kodo, C.I. and Agarwal, H.O. 1972. Principles and Techniques in Plant Virology, Van Nostrand, Reinhold Company, New York.
5) Conrat, F.H., Kimball, P.C. and Jay, L. 1988.V irology. Prentice Hall, Englewood Chiff, New Jercy.
6) Jawaid, A. Khan and Jeanne Dijkstra. 2002. Plant Viruses as Molecular Pathogens. Food Products Press, NY
7) Alexopoulos, C.J. Mims, C.W. and Blackwell, M. 2013. Introductory Mycology 4th edn. Wiley.
8) Singh, R. S. 2009. Plant Disease. 9th edn. Oxford and IBH Pub.Co., New Delhi.
9) Agrios, G. N. 2005. Plant Pathology 5th edn. Academic Press, San Diego.
10) Rangaswamy, G. and Mahadevan, A. 2002. Diseases of crop plants in India, Prentice Hall of India Pvt.Ltd. New Delhi.
11) Mehrotra, R. S. 2003. Plant Pathology. 2nd edn. Tata Mc Graw-Hill Pub. Co. Ltd., New Delhi.
12) Cann, A.J. 2012. Principles of Molecular Virology 5th edn. Elsevier Ltd, USA.
13) Flint, S.J. Enaquist, L.W., Rancnicllo, V. R. and Skalka, A.M. 2009. Principles of Virology pathogenesis and control. 3rd edn. APS Press, USA.
14) Hall, R. 2014. Plant Virology, 5th edn. Elsevier, USA.
15) Aneja, K.R. 2003. Experiments in Microbiology plant Pathology and Biotechnology, 4th edn. New Age International Publishers, New Delhi.
16) Holt, J.G., Krige, N.R., Sneath., P.H.A. Stuley, J.T. and Williams, S.T. 2010. Bergey`s Manual of Determinative Bacteriology, 9th edn. Williams and Wilkins, USA.

BOTANY: I SEMESTER - HARD CORE 1.2

PHYCOLOGY, BRYOPHYTES, PTERIDOPHYTES AND GYMNOSPERMS

Theory-32 Hrs

Unit-1: Phycology: Diversity and distribution of algae; Unicellular, colonial, filamentous, heterotrichous, parenchymatous, pseudoparenchymatous, siphonous forms; General characteristics, classification and phylogeny of algae; Pigmentation in algal groups; Role of photosynthetic and accessory pigments; Life cycles in algae - haplontic, diplontic, isomorphic, heteromorphic; Economic importance of algae.

Unit -2: Bryophytes: Introduction, general characteristics, classification and phylogeny of Bryophytes; Distribution, habitat, external and internal morphology and reproduction; Comparative account on gametophytes and sporophytes of bryophytes; Economic and ecological importance.

Unit -3: Pteridophytes: Introduction, classification and phylogeny; Morphology, anatomy reproductive biology and phylogeny; Psilophytes, Lycophytes, Sphenophytes, Filicophyta; Evolution of sorus; evolution of sporangium; Gemetophyte development - homosporous and heterosporous ferns; Heterospory and seed habit; Stelar evolution in Pteridophytes; Ecology of Pteridophytes; Economic importance.

Unit- 4: Gymnosperms: Distribution, general characteristics, classification and phylogeny of Gymnosperms; Range in morphology, anatomy, reproduction and interrelationships of - Cycadales, Ginkgoales, Coniferales, Gnetales; Pteridosperms; Economic importance of Gymnosperms.

Practicals-32 Hrs

1-4) Algae: Study of Cyanophyceae: *Anabaena, Oscillatoria*; Study of Chlorophyceae: *Oedogonium*, *Pediastrum;* Study of Phaeophyceae: *Turbinaria, Ectocarpus*; Study of Rhodophyceae: *Gracilaria*, *Batrachospermum*; Economic products of algae.

5-7) **Bryophytes:** Study of morphology, anatomy and reproductive morphology - Hepaticopsida- *Marchantia, Dumortiera*; Anthocerotopsida- *Anthoceros, Notothylas*; Bryopsida- *Bryum* and *Polytrichum*.

8-10) **Pteridophytes:** Study of vegetative habit, anatomy and reproductive morphology of *Psilotum, Lycopodium, Isoetes, Ophioglossum, Botrychium, Angiopteris, Pteris, Hymenophyllum, Marselia, Salvinia, Azolla;* **Paleobotany**- Study of Lepidodendrales, Calamitales, Sphenophyllales and Coenopteridales (Fossil Pteriodophytes).

11-12) **Gymnosperms:** Study of morphology, anatomy and reproductive morphology of *Zamia, Pinus* and *Ephedra, Ginkgo, Auracaria, Podocarpus, Gnetum, Agathis, Cupressus*, *Thuja*; Economic importance of Gymnosperms.

References:

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11) Odum, E.P. Fundamentals of Ecology. 3rd edn. Toppan Co., Ltd., Japan.
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BOTANY: I SEMESTER - HARD CORE 1.3
SYSTEMATICS OF ANGIOSPERMS

Theory-32 Hrs

Unit-1: Introduction to plant systematics; Plant classification systems-artificial, natural and phylogenetic systems; Contributions of Carolus Linnaeus, Michel Adanson, de Jussieu, de Candolle to plant classification; Concepts of taxonomic hierarchy; Taxonomic Categories-Genus concept; Species concept; Intraspecific categories; subspecies; varieties and forms; History of botanical nomenclature; ICBN and ICN aims and principles; Rules and recommendations; Rule of priority; Typification; Author citation, Legitimate and illegitimate names; Name changes and synonyms; Effective and valid publication; Herbarium and its significance; Botanical gardens.

Unit-2: **Taxonomic Literature:** General taxonomic indices, world floras and manuals; Monographs and revisions; Bibliographies, catalogues and reviews; Periodicals, glossaries and dictionaries; Hortus Malabaricus; Taxonomic websites-IPNI, Plant List, Tropicos, Botanico-Periodicum-Huntianum (BPH); Biodiversity Heritage Library (BHL); Botanicus, Index Herbariorum; Taxonomic Keys- bracketed keys, indented keys, numbered keys, edge punched and body punched keys.

Unit-3: Study of plant classification Systems; Broad outlines of Bentham and Hooker's system, Engler and Prantl's system, Hutchinson's system, Takhtajan's system, and Cronquist's system; Numerical Taxonomy-principles, selection of characters, merits and demerits; Angiosperm Phylogeny Group (APG) III & IV classification; Study of angiosperm families-Magnoliaceae, Nympheaceae, Urticaceae, Papaveraceae, Euphorbiaceae, Acanthaceae, Rubiaceae, Alismataceae, Cyperaceae, Commelinaceae, Zingiberaceae, Liliaceae, Dioscoreaceae and Orchidaceae.

Unit-4: Molecular Systematics: Nuclear, mitochondrial and chloroplast genes. Gene sequencing, analysis of molecular data, alignment of sequences; Phylogenetic tree construction-Maximum Likelihood and Neighbour Joining Methods; Phylogenetic analysisrooted and unrooted trees; Data analysis- alignment, substitution, model building; Phylogentic softwares-CLUSTAL W, MEGA, Mesquite, PAUP, PHYLIP, Treefinder, TreeBase.

Practicals-32 Hrs

1) Methods of preparation and maintenance of Herbaria.
2-4) A field trip of three days to a floristically rich area to study plants belonging to different families (Every student shall submit a report for evaluation for two credits).
5-10) Identification of the flowering plants in and around Mysore using keys, floras and monographs.
11-12) Construction of phylogenetic tree based on molecular data of plant species retrieved from GenBank.

References:

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2. Simpson, M.G. 2006. Plant Systematics. Elsevier, Amsterdam.

3. Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.A. and Donoghue, M.J. 2002. Plant Systematics: A phylogenetic Approach. Sinauer Associates, Inc., Massachusetts.
4. Gurucharan Singh. 2004. Plant Systematics: Theory and Practice, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
5. Jeffrey, C. 1982. An introduction to Plant Taxonomy. II Edn., Cambridge Uni. Press.
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8. Johri, B.M. and Bhatacharjee, S.P. 1994. Taxonomy of Angiosperms. Narosa Publishers, New Delhi.
9. Lawrence, G.H.M. 191. Taxonomy of Vascular Plants. MacMillan, London.
10. Chase, M.W. and Reveal, J.L. 2009. A phylogenetic classification of the land plants to accompany APG III. Botanical Journal of Linnaean Society, 161: 122-127.
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12. APG-IV. 2016. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants APG-IV. Botanical Journal of Linnaean Society, 181: 1-20.

BOTANY: I SEMESTER - SOFT CORE 1.1
FUNGAL BIOLOGY AND BIOTECHNOLOGY

Theory-32 Hrs

Unit-1: Introduction and historical overview of mycology; General characteristics and importance of fungi in human life; Fungi –Taxonomy and Systematics; Fungi in genetic and applied research; Estimation of Fungal diversity; Quantitative Indices- species richness, species evenness and species abundance; Molecular methods used for fungal diversity estimation-nuclear genome, messenger RNA transcripts, Ribosomal/DNA sequence comparisons and mitochondrial genome.

Unit-2: Macro fungi and micro fungi living on plant substrata; Lignicolous macrofungi; Lichenized fungi; Sequestrate fungi; Endophytic fungi; Saprobic soil fungi; Fungi in stressful environment; Mutualistic, arbuscular, and endomycorrhizal fungi; Yeasts; Fungicolous fungi; Fungi in fresh and marine water habitats; Fungi associated with aquatic animals; Fungi as parasites of humans and plants; Fungi associated with animals, insect, arthropod and nematodes; Coprophilous fungi.

Unit-3: Fungal Fermentation and Food Products: Food and Beverages; Single cell proteins-Myco-proteins; Food processing by fungi-bread, soybean products, cheese and fermented milk; Fungal secondary metabolites-antibiotics, immunosuppressive agents, anti-tumour agents, fungal toxins as medicines; Fungal pigments; Steroid transformation; Fungal enzymes; Bio-control agents; Application of molecular biology in fungal biotechnology.

Unit-4: Mushrooms and fungi in medicine; Toxic macromycetes; Mushroom cultivation; Model organisms- *Saccharomyces cerevisiae*/*Neurospora crassa*; Bio-deterioration of food grains and mycotoxins; Fungal communities of herbivore dung; The fungal communities of composts; Fungal interactions and practical exploitation; Heavy metals in fungi-accumulation and sorption; Biotechnology of wood rotting fungi.

Practicals-32 Hrs

1) Study of Myxomycetes and Chytridiomycetes
2) Study of Plasmodiophoromycetes and Oomycetes
3) Study of Zygomycetes
4) Study of Ascomycetes
5) Study of Basidiomycetes
6) Study of Deuteromycetes 7)Study of Lichens
8) Study of VAM fungi
9) Detection of aflatoxin B1
10) Cultivation of Oyster mushroom.
11) Alcoholic fermentation of grape juice by *Saccharomyces*.
12) Cultivation of *Penicillium* and testing antibiotic principle.
13) Study of edible and poisonous mushrooms.
14) Study of fungal model organisms - *Saccharomyces cerevisiae*/*Neurospora crassa*

References:

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2) Deacon, J. W. 1997. Modern Mycology 3rd edn. Blackwell Science publishers, London.

3) Mehrotra, R.S. and Aneja, K.R. 1990. An Introduction to Mycology, New Age International (P) Limited, New Delhi.
4) Mueller, G M; Bills, GF and Foster, M.S. 2004. Biodiversity of Fungi, Elsevier Academic Press, New York.
5) Rai, M. and Bridge, P.D. 2009. Applied Mycology, CABI International, UK.
6) Carlile, M.J. Watkinson,S.C. and Gooday, G.W. 2001.The Fungi, 2nd edn. Academic Press, USA.
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BOTANY: I SEMESTER - SOFT CORE 1.2
ALGAL BIOLOGY AND BIOTECHNOLOGY

Theory-32 Hrs

Unit-1:Algal Biology: Historical development of Phycology and contributions of Phycologists; Thallus organization in algae-Cyanophyceae, Chlorophyceae, Charophyceae, Euglenophyceae, Xanthophyceae, Bacillariophyceae, Phaeophyceae and Rhodophyceae; General characteristics, algal classification, affinities and phylogeny- polyphasic approach; Molecular markers for phylogenetic study; Algal physiology- ultra-structure of cells; Photosynthesis and respiration.

Unit-2: Algal blooms and Toxins: Blooms produced by algal groups; Toxins produced by cyanobacteria, diatoms, dinoflagellates, prymnesiophytes and eugleoids; bioaccumulation and biomagnification; effects of toxins on aquatic life and humans; Scenario in coastal waters of India- monitoring and safety measures; Algal communities of extreme environments- Thermal hot springs, cold springs, snow and ice; **Fresh water algae**-Ecological classification of fresh water organisms; Lentic communities of algae (pond, lake, bog, swamp); Lotic communities (streams, rivers, rapids; **Marine algae-** Marine biota; zonation; quantitative study of phytoplanktons, marine communities of algae.

Unit-3: Algal Biotechnology: Algal culture techniques; general principles; physical parameters; culture media; strain improvement; **Algal cultivation methods-**conventional, advanced; **Cultivation of microalgae-*Spirulina*** and ***Dunaliella***; Media, seeding, cultivation systems, harvesting; processing, drying methods, packaging, marketing; Algal cultivation and production in India; **Cultivation of macroalgae- *Porphyra;*** Nutritional value; importance of life cycle; methods of cultivation in advanced countries; Pillar, semi raft floating and open sea cultivation.

Unit-4: Applications of algae/products: Pollution indicators, treatment of waste water plants, heavy metal toxicity and phyco-remediation; Bio-fouling and biofuel production; Algal products as sources of nutraceuticals; Food colorants; Aquaculture feed; Therapeutics and cosmetics; Medicines; Dietary fibres from algae and uses; Biotechnological applications of algal silica and oils.

Practicals-32 Hrs

1) Study of fresh water planktonic forms in the lake samples.
2) Study of fresh water diatoms.
3) Chlorophyceae: *Ulva, Caulerpa, Halimeda, Acetabularia.*
4) Xanthophyceae: Mounting of *Botrydium* from soils.
5) Phaeophyceae: *Dictyota, Sargassum, Cystophyllum.*
6) Rhodophyceae: *Gracilaria, Gelidium.*
7) Cyanophyceae: *Microcystis*, *Nostoc, Spirulina.*
8) Estimation of carotene content in algal cells .
9) Culturing of microalgae: *Spirulina/ Chlorella/Scenedesmus/Dunaliella.*
10) Applications of algal products: Agar, spirulina tablets/powder, beta-carotene, phycobiliproteins, triglycerides, Mycosporine like amino acids (MAA), diatom silica as nanoparticles.
11) Visit to National Institute of Oceanography, Goa.
12) Study of algal herbaria.

References

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3) Fritsch, F. E. 1935. Structure and reproduction of Algae Vol. I and II. Cambridge University Press, London.
4) Hoek, V., Mann, D. G. and Jahns, H. M. 1995. An introduction to Phycology, Cambridge University Press, UK.
5) Murthy, A.V.S.S. 2005. A text book of algae. I.K. International Pvt., Ltd., New Delhi.
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10) Bux *et al.* (eds.). 2016. Algae Biotechnology: Products and Processes, Springer, ISBN 9783319123332 (P), 9783319123349 (Online).
11) Chu, W. 2012. Biotechnological Applications of Microalgae. IeJSME 6(1): S24-S37.

BOTANY: I SEMESTER - SOFT CORE 1.3
LICHENOLOGY AND MYCORRHIZAL TECHNOLOGY

Theory-32 Hrs

Unit-1: Introduction: Photobionts- identification, reproduction, and taxonomy of photobionts; Occurrence within lichens; Mycobionts- Lichenized versus nonlichenized fungi; Bryophilous and folicolous lichens; Thallus morphology and anatomy; Growth forms - crustose lichens, foliose lichens, fruticose lichens; Vegetative structures- Homoiomerous thallus, stratified thallus, cortex, epicortex, and epinecral layer, photobiont layer and medulla, lower cortex, Attachment organs and appendages; Cyphellae and pseudocyphellae; Cephalodia (Photosymbiodemes); Reproductive structures- sexual reproduction in lichen-forming ascomycetes; Mating systems, dikaryon formation, Ascomal ontogeny, Ascosporogenesis; Ascus structure and function; Generative reproduction: ascoma, perithecia, apothecia, Thallinocarpia, Pycnoascocarpia, Hysterothecia, Asci, Basidioma; Vegetative reproduction- aposymbiotic propagules, symbiotic propagules; Systematics of lichenized fungi- History, classification and phylogeny.

Unit-2: Morphogenesis- Acquisition of a compatible photobiont; Recognition and specificity; Structural and functional aspects of the mycobiont–photobiont interface; Genotypes and phenotypes, growth patterns; Biochemistry and secondary metabolites- intracellular and extracellular products; The fungal origin of the secondary metabolites; Major categories of lichen products; Application to pharmacology and medicine; Harmful properties of lichen substances, lichens in perfume, lichens in dyeing; Stress physiology and the symbiosis- stress tolerance, limits to stress tolerance; harmful effects of stress, constitutive and inducible stress tolerance, evolution of stress tolerance in lichens; Modes of water uptake, light, temperature, carbon dioxide; The carbon economy of lichens.

Unit-3: Nitrogen, its metabolism and potential contribution to ecosystems, Methods of determination of nitrogen fixation; Nutrients- chemical and physical properties of nutrients and metals; Nutrient requirements, sources of nutrients, accumulation mechanisms, compartmentalization of elements within lichens; Metal toxicity, metal tolerance; Environmental role of lichens- dispersal, establishment, pedogenesis and biodeterioration; Community structure, succession, ecosystem dynamics; Animal and lichen interactions; Forest management, conservation, environmental monitoring; Lichen sensitivity to air pollution- lichens in relation to sulfur dioxide, oxidants and lichens, hydrogen fluoride and organopollutants.

Unit-IV: Mycorrhizal fungi: Introduction and classification; Types of mycorrhizas- Arbutoid mycorrhizas, ectomycorrhizas, vesicular arbuscular mycorrhizas or arbuscular mycorrhizas, ectendomycorrhizas, ericoid mycorrhizas, monotropoid mycorrhizas and orchid mycorrhizas; Phoshate solubilisation; Ecological significance of AM fungi; Importance of mycorrhiza in evolution of land plants; Role of mycorrhiza in agriculture, horticulture and forestry.

Practicals-32 Hrs

1-3) Survey of lichen vegetation in the study area: Frequency, density and abundance.
4) Determination of species richness and species diversity.
5) Isolation and maintenance of cyanobionts and phycobionts
6) Isolation and maintenance of mycobionts

7) Analysis of secondary metabolites of lichens.
8) Biological activity of secondary metabolites of the lichens.
9) Culture methods for lichens and lichen symbionts.
10) Root clearing and staining technique to study arbuscular mycorrhizal fungi.
11) Assessment of % root colonization of arbuscular mycorrhizal fungi.
12) Isolation and identification of arbuscular mycorrhizal fungi.

References:

1) Thomas H. Nash , 2008. Lichen Biology, 3rd edn. Cambridge University Press, The Edinburgh Building, Cambridge CB2 8RU, UK
2) Awasthi D.D. 2000. Lichenology in Indian subcontinent: A supplement to "A hand book of lichens". Publisher: M/s Bishen Singh Mahendra Pal Singh, Dehra Dun.
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4) Sally E. Smith and David J. Read (2008). Mycorrhizal Symbiosis. 3rd edn. Academic Press, New York.
5) Larry Peterson R., Hugues B. Massicotte, Lewis H. Melville, 2004. Mycorrhizas: Anatomy and Cell Biology, CAB International, UK.

BOTANY: I- SEMESTER - SOFT CORE 1.4
PHYTOPATHOLOGY

Theory-32 Hrs

Unit-1: Concept of plant disease, Economic aspects of plant diseases; Types of plant diseases- Infectious diseases and non-infectious diseases; Causative agents of plant diseases; Angiospermic parasites; Development of plant pathology; Plant pathology in practice- Plant Clinic and Plant Doctor Concept; Parasitism and pathogenicity; Disease triangle; Infections and colonization; Weapons of plant pathogens; Effect of pathogen on physiology of host plant (photosynthesis, translocation and transpiration, respiration, permeability, transcription and translation).

Unit-2: Defence mechanisms in Plants- Pre-existing structural and chemical defences, induced structural and biochemical defences; Plant disease epidemiology- Elements of an epidemic and development of epidemics; Plant Disease forecasting; Genes and Diseases, Gene for gene concept, non-host resistance; Types of plant resistance to pathogens (Horizontal and Vertical Resistance); 'R' Genes and 'avr' genes; Genetics of virulence in pathogens and resistance in host plants; Breeding for disease resistance.

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Unit-3: Management of Plant Diseases: Exclusion, eradication, cross protection, direct protection, integrated disease management, chemical methods of plant disease control; Biotechnological approaches to plant disease management; Gene silencing and disease control; Mechanism of gene silencing and control of viral diseases; Engineered resistance to viral, bacterial, fungal and insect diseases of crop plants.

Unit-4:Study of diseases of crop plants: Potato Spindle Tuber Disease, Tobacco Mosaic Disease, Sandal Spike Disease, Bacterial blight of Paddy, Citrus Canker, Late Blight of Potato, Downy Mildew of Maize, Blight of Paddy, Angular leaf spot of Cotton, Tikka disease of ground nut, Rust of coffee, Grain and Head smut of Sorghum. Leaf blight of Paddy, Blast of Paddy, Powdery mildew of cucurbits, Wilt of Tomato, Phloem Necrosis of Coffee, Root Knot of Disease of Mulberry and Vegetables; Non-parasitic diseases of plants; Seed-borne diseases.

Practicals-32 Hrs

1) Isolation of bacterial, fungal, and nematode plant pathogens of crop plants.
2) Study of mineral deficiency diseases of Tomato and French bean.
3) Estimation of foliar infection by Stover's method.
4) Study of spore germination.
5) Estimation of total phenols in diseased and healthy plant tissues.
6) Mycoflora analysis by Standard Blotter Method SBM/agar plating method.
7)-9) Study of Tobacco mosaic, Bacterial blight; Downy mildew of Maize; Powdery mildew of cucurbits; Grain smut of sorghum; Leaf rust of Coffee; Root Knot of Mulberry. Bunchy top of banana, Grassy shoot of sugar cane, Little leaf of Brinjal; Potao Spindle Tuber Disease (PSTVd)
10) Study of effect of pathogens on seed germination and vigour index.
11) Study of effect of fungicide on seed-borne pathogens.
12) Study of Fungal bio-control agents.

References:

1) Agrios, G. N. 2005. Plant Pathology 5th edn. Academic Press, San Diego.
2) Dickinson, M. 2003. Molecular Plant Pathology, Garland Publishing Inc, CT.
3) Ingram,D.S. and Robertson, N.F. 1999. Plant Diseases, Collins Publishers, London.

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BOTANY: II- SEMESTER- HARDCORE 2.1

REPRODUCTIVE BIOLOGY OF ANGIOSPERMS AND PLANT MORPHOGENESIS

Theory-32 Hrs

Unit-1: Reproductive Biology of Angiosperms: Historical overview; Contributions of P. Maheshwari; BM Johri; BGL Swamy to the development of embryology in India; Microsporogenesis and Microgametogenesis- wall layers and functions; Tapetum- types, concept of male germ unit and its significance; Pollen morphological features; Unusual features-pollen development in Cyperaceae, pollen embryosac; Concept and scope of palynology.

Unit-2: Megasporogenesis and Megagametogenesis; Ovular structure and types; Development of monosporic, bisporic, tetrasporic and special types of embryo sacs; Ultra structure and nutrition of female gametophyte, concept of female germ unit and its significance; Fertilization- a general account, double fertilization, single fertilization, heterofertilization and polyspermy; Pollen recognition and rejection reactions - types, structures, methods to overcome incompatibility reactions; Endosperm- types, haustorial variations, ruminate and composite endosperm; Embryo- structure, development of monocot, dicot and grass embryo; Significance of embryonal suspensor; Experimental Embryology- scope and applications.

Unit-3: Plant Morphogenesis: Models of morphogenesis- comparison of plant v/s animal morphogenetic pathways: Embryo, *Arabidopsis thaliana*; Concepts- cell fate/ fate maps, gradients, stem cells in plants and their significance in development, polarity, symmetry, totipotency of cell types, pleuripotency, plasticity, differentiation, redifferentiation, dedifferentiation and regeneration in *Acetabularia* and *Arabidopsis thaliana.*

Unit-4: Plant Growth and Development: Types, shoot apical meristems, root meristems; control of cell division in meristems; Quiescent center and meresteme de attente; *Arabidopsis*- vascular patterning and leaf development, abnormal growth; Cellular basis of growth- maintenance of cell shape; Cytoskeletal elements; Photomorphogenesis- definition, history, Hartmann's technique; Photoreceptors and photo morphogenesis, localization and properties; Effect of blue light-mediated photomorphogenesis with suitable examples.

Practicals-32 Hrs

Reproductive Biology of Angiosperms:

1) Study of microsporangium- slides: wall layers, tapetal types, two-celled and three-celled pollen; pollen tetrads.

2) Study of pollen germination: *Balsam, Delonix, Hibiscus* and *Peltaphorum*

3) Study of megasporangium-slides: female gametophyte development in *Penstemon, Xyris pauciflora,* 2, 4, 8-nucleate stages, mature embryo sac.

4) Endosperm mounting- *Cucumis sativus, Grevellia robusta* and *Croton sparsiflorus*

5) Embryo: Slides-monocot, dicot and grass embryo.

6) Embryo mounting : *Crotalaria.*

Plant Morphogenesis:

7) Study of stem cells in plants: SAM, RM.

8) Regeneration abilities of shoot apical meristems of dicots on media with combinations of growth regulators.

9) Study of totipotency in cell types: stomata, epidermal cells, stem and leaf explants on a tissue culture media.

10) Polarity in stem cuttings: *Pothos* spp.

11) Study of regeneration in succulents *Kalanchoe*, *Byrophyllum.*

12) Study of leaf galls of plants: *Pongamia pinnata and Achyranthes aspera*: Morphological observations and histology.
13) Study of *Arabidopsis thaliana* as a model plant.

References:

1) Johri, B. M. 1984. The embryology of Angiosperms. Springer Verlag.
2) Johri, B. M. 1982. The experimental embryology of vascular plants. Springer Verlag, New York.
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5) Maheshwari, P. 1950. An introduction to the embryology of Angiosperms. McGraw Hill book Co., Inc., New York.
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Chasan, R. 1994. Tracing tracheary element development. The Plant Cell 6:917-919.
11) Lyndon, R. F. 1990. Plant Development : The Cellular basis. Unwin Hyman, London.
12) Aloni, R. 1987. Differentiation of vascular tissues. Annu. Rev. Plant Physiol. 38:179- 219.
13) Raman, A. 2007. Insect induced plant galls of India; unresolved questions. Curr. Sci. 92 (6): 748-757.
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BOTANY: II- SEMESTER - HARD CORE 2.2
CELL BIOLOGY AND GENETICS

Theory-32 Hrs

Unit-1: Bio Molecules and Membranes: Structure, composition of bio-molecules and their stabilizing interactions (carbohydrates, lipids, proteins and nucleic acids); Unit membrane structure and functions; Membrane proteins, membrane transport and the electrical properties; Intra-cellular compartments and protein sorting; Intracellular membrane traffic; Cytoskeletons.

Unit-2: Functions of Organelles: Cell wall, membranes, nucleus, mitochondria, Golgi bodies, lysosomes, spherosomes, peroxisomes, ribosomes, endoplasmic reticulum, Plastids, chloroplast, vacuoles and cytoskeleton; Cell cycle and mechanism of cell cycle regulations; A brief account of cell signalling, receptors, second messengers; General mechanism of signal transduction pathway; Programmed cell death in life cycles of plants.

Unit-3: Extensions of Mendelian Principles co-dominance, incomplete dominance, gene interactions, multiple alleles, lethal alleles, pleiotropy, penetrance and expressivity, polygenic inheritance, linkage and crossing over, sex linked inheritance, sex limited and influenced traits, genome imprinting, extra nuclear inheritance; C**oncept of the gene**-classical-alleles, multiple alleles, pseudo-alleles, complementation test, experiments on rII locus and lozenge locus, modern- jumping genes, overlapping and genes within genes, split genes, nested genes, fusion genes; **Gene mapping methods-** linkage maps, tetrad analysis; Recombination in bacteria mapping genes in bacteria by interrupted mating technique, fine structure mapping, transduction and transformation mapping, mapping genes in Bacteriophages**,**

Unit-4: Sex Determination and Dosage Compensation: Chromosomal and genetic basis of sex determination; Mechanism of sex determination in *Melandrium*, *C. elegans*, Drosophila and humans, dosage compensation mechanisms in humans, Drosophila and *C. elegans*. **Transposable elements**- discovery in maize and bacteria, transposal elements in bacteria and bacteriophage, types and functions; Transposable elements in eukaryotes- Plants, *Drosophila* and Humans, mechanisms of transpositions;Transposable elements in research.

Practicals-32 Hrs

1) Determination of reducing sugars by Nelson-Somogyim's method.
2) Estimation of total soluble sugars by volumetric method.
3) Quantitative determination of free Amino acid content in germinating seeds.
4) Estimation of ascorbic acid in plant tissues.
5) Estimation of Phospholipids by TLC.
6) Slides/Charts/photos NP (Cytology Genetics and Embryology).
7) Study of mitosis in normal and induced root tips cells of Onion.
8) Study of meiosis in onion flower buds , translocation in Rhoeo.
9) Study of special chromosomes- B chromosomes, and sex chromosomes.
10) Determination of chiasma frequency in onion.
11) -12)To solve genetic problems on linkage, ordered and unordered tetrads.

References:

1) Atherly, A.G. Girton, J.R. Donald, J.R. 1999. The Science of Genetics. Saunders College Publishers. Fortworth .
2) Griffith, A.J.F. Gelbart, W.M. Muller, J.H. and Lewintin, R.C. 1999. Modern Genetic Analysis. W.H. Freeman and Co. New York.

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4) Fairbanks, D.J. and Anderson, W.R. 1999. Genetics the continuity of Life. Brooks's/Cole publishing Company, California.
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BOTANY: II SEMESTER HARD CORE 2.3
PLANT BREEDING AND EVOLUTIONARY BIOLOGY

Theory-32 Hrs

Unit-1: Introduction: Objective and role of plant breeding; Evolution of plant breeding, scope of plant breeding, sciences related to plant breeding, Vavilov's concept of origin of centers of origin of crop plants; Recent trends in plant breeding; **Breeding Methods-**plant introduction and acclimatization, domestication and agriculture, pure line, clonal, mass and progeny selections, recurrent selection, pedigree, bulk and back cross methods; Heterosis breeding synthetic and composite varieties; **Breeding Techniques-**Mutation breeding, polyploidy, hybridization, tissue culture techniques in crop improvement, protoplast fusion, electrophoration, electro-fusion, biolistics, somatic hybridization, transgenic plants (GMO's); The role of Gene technology in plant breeding.

Unit-2: Breeding for Specific Purposes: Breeding for disease resistance, insect resistance, drought and salinity, quality trait, multiple cropping systems, ideotype breeding, breeding for Adaptation; **Crop breeding and seed production-** Breeding field crops, seed production techniques, release of new varieties, intellectual property rights, computer application in plant breeding, crop breeding Institutes/Centers; Genetic resources and germplasm conservation; Scientific Plant breeding; Green revolution; The elite crop (Golden rice); Contributions of **Dr.**
M.S. Swaminathan, Dr. Norman E. Borlaug and N.I. Vavilov.

Unit-3: Nature of Evolution : The origin, theories of evolution of life, earth and the universe,; Conditions of the early earth, emergence of the first living cell, origin of prokaryotic and eukaryotic cells, life in the Palaeozoic, Mesozoic and Coenozoic era. **Development of Evolutionary thoughts;** Ecological context, before Darwin, Darwinism, Darwin's evolutionary theory, Neo – Darwinism, modern synthesis: **Fossil evidence of Ancient life,** fossilization,; Interpreting geological time scale and fossil records; Evidences from comparative, morphology, patterns of development, comparative physiology and biochemistry, biogeography, palaeontology, taxonomy, anatomy and embryology, plant and animal breeding; Evidence from changing earth and sea; Extinctions; Evolutionary ecology.

Unit-4: Natural Selection : Types of natural selection, selective forces, selection models, sexual selection, selection and non adaptive characters, Adaptive radiation, artificial selection, **Variation- g**ene flow, genetic drift, gene mutation - Mendelian concept, chromosomal mutation, architectural changes in chromosomes; The Hardy – Weinberg law, polyploidy in plant evolution**;** Speciation and origin of higher categories **-**Types of speciation, models of speciation, pattern of speciation, isolating mechanism and species formation, signification of speciation; Molecular evolution.

Practicals-32 Hrs

(1) Study of floral biology of crops - typical examples of self and cross pollinated plants.
(2) Selfing and hybridization techniques - Bagging and emasculation.
(3) Pollen viability: germination test and TTC test.
(4) Studying of centre's of origin of cultivated crops - N.I. Vavilov Concept.
(5) Mode of pollination study in different crops.
(6) Identification of crop breeding institutes/ centers and logos.
(7) Studying and identification of contributors of plant breeding - M.S. Swaminathan, N.I. Vavilov, Norman . E. Borlaug .
(8) Study of contributions of scientists to evolutionary biology.
(9)-12) Study of models and photographs related to evolution.

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BOTANY: II- SEMESTER - SOFT CORE 2.1
PLANT ANATOMY AND HISTO-CHEMISTRY

Theory-32 Hrs

Unit-1: Plant Anatomy: Primary vegetative body of the plant; Anatomical features of leaf, stem and root (dicot and monocot); leaf of fern and gymnosperm; Structure of modified leaves- Kranz anatomy and C4 photosynthesis; Ultra-structure and chemistry of the cell wall; formation of the cell wall and its uses.

Unit-2: Anatomy of Vascular Tissue: Ultra structure and differentiation of xylem and phloem tissues; Apical meristems- shoot apex in Pteridophytes, Gymnosperms and Angiosperms, theories, root apical meristems.

Unit -3: Secondary Growth: Vascular cambium, secondary xylem of gymnosperms and dicots and secondary phloem of Gymnosperms and dicots; Periderm and bark; Anomalous secondary growth in monocots and climbers; Leaf ontogeny - Dicot- simple, compound, Monocot; Floral anatomy-flower parts, floral meristem, vascular system.

Unit-4: Plant Histochemistry: Tests for minerals, carbohydrates, lignins, polyphenols, proteins, lipids and nucleic acids; Study of instruments: (a) Camera lucida (b) Micrometry (c) Microtome. Principles of histo-chemical stains; Killing, fixing and staining of plant tissues; Double staining- TBA method.

Practicals-32 Hrs

1) Staining of xylem and phloem elements.
2) Study of anatomy of roots in: *Ficus, Musa, Dieffenbachia*, *Vanda.*
3) Study of anamalous secondary growth in the following examples: Stem of *Aristolochia*, *Nyctanthes, Pyrostegia, Peperomia, Tinospora, Achyranthes*.
4) Study of Ecological anatomy.
5) Study of Vasculature in floral organs.
6) Studying double staining technique.
7-11) Embedding: TBA method, embedding for electron microscope, Sectioning**,** Microtomes, whole mounts maceration.
12) Histochemical- PAS Test**,** Sudan black- lipids**,** Feulgen reaction – Nucleic acids.

References:

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BOTANY: II- SEMESTER - SOFT CORE 2.2

ETHNO-BOTANY AND INTELLECTUAL PROPERTY RIGHTS (IPR)

Theory - 32 Hrs

Unit-1: Ethno-botany: Introduction, concept, scope and objectives; Ethno-botany as an interdisciplinary science; The relevance of ethno-botany in the present context; Ethnic groups; Ethno-botany- Major and minor ethnic groups of India and their life styles; Forest Vs. ethnic groups; Plants in tribal life with reference to Magico-religious rituals and social customs; Sacred groves.

Unit-2: Methodology used in the study of Ethnobotany and Ethno pharmacology: Field work, Herbarium, Ancient Literature, Archaeological findings, temples and sacred places, protocols. Preliminary phyto-chemical analysis of ethno-botanical important medicinal plants.

Unit-3: Role of ethno-botany in modern Medicine with special examples; Medico-ethno-botanical Sources in India with special reference to Karnataka; Tribals Vs. Agriculture: Shifting, Podu and Jhum cultivation; Role of ethnic groups on surrounding environment; Crop genetic sources; Endangered taxa and forest management (participatory forest management); Ethno- botany as a tool to protect interests of ethnic groups; Sharing of wealth concept with few examples from India.

Unit-4: Study of Intellectual Property Rights – patents, trademark, geographical indication, copyright; IPR and Traditional Knowledge; Bio-piracy of traditional knowledge; Ethno botany and legal aspects; National and international organizations and treaty related to traditional knowledge – WIPO, TKDL, TRIPS, CBD, Nagoya protocol etc., Ethno botany as a source (recent) of already known drugs: a) *Withania* as an antioxidant and relaxant b) *Sarpagandha* in brain ailments c) *Becopa* and *Centella* in epilepsy and memory development in children d) *Phyllanthus fraternus* in diabetic and viral jaundice e) *Artemisia* as a powerful cerebral anti malarial agent and its possible use in tuberculosis.

Practicals-32 Hrs

1) Survey and collection important ethno botanical plants by using questionnaire and interview.
2) Preliminary phyto- chemical analysis of medicinal plants.
3) Study of biological functional properties of crude drugs – Anti microbial activity.
4) Study of methods of *in-situ* or *ex-situ* conservation of important medicinal plants.
5) Study of techniques used in Pharmacognosy – organoleptic, anatomy and chemical methods.
6) A visit to a Tribal area to conduct field work and collect ethno botanical information / data.
7) Listing of Crude drugs in Pansali shops (local crude drugs shops) and their identification (little known drugs only).
8) -12) Visit to nearby Western Ghats and Sacred Groves.

References:

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BOTANY: II- SEMESTER - SOFT CORE 2.3
ECONOMIC BOTANY

Theory -32 Hrs

Unit- 1: Economic Botany: The origin of cultivated plants and Agriculture; The future role of plants in relation to mankind; Introduction to Green revolution; Study of origin, distribution, cultivation and utility of the useful parts of the following- - rice, wheat, maize, barley, sorghum and millets; Red gram, green gram, black gram, horse gram, pea, cow pea, bengal gram; Oil Yielding plants- sunflower, safflower, groundnut, linseed, rape seed; A brief account of economically important horticultural and floricultural plants.

Unit- 2: Economic Botany: Study and utility of the useful parts of the following- Sugar yielding plants- sugar cane and sweet potato, sugar beet and *Stevia*; Spices and condiments - ginger, turmeric, cardamom, cinnamon, clove, saffron, all spice, black pepper, nutmeg, red pepper, coriander, cumin, fennel and *Vanilla.*

Unit -3: Economic Botany Study and utility of the useful parts of the following- fibre- cotton, jute, flax, hemp, Sunn hemp, China grass, coconut and Kapok; Timber yielding plants- *Tectona* and *Dalbergia*; Dyes- indigo, henna; Masticatories and fumitories-areca nut, betel leaf, tobacco; rubber- Para rubber and other substitutes; Gums- Gum Arabic, Karaya gum.

Unit-4: Medicinal Botany: Scope and importance of medicinal plants; Indigenous medicinal Sciences; Important medicinal plants and their uses; Major exporters and importers of traditional medicinal plants and plant products; Application of natural products to certain diseases- jaundice, cardiac, infertility, diabetics, blood pressure and skin diseases; Poisonous plants.

Practicals-32 Hrs

1) Utility, uses and economic importance of cereals and millets.
2) Utility, uses and economic importance of horticultural and floricultural plants
3) Utility, uses and economic importance of pulses and oil yielding crops.
4) Utility, uses and economic importance of sugar yielding crops.
5) Utility, uses and economic importance of spice and condiments.
6) Utility, uses and economic importance of fiber and timber yielding plants.
7) Utility, uses and economic importance of dye, rubber and gum yielding plants
8) Utility, uses and economic importance of masticatories and fumitories
9) -12) Study of medicinal and poisonous plants.

References:

1) Hill, A.F. 1952. Economic Botany, TataMcGraw Hill, New Delhi.
2) Kochhar, S.L. 1998. Economic Botany of Tropics, Macmillan India Publishers, New Delhi.
4) Pandey, B.P. 2000. Economic Botany. S. Chand & Company, New Delhi.
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BOTANY: II SEMESTER- OPEN ELECTIVE 2.1
MEDICINAL PLANTS

Theory-32 Hrs

Unit-1: Medicinal Plants: History, scope and importance of medicinal plants; Indigenous medicinal sciences; History, origin, panchamahabhutas, saptadhatu and tridosha concept, Rasayana, plants used in ayurvedic treatments, Siddha: Origin of Siddha medicinal systems, Basis of Siddha system, plants used in Siddha medicine. Unani: History, concept: Umoor-e-tabiya, tumors treatments/ therapy, polyherbal formulations.

Unit-2: Medicinal Plants Conservation: Conservation of endangered and endemic medicinal plants; Endemic and endangered medicinal plants; Red list criteria; *In-situ* conservation-biosphere reserves, sacred groves, national parks; *Ex situ* conservation- botanic gardens, ethno medicinal plant gardens; Propagation of medicinal plants - objectives of the nursery, its classification, important components of a nursery, sowing, pricking, use of green house for nursery production, propagation through cuttings, layering, grafting and budding.

Unit - 3: Funding for Cultivation of Medicinal Plants: Sources of financial aids for medicinal plant cultivation: Aims and objectives, Functions and activities of the board, Schemes and Projects for Financial assistance, Funding of projects; Procedure for processing project proposal for approval, Implementation and monitoring.

Unit- 4: Ethno botany and Folk medicines: Definition; Ethno botany in India: Methods to study ethno botany; Applications of Ethno botany: National interacts. Ethno medicine. Application of natural products to certain diseases- Jaundice, cardiac, infertility, diabetics, Blood pressure and skin diseases. Brief introduction to poisonous plants.

References:

1) Trivedi, P. C. 2006. Medicinal Plants: Ethnobotanical Approach, Agrobios, India.
2) Purohit and Vyas, 2008. Medicinal Plant Cultivation: A Scientific Approach, 2nd edn.
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4) Yoganarasimhan, S.N. Medicinal Plants of India- Vol 1- Karnataka, Interline Publishing Pvt. Ltd.

BOTANY: III- SEMESTER - HARD CORE 3.1
BIOCHEMISTRY AND PLANT PHYSIOLOGY

Theory -32 Hrs

Unit-1: Biochemistry- Brief account of plant structural and functional molecules-carbohydrates, proteins, lipids and nucleic acids**;** classification, structural and functional properties of bio molecules; Biochemistry of cell membranes; **Lipids-**building and storage molecules, classification and significance; **Proteins-** classification, structure- primary, secondary, tertiary and quaternary structure; properties of proteins; **Enzymes**-Nomenclature, nature and properties of enzymes, active sites, co-enzymes, kinetics of enzyme action, catalysis, specificity and inhibition, allosteric enzymes, ribozyme and abzyme.

Unit-2:Solute transport: Transport of solutes across the membranes Transmembrane proteins, Transport of ions, solutes and macro-molecules, Mechanism of translocations in phloem; Role played in signal transduction pathway stomatal physiology; **Phytosynthesis in higher plants** (i) Photophosphorylation - Calvin cycle; **Photorespiration** - C4 – Pathway, CAM in plants; Oxidative Phosphorylations; Glycolysis -TCA – Cycle and terminal oxidation.

Unit-3: Plant Hormones- plant hormones-discovery, biosynthesis, metabolism, transport and physiological effects of plant hormones and their applications; **Nitrogen metabolism** -(i) Molecular mechanism of N2 fixation (ii) Biosynthesis of amino acids (iii) Assimilation of nitrate and ammonium; **Lipid metabolism-** fats and oils biosynthesis and oxidation of lipids; Physiology of seed germination and flowering.

Unit -4: Stress Physiology: Water deficit and its physiological consequences; Drought tolerance mechanisms, Salinity stress and plant responses. Heat stress and heat shock proteins; Metal toxicity in plants. Biotic stress, HR and SAR mechanisms; **Mineral nutrition**-in plants and deficiency diseases; **Plant development-** physiology of flowering; **Phytochrome**- photochemical and biochemical properties of phytochrome; Concept of photoperiodism and vernalization and its influence on flowering;

Practicals-32 Hrs

1) Estimation of protein by Lowry's method
2) Determination of water potential of tissue by plasmolytic method
3) Determination of water potential by Gravimetric method
4) Quantitative estimation of chlorophyll a, chlorophyll b and total chlorophyll in plant tissue
5) Determination of diurnal fluctuation of acid content of CAM plants (TAN)
6) Determination of temperature quotient (Q10) of water uptake
7) Separation of chlorophyll pigments/Anthocyanin by TLC
8) Protein analysis by SDS PAGE method.
9) Estimation of Alpha-amylase activity in germinating seedling.
10) Silver staining of proteins.
11-12) Visit to Molecular Biology Laboratories.

References:

1) Barkla, B.J., and Pantajo, O. 1996. Physiology of ion transport across the tonoplast of higher plants. Ann. Rev. Plant Physiol. 47: 159-184.
2) Clayton, R.K. 1980. Photosynthesis: Physical mechanisms and chemical patterns. Cambridge Uni. Press, Cambridge.
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photooxidation. Nature 384: 557- 560.
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BOTANY: III- SEMESTER - HARD CORE 3.2
MOLECULAR BIOLOGY

Theory-32 Hrs

Unit-1: Organization of chromosomes and genes in prokaryotes and eukaryotes - Operon, interrupted genes, gene families, unique and repetitive DNA, heterochromatin, euchromatin, transposons, mitochondrial and chloroplast genome organization, Transposable elements in prokaryotes and eukaryotes, genetic and evolutionary significance, **DNA replication**- patterns, Messelson and Stahl's and Taylor's experiment, enzymes of replication, mechanism of DNA replication in prokaryotes and Eukaryotes, proof reading and error correction mechanisms.

Unit-2: Molecular mechanism of mutation, repair and recombination:- Mutation-DNA damage by spontaneous mutations, physical and chemical mutagens and their molecular mechanisms, **Repair mechanisms**- direct reversal of damage, base and excision repair, recombinational repair, SOS repair, translation repair synthesis, transcription coupled repair, **Recombination**- homologous recombination, models of recombination, mechanisms, protein machinery of homologous recombination, genetic consequence of homologous recombination, gene conversion, site specific recombination, mechanism and biological significance, non homologous recombination- transposition, molecular mechanisms of transposition- conservative, replicative and retro-transposition.

Unit-3: RNA synthesis, processing and translation: transcription activators and repressors, promoters, RNA polymerases and transcription factors, mechanism of transcription in prokaryotes and eukaryotes, **RNA processing**- capping, polyadenylation, splicing, alternative splicing, RNA editing, exon shuffling and RNA transport, **Translation and processing**- ribosomes, tRNA aminoacylation, aminoacyl tRNA synthetase, genetic code, wobble hypothesis, deciphering of the code, translation mechanism , translation proof reading, translation inhibitors and post translational modifications.

Unit-4: Regulation of gene expression in Prokaryotes: Operon concept, regulation at transcription initiation- lac and trp operon control, regulation of lytic and lysogenic cycles in lambda phage, regulation beyond transcription initiation-premature termination- trp operon, ribosomal proteins as translational repressors, riboswitches, **Regulation of gene expression in eukaryotes**-transcription activators and repressors, regulation after transcription initiation- alternative splicing, translational control in ferretin and tranferrin mRNA, RNA interference, role of chromatin in regulation of gene expression and gene silencing.

Practicals-32 Hrs

1) Isolation of DNA from CTAB method.
2) Isolation of DNA from Onion.
3) Isolation of DNA from mulberry leaves.
4) Estimation of DNA by DPA method.
5) Extraction of RNA by trizol/ phenol-chloroform methods.
6) Estimation of proteins by Biuret method.
7) Estimation of protein by Bradford method.
8) Determination of Tm value of DNA.

9-12)Photo graphs/ charts related to molecular biology/Molecular Biologists.

References:

1) Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Rafi, Keith Roberts, and Peter

Walter. 2008. Molecular biology of the cell, 5th edn., Garland science, Taylor & Francis Group, LLC, 270 Madison Avenue, NewYork ,USA.
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12) Bowle.2002. Molecular Biology of Plants. Vol 1 & 2 Oxford University Press.

BOTANY: III-SEMESTER - HARD CORE 3.3
PLANT BIOTECHNOLOGY

Theory-32 Hrs

Unit-1: Plant Tissue Culture: Scope and importance of plant tissue culture - Media composition and types, hormones and growth regulators, explants for organogenesis; Micro propagation, embryo and endosperm culture, somatic embryogenesis, variation and cell line selection, adrogenesis and microspore culture, significance of haploids, diploidization and bulbosum technique; Cryopreservation, germplasm collection; Somatic Hybrids- Isolation and protoplast culture and somatic hybridization and its significance, Synthetic seed production and somaclonal variations.

Unit-2: Genetic Engineering: Milestones in plant recombinant DNA technology; Importance of gene manipulation in future perspectives; **Tools in Genetic Engineering-** Enzymes in genetic engineering - restriction endonucleases, types and their actions, other DNA modifying enzymes; Cloning vectors- plasmids isolation and purification - Ti Plasmid, pBR322, pUC-series. Phage vectors-M13 phage vectors, Cosmids -types, phasmids or phagemids, shuttle vectors-types; YAC and BAC vectors, Lambda phage vectors, Lamda phage DNA as a vectors; Cloning vectors and expression vectors; Vectors for plant cells; Vectors for animal cells, baculovirus vectors- adenoviruses, retroviruses, transposons as vectors, Synthetic construction of vectors.

Unit 3: Applications of Genetic Engineering for pest, disease and stress tolerance: The genetic manipulation of herbicide resistance with suitable examples; The genetic manipulation of pest and disease resistance with suitable examples; Transgenic approaches to viral and bacterial disease resistance. Engineering for stress tolerance and Metabolic Engineering of Plants; Future prospects for GM crops.

Unit 4: Biofertilizers: Preparation and applications of biofertilizers such as Rhizobium, Azotobacter, Blue Green Algae and VAM. Single Cell proteins (SCP): Health benefits and advantages of single cell proteins- *Spirulina.* Biofuels: Ethanol and Biofuel production from plants. Mushroom cultivation and its advantages. Bioremediation: Phytoremediation; Biodegradation, Xenobiotics. Biotechnology of medicinal and aromatic plants for human welfare.

Practicals-32 Hrs

1) Preparation of plant tissue culture media and types.
2) Organ culture (Shoot tip, nodal and leaf culture) for callus Initiation and regeneration.
3) Anther culture for the production of haploids.
4) Suspension culture and production, separation and estimation of secondary metabolites.
5) Encapsulation of somatic embryos and production of Synthetic seed.
6) Extraction of secondary metabolites using Soxhlet extractor and Identification of In vitro secondary metabolites-alkaloids, steroids and flavonoids.
7) Restriction digestion of plasmid and genomic DNA and gel electrophoresis.

8) Isolation of genomic DNA from bacteria/plants and purification by agarose gel electrophoresis.
9) Restriction analysis of plasmids, gel purification of DNA, small and large scale purification of plasmids.
10) Preparation of competent *E. coli* cells. Bacterial transformation and recovery of plasmid clones.
11) Gene cloning in plasmids, analysis of recombinant plasmids.
12) DNA amplification by PCR, RT-PCR, Real Time PCR.
13) Analysis of DNA and RNA and Protein by Southern, Northern and Western blotting.
14) Primer design for PCR.

References:

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5) Plant Genetic Transformation and Gene Expression by (eds) J.Draper *et.al*. Blackwell Scientific Publications, Oxford (1988).
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7)Chawla H.S., 2009, Plant Biotechnology. Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi.
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9)PUROHIT S. D., 2012. Introduction To Plant Cell Tissue And Organ Culture PHI Learning Pvt. Ltd., New Delhi
10) Roberta, H. Smith, 2012. Plant Tissue Culture: Techniques and Experiments 3 edition. Academic Press; US.

BOTANY: III- SEMESTER- SOFT CORE 3.1
MOLECULAR GENETICS OF PLANTS

Theory-32 Hrs

Unit-1: Plants as genetic tools in Biology: *Arabidopsis, Rice, Maize, Saccharomyces;* Genome organization in plants; *Arabidopsis thaliana*- an experimental model for understanding plant development and functions; Plant genes and regulation; nucleus and chromatin organization; Histones and histone modifications; DNA packaging, organization and types of DNA sequences; functional and non- functional sequences, organization of plant nuclear genes, plastid genes and mitochondrial genes.

Unit-2: Genes responding to hormones, phytochrome, responses to abiotic stresses; Genes induced by water stress and freezing stress; Genes involved in photosynthesis and nitrogen fixation and their regulation; Molecular development of leaf and flower - ABC and revised model of flower development; Genes involved in fertilization, seed development, embryo development.

Unit-3: Genetics of *Agrobacterium:* Biology and genetics of *Agrobacterium tumefaciens;* The Ti- plasmid, *Vir* genes and expression, Mechanism of T-DNA transfer and integration; Basic features of vectors for plant transformation; Proteomics, genomics and bioinformatics; Structural and functional genomics, comparative genomics - biochemical, evolutionary, physiological and phylogenomics; Tools to study functional genomics.

Unit-4: Proteomics- functional and comparative proteomics; Protein distribution, characterization and identification, differential display proteomics, detection of functional linkages; Pharmacogenomics; Bioinformatics- tools of bioinformatics, data bases and data base management, bioinformatics in taxonomy, biodiversity, agriculture; Bioinformatics in drug design and drug discovery.

Practicals-32 Hrs

1) *Arabidopsis thaliana*- study of plant system and its biology.
2) *Arabidopsis* RNA extraction (total and polysomal) for Northern blotting.
3) Expression of foreign genes in plant cells through *Agrobacterium tumefaciens* (Chart)
4) Production of tobacco transgenic plants and assay for the introduced transgenic (Chart)
5) Co-cultivation of tobacco *Agrobacterium tumefaciens*
6) -12) Learning gene bank formats- EMBL format, FASTA format, Swiss- PROT, Ex PASy

References:

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2) Ausubel, F.M., Brent, R., Kingston, R.E., Moore, D.D., Seidman, J.G., Smith, J.A., and Struhl, K. 2005. Current protocols in molecular biology. Current Edition.
3) Brown, T.A. 2000. Essentials of Molecular Biology. Vol. I & II, Oxford University Press.
4) Potrykus, I., and Spangenberg, G. 1995. Gene transfer to plants. Springer, Berlin, Heidelberg.
5) Watson, J.D., and Baker, T.A., Bell, S.P. Gannm, A. and Levine, M. 2004. Molecular Biology of Genes. 5th edn., Pearson Education.
6) Gilmartin, P.M., and Bowler, C. 2002. Molecular Biology of Plants. Vol. I & II, Oxford University Press.
7) Karchar, S.J. 1995. Molecular Biology- A Project Approach, Academic Press, New York.
8) Sambrock, J., Fritch, E.F., and Maniatis, T. 1989. Molecular cloning- a laboratory manual.
9) Slater, A., Scott, N., and Flower, M. 2000. Plant Biotechnology- the Genetic Manipulation of Plants, Oxford University Press, Oxford.

10) Lea, P.J., and Leegood, R.C. 1999. Plant Biochemistry and Molecular Biology. John Willey and Sons Press, New York.
11) Draper, J. 1988. Plant Genetic Transformation and Gene Expression. Blackwell Scientific Publications, Oxford.
12) Old, R.W., and Primrose, S.B. 2004. Principles of Gene Manipulation. An introduction to Genetic Engineering. 5th Edition, Blackwell Science Publications.

BOTANY: IV- SEMESTER- SOFT CORE 3.2
MOLECULAR PLANT PATHOLOGY

Theory-32 Hrs

Unit-1: Concepts and scope of physiological and molecular plant pathology; Molecular approaches to plant disease diagnosis; Nucleic acid based probes for detection of plant pathogens including non-culturable organisms; **Pathogenicity and Disease Development**-factors; induced resistance, virulence and pathogenecity factors; Plant-pathogen interactions with emphasis on incompatible interactions and induced resistance.

Unit -2: Pathogenesis: Necrogenic plant pathogenic bacteria with emphasis on hrp and avr genes and virulence factors; Fungal plant pathogens with emphasis on virulence and pathogenicity factors; Plant viruses with emphasis on virus replication, virus transport in plants and control of plant viruses with transgenic plants; **Signal Transuduction-** recognition of the pathogen by the host, transmission of the alarm signal to the host defense providers; Necrotic defense reaction, defense through hypersensitive response; Molecular basis of induced biochemical reaction; Local and systemic acquired resistance (SAR).

Unit-3:Genetics of Plant Diseases and Resistance: Genes and diseases; physiological specialization among plant pathogens; Variability in viruses, bacteria and fungi; Levels of variability in pathogens and loss of virulence in plant pathogens; Genetics of virulence in pathogens and of resistance in host plants; Molecular plant breeding for disease resistance.

Unit-4: Genetics and molecular basis of host-pathogen interaction: Evolution of parasitism; genetics oh host-pathogen interaction; Gene for gene relationship; Criteria for gene for gene type relationship; Molecular basis of host pathogen interaction; Host-parasite-interaction. **Biotechnological methods of plant disease management;** Genetic engineering and crop protection; Cross protection; Gene silencing and disease control- mechanism of gene silencing and control of viral diseases; Engineered resistance to viral, bacterial, fungal and insect diseases of crop plants.

Practicals-32 Hrs

1-2) Testing hypersensitivity reaction on *Nicotiana and Bajra.*
3) Estimation of lypoxygenease in diseased and healthy plants.
4) Estimation of polyphenols in diseased and healthy
plants. 5-7) Studying systemic acquired resistance in
crop plants.
8) Genetic testing of disease resistance in plants.
9-11) Molecular detection of viruses, Mycoplasma, fungi and bacteria from infected plants.
12) In-vitro testing of pathogen virulence.
Visit to agricultural research station to study diseases on different crop plants.

References:

1) Singh, R. S. (1973). Plant Disease. Oxford and IBH Pub.Co. New Delhi.
2) Agrios, G. N. (1994). Plant Pathology 2nd Edn. Academic Press NY.
3) Johnston A and Both, C. 1983-Plant Pathologists Pocket-book. 2nd Edn.
Commonwealth Mycological Institute, Oxford and IBH Pub. Co. Calcutta.
5) Rangaswamy G and Mahadevan A 2002. Diseases of crop plants in India, Prentice
Hall of India Pvt. Ltd. New Delhi.
6) Mehrotra, R. S.1983-Plant Pathology Tata Mc. Graw Hill Pub. Co. Ltd., New Delhi.
7) Vidhyasekaran, P. 2004. Encylopedia of Plant Pathology.Viva Books Pvt.Ltd. New Delhi.

BOTANY: III SEMESTER- SOFT CORE 3.3
PLANT PROPAGATION AND PLANT BREEDING

Theory-32 Hrs

Unit-1: **Plant Propagation:** History, scope and importance of plant propagation; Propagation structures with reference to green house equipment and media; Seed propagation and vegetative propagation; Propagation by cuttings; Biology and techniques of grafting; Techniques of budding; Layering and its natural modifications; Propagation by specialized stems and roots; Micro propagation **–** techniques and applications in forestry and horticulture; Limitations and applications of vegetative propagation; Propagation methods of some selected plants – Citrus, Grape, Mango, Mulberry, Hibiscus, Rose, Croton, Eucalyptus.

Unit-2: Plant Breeding: History of plant breeding, objectives of plant breeding, salient achievements of plant breeding; Centres of origin of crop plants, Exploration and collection of plant genetic resources, evaluation of germplasm collection, documentation, conservation of plant genetic resources, utilization of genetic resources; The theory of pure line selection – Genetic basis, sources of genetic variation in pure lines, the land variety (races); Mendelian experiments of plant hybridization; Quantitative Inheritance; Applications of biometrical genetics in plant breeding.

Unit-3: Plant Breeding: Types of plant breeding; Fertility regulating mechanisms - manual or mechanical control, genetic control, incompatibility, male sterility, genetic engineering for male sterility, chemical control, genetic basis of heterosis; Synthetic and composite varieties **-**genetic basis, procedure for developing synthetic and composite varieties - genetic basis, procedure for developing synthetic varieties; Breeding for resistance to disease and insect pests.

Unit - 4 :Mutation Breeding: Significance of induced mutations in plant breeding; Polyploidy in plant breeding**- t**ypes of polyploids, induction of polyploidy, phenotypic effects of polyploidy, significance of polyploids; Tissue culture in crop improvement; Molecular approaches to crop improvement- probes, gel electrophoration, electrofusion, biolistics, gene cloning, transgenic plants (GMO's), molecular markers, construction of genetic maps, application of DNA makers in plant breeding, the role of gene technology in plant breeding; Crop breeding Institutes/Centers, Molecular biology in relation to intellectual property rights.

Practicals-32 Hrs

1) Study of types of vegetative propagation: Cutting, Grafting, budding, layering.
2) Study of propagation by modified stems and modified roots.
3) Preparation of media, explants, culture, initiation of shoot multiplication.
4) Pot and green house implants (demonstration) (5) Studying of floral biology.
6) Hybridization techniques - bagging and emasculation.
7) Pollen viability test : Seed germination test, TTC test.
8) Mode of pollination study in different crops.
9) Visit to crop breeding stations/institutes / centres.
10) Estimation of protein quality, Amino acid Analysis and determination of oil and fatty acids.
11) Observation of colour and conditions of mature anthers in different crops.
12) Identification of and studying of important plant breeders.

References:

1) Abbottt, A.J. and Atkin, R.K. eds. 1987. Improving vegetatively propagated crops.

Academic press, New York.
2) Bose, T.K., Sadhu, M.K., & Das, P., 1986. Propagation of Tropical and Subtropical Horticultural crops, Nowya Prakash, Calcutta.
4) Hartmann, H.T., Kester E.D., Davis, F.T., and Geneve, R.L. 1997. Plant propagation. Principles and practices. Prentice Hall of India Private Limited, New Delhi.
5) Krishnamurthy. H.M. 1981. Plant Growth substances including application in Agriculture.
6) Pierik, L.M. 1987. In vitro culture of Higher plants Murtinus Nijhoff pub. Dordrecht.
7) Razdan, M.K. 1994. An Introduction to Plant tissue culture, Oxford and IBH Pub. Co., PVT. Ltd., Bombay and Calcutta.
8. Mac Donald, B. 1987. Practical woody plant propagation for nursery growers. Portland, OR: Timber press.
9. Sadhu, M.K. 1989. Plant propagation Wiley eastern Ltd. N. Delhi.

BOTANY: III SEMESTER SOFT CORE 3.4
PHYTOCHEMISTRY AND HERBAL TECHNOLOGY

Theory-32 Hrs

Unit-1: **Phytochemisrty:** Scope of phytochemistry, plants as source of chemical compounds, primary and secondary metabolites and its applications; Definition, source of herbal raw materials, identification, authentication, standardization of medicinal plants as per WHO guidelines and different herbal pharmacopoeias; Natural pigments, natural products as markers for new drug discovery.

Unit-2: Extraction, isolation and purification of phytochemicals: Selection of plant samples, processing and storage of samples for extraction; Factors influencing the choice of extraction, principles of extraction methods, infusion, decoction, digestion, maceration, percolation, solvent extraction, fluid extraction, ultrasound, microwave assisted extraction, advantage and disadvantage involved in each method; Isolation of selected primary and secondary metabolites – amino acids, proteins and carbohydrate; Phenolics, flavonoids, alkaloids, lipids, oils, terpenes and saponins; Purification techniques for primary and secondary metabolites – solvent-solvent fractionation and chromatography techniques.

Unit-3: Characterisation of Phytochemicals: Preliminary, qualitative and quantitative techniques – paper chromatography, thin layer chromatography, column chromatography-HPLC, GC (qualitative and quantitative), colour reactions for amino acids, sugars, phenolics, flavonoids, alkaloids, terpenes, saponins, oils, lipids; Spectroscopic estimations/gravimetric determination of total sugars, amino acids, proteins, phenolics, flavonoids, alkaloids, terpenes, saponins, oils, lipids; Characterisation using spectroscopic techniques - UV/VIS, FTIR, DSC (differential scanning calorimeter), NMR, MS, MALDI. XRD – single crystal and powder.

Unit-4: Standardisation and Validation of Photochemical: Quality determination of herbal drugs; Role of processing methods and storage conditions on quality of drugs; Standardisation parameters- impurity limit, ash content, extractable matter, moisture content, other phytochemicals, microbial contaminants, pesticides; Validation of drug – guidelines, limit of detection and quantification of impurities, organoleptic properties, physical, chemical, biological characteristics, stability testing, storage conditions and packing system/unit.

Practicals-32 Hrs

1) Survey and collection of medicinal plants for analysis.
2) Selection of plant part, processing and storage of samples for further analysis.
3) Extraction methods - aqueous and sequential solvent extraction of compounds.
4) Preliminary phytochemical analysis of active principles from the extracts.
5) Antibacterial/antifungal activity of crude /active principles
6) Identification of secondary metabolites using TLC- phenolics, flavonoids, alkaloids, terpenes, saponins etc.
7) Column chromatographic separation of active principles.
8) Characterisation of active principle using spectroscopy, HPLC, GCMS, LCMS, FTIR, and MALDI TOF.
9) -12) Submission of report on TEN important curative principles of Indian medicinal plants.

References:

1) Braithwaite, A. and Smith, F.J. 1996. Chromatographic Methods. 5th edn., Blackie Academic & Professional, London.
2) Bourne, U.K. Kokate, Purohit, C.K. and Gokhale S.B. 1983. Pharmacognosy. Nivali Prakashan Publication.
3) Braithwaite, A. and Smith, F. J. 1996. Chromatographic Methods. 5th edn. Blackie Academic & Professional, London.
4) Sadasivam. S. and A. Manickam, 0000. Bio Chemical methods 2nd edn. New Age International Pvt Ltd. New Delhi.
5) Harborne, J.B. 1984. Phytochemical Methods, 2nd edn. Chapman and Hall, London. Harborne J.B., 1973. Phytochemical methods a guide to modern techniques of plants analysis. Chapman and Hall Ltd. London.

BOTANY: III SEMESTER- OPEN ELECTIVE 3.1
PLANT PROPAGATION TECHNIQUES

Theory-32 Hrs

Unit-1: History, scope and importance of plant propagation; Propagation structures with reference to green house equipment and media; Seed propagation – the development of seeds, techniques of seed production and handling principles and media.

Unit-2: Vegetative propagation: Techniques of propagation by cuttings; stem cuttings – hard wood, semi hard wood, soft wood and herbaceous, leaf cuttings, leaf bud cuttings, root cuttings; Biology and techniques of grafting: Whip and tongue, wedge and cleft, bark, side grafting, approach.

Unit-3: Techniques of budding: T- budding patch budding, chip budding, ring budding; Layering and its natural modifications- simple layering, tip layering, mound or stool layering, air layering, compound or serpentine layering and trench layering; Propagation by specialized stems and roots.

Unit- 4: Micro propagation – techniques and applications in forestry and horticulture; Advantage, limitations and applications of vegetative propagation, Somaclonal variations; Propagation methods of some selected plants – Citrus, gape, mango, mulberry, hibiscus, rose, Croton, Eucalyptus.

References:

1) Abbott, A.J. and Atkin, R.K. (eds.) 1987. Improving vegetatively propagated crops. Academic press, New York.
2) Bose, T.K., Sadhu, M.K., and Das, P., 1986. Propagation of Tropical and Subtropical Horticultural crops, Nowya Prakash, Calcutta.
3) Hartmann and Kester, 1983. Plant propagation
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5) Krishnamurthy. H.M. 1981. Plant Growth substances including application in Agriculture.
6) L.M. Pierik 1987. In vitro culture of Higher plants Murtinus Nijhoff pub. Dordrecht.
7) M.K. Razdan 1994. An Introduction to Plant tissue culture, Oxford and IBH Pub. Co., PVT. Ltd., Bombay and Calcutta.
8) Mac Donald, B. 1987. Practical woody plant propagation for nursery growers. Portland, OR: Timber press.
9) Sadhu, M.K. 1989. Plant propagation Wiley eastern Ltd. N. Delhi.

BOTANY: IV- SEMESTER- HARD CORE 4.1
ECOLOGY, CONSERVATION BIOLOGY AND PHYTOGEOGRAPHY

Theory-32 Hrs

Unit-1: Introduction and scope of Ecology: Plants and the environment- plant adaptation, ecotypes, habitat ecology- fresh water and marine water ecology (ecosystems), wetlands and their characteristics; Ecosystem function; The distribution of biomes; Major Terrestrial Biomes; Forests-Tropical Forests-Temperate Forests, Taiga, Grasslands, Savanna, Temperate Grasslands/Prairies, Tundra, Deser and Chaparral.

Unit-2: Environmental Biology: Global warming: Greenhouse gases - causes and consequences; Ozone depletion- causes and consequences; Air, water and soil pollution - major pollutants, their source, permissible limits - and control methods; Radioactive pollution- Ionising radiation, disposal of radioactive waste, nuclear accidents; Environmental Education Programmes - WWF, UNEP, MAB; Role of plants in solving energy crisis and ameliorating global warming.

Unit-3: Biodiversity and Conservation Biology: Science in the service of Biodiversity, biodiversity and its value, biodiversity issues, concerns, management; Biodiversity hot spots; Biodiversity- threats and current status of biodiversity; IUCN categories, Red Data book and Red lists, invasive alien species as threat to biodiversity; Conservation strategies- past, present, and future; Attitudes about conservation; conservation movements; CITES (Convention on international trade in endangered species), WCU (World Conservation Union); Endangered species Act. 2002 (GOI); Protected areas, Network of India- history, size, scale and management; Heritage trees.

Unit-4: Phytogeography: Biogeography of the world, India and Karnataka; Climatic zones, tectonics, continental movements; Types of plant distribution – discontinuous distribution - land bridge theory, continental drift; continuous distribution-cosmopolitan, circumpolar, circumboreal, circumaustral, pantropical; Distribution of plants - islands; Phytochorea of the world, India; Plant dispersal, migrations and isolation; Eendemic plants of Western Ghats and Eastern Himalayas; Origin, distribution and acclimatization of coffee, cardamom, sugarcane, cashew, ragi, maize, wheat, rice and cotton; Remote sensing and GPS, study of vegetation by GIS (Geographical Information system).

Practicals-32 Hrs

1) Study of local vegetation by quadrate method.
2) Water analysis for pollution studies.(Bio-monitoring: TDS, Hardness, Chlorides, CO_2 COD, DO, BOD)
3) Rapid detection of bacteriological quality of water with special reference to feacal coliforms.
4) Morphology and anatomy of plants in relation to habitats - Xerophytes, Mesophytes, Hydrophytes.
5) *In situ* and *Ex situ* method of conservation.
6) Eminent phytogeographers of the world (photos).
7) Continental drift (charts).
8) Application of Remote Sensing, GIS and GPS in Forestry and Wild life management.
9) Biogeography of the world – Oceans, deserts, islands, mountains.

10) Biogeography of India –rivers, mountains, islands.
11) Floristic regions of world – India and Karnataka.
12) Study of endemic plants of India.
13) Origin, acclimatization and distribution of Coffee, Cardamom, Sugarcane, Cashew, Ragi, Maize, Wheat, Rice and Cotton.

References:

1) Polunin, N. 1961. Introduction to plant geography.
2) Good R.D. 1974. Geography of the flowering plants.
3) James H. B. 1998. Biogeography.
4) Cain, S.A. 1944. Foundations of plant Geography.
5) Croiat, 1952. Manual of Phytogeography.
6) Edgar A. 1972. Plants, Man and Life.
7) Valentine, D. H. 1972. Taxonomy, Phytogeography & Evolution.
8) Phil Gibson J. and Gibson Terri, R. 2006. Plant ecology.
9) Primack, R. B. 2006. Essentials of conservation biology.

10) Ricklefs, R. E. 2001. The Economy of Nature.
11)Narasaiah M. L., 2005. Biodiversity and Sustainable Development.
12)Tondon P, Abrol Y. P, Kumaria S., 2007. Biodiversity and its significance.
14) Krishnamurthy K. V. 2007. An Advanced Textbook on Biodiversity: Principles and Practice.
15) Christian Leveque and Jean-Claude Mounolou (2003). Biodiversity.
16) Jeffries Michael J. 2006. Biodiversity and conservation.

BOTANY: IV- SEMESTER- SOFT CORE 4.2
PROJECT WORK

BOTANY: IV- SEMESTER- SOFT CORE 4.1
SEED TECHNOLOGY

Theory-32 Hrs

Unit-1: Seed Technology: Introduction to seed science and technology and its goals; Development of seed technology industry in India; Seed as basic input in agriculture; Seed Biology - Seed development, morphology and anatomy of dicot and monocot seeds; Seed structure and functions; Seed programmes and organizations; Seed village concept, seed production agencies, seed industry and custom seed production in India; International Seed Science and Technology Organizations.

Unit-2:Seed Production: General principles of seed production in self and cross pollinated and vegetatively propagated crops; Hybrid seed production; Maintenance of inbred lines and breeders seeds; Synthetic and composite seeds; Improved seed and their identification; Germplasm banks; **Seed Processing**-Harvesting, seed drying, seed cleaning and grading; Equipments; Seed Storage- types of storage structure; seed factors affecting storage life, effect of storage on relative humidity, temperature and moisture; Seed deterioration; Seed treatment.

Unit-3: Seed Quality Testing: Devices and tools used in seed testing; ISTA and its role in seed testing; Seed sampling- physical purity and heterogeneity test; Seed moisture content-importance and determination and methods; Viability and vigour testing; Genetic purity testing -objective and criteria for genetic purity testing, seed health testing, field and seed standards, designated diseases, objectionable weeds; Significance of seed borne diseases, seed health testing and detection methods for seed borne fungi, bacteria, viruses and nematodes; Preparation and dispatch of seed testing reports, storage of guard samples, application and use of seed standards and tolerances.

Unit- 4: Seed Certification: Principles and philosophy of seed certification, purpose and procedures, national seed programme; National Seed Corporation (NSC) - agencies responsible for achieving self-reliance in seed production and supply of quality of seeds (State Seeds Corporation; National Seed Development Council (NSDC); Central Seed Committee(CSC) ; Seed market surveys, seed industry in relation to global market; Concept of WTO, GATT, IPR, Plant Variety Protection and its significance seed technology; UPOV and its role.

Practicals-32 Hrs

1) Determination of physical purity of seed samples.
2) Determination of density or weight per thousand seeds.
3) Determination of seed Heterogeneity.
4) Visual examination of dry seeds for disease symptoms.
5) Determination of moisture content by hot air oven method.
6) Seed viability test- TTC method.
7) Determination of seed germination by TP/BP/Sand method.
8) Evaluation of seedlings vigour by BP/Sand methods.
9) Seed vigour evaluation by (a) conductivity test (b) Hiltner's test (c) Performance test(d) Accelerated ageing test (e) Cold test.
10) Examination of suspensions obtained from washings of seed.
11) Infection sites studied by planting seed components.
12) Detection of seed-borne fungi and their characters of five seed borne pathogens. Vist: Visit to seed industries/seed companies/ seed research stations.

References:

1) ACAR.2009. Handbook of Agriculture. Indian Council of Agricultural Research, New Delhi.

2) ACAR.2013. Handbook of Horticulture. Indian Council of Agricultural Research, New Delhi.

3) Agarawal, P. K. 2005. Principles of Seed Technology.2nd edn. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.

4) Basra, A. S. 2006. Handbook of Seed Science and Technology, The Haworth Press, USA.

5) Copeland, L. O. and McDonald, M. B. 2001. Principles of Seed Science and Technology. 4th edn. Chapman & Hall.

6) Copeland, L.A. 1995. Principles of Seed Science and Technology- Kluwer Academic Publishers, The Netherlands.

7) Michael, B. and Bewley, D. 2000. Seed technology and its biological basis. Wiley- Blackwell.

8) Neergaard, P. 2005. Seed Pathology, Palgrave, Macmillan, Denmark. Science, Technology and Uses. CABI, UK.

9) Vanangamudi, K., Natarajan, K., Saravanan, T., Natarajan, N., Umarani, R., Bharathi, A. and Srimathi, P. 2006. Advances in Seed Science and Technology: Vol: III: Forest Tree Seed Technology and Management, Agrobios, New Delhi.

BOTANY: IV- SEMESTER- SOFT CORE 4.2
SEED PATHOLOGY

Theory - 32 Hrs

Unit-1: Seed Pathology: Introduction, historical development, development of seed health testing; Reduction in crop yields loss in due to seed-borne diseases; Seed-borne pathogens **(**Fungi, Bacteria, Mycoplasma-like Organisms, fastidious Vascular Bacteria, Spiroplasmas, Viruses, Viroids, Nematodes); Location of seed-borne inoculums, histopathology of some seed-borne pathogens; Seed infection, mechanism of seed infection, seed infestation or contamination; Factors affecting seed infection; Longevity of seed-borne pathogens.

Unit-2: Seed transmission and inoculation, factors affecting seed transmission; Cultural practices, epidemiology and inoculum thresholds of seed-borne pathogens; Classification of seed-borne; Role of Seed-borne inoculum in disease development; Economic loss due to seed borne pathogens; Certification program; Seed health tests, Nonparasitic seed disorders; Deterioration of grains; Storage fungi, field and storage fungi; Invasion by storage fungi; effects of seed deterioration.

Unit-3: Detection of Seed-borne Diseases: Examination of dry seeds; Isolation of fungi, Bright-field microscopic examination, observation under UV light, measurement of gases, Determination of FAV, Moldy smell, collection of seed exudates; Immunoassays, ergosterol estimation; Avoiding damage to seeds during harvesting; Processing, threshing, storage conditions, reducing seed moisture to safe limits, seed treatment, resistance.

Unit-4: Mycotoxins - Fungi known to produce mycotoxins, Factors affecting mycotoxin production the effects and control of mycotoxins, storage conditions, sorting of grains, cultural operations, chemical treatment, biological control, detoxification, regulatory measures, use of resistant cultivars; Control of seed-borne pathogens; Selection of seed production areas; Crop management, crop rotation, isolation distances, rouging, biological control, chemical method, mechanical method, physical methods; Certification- certification standards, plant quarantine, national and international regulations.

Practicals-32 Hrs

1-5) Detection of seed-borne fungi and their identification.
6) Detection of Seed-borne bacteria.
6) Detection of seed-borne viruses.
7) Detection of seed-borne insects by egg-plug staining.
8) Detection seed-borne nematodes.
9) Effect of deterioration of grains by Storage Fungi.
10) Detection of seed-borne fungi by PCR.
11) Estimation of ergosterol by UV-visible Spectrophotometer.
12) Detection of mycotoxins by thin Layer chromatography.

References

1) Agarwal, V. K. and Sinclair, J. B. 1996. Principles of Seed Pathology, 2nd edn. CRC Press, Tayler and Francis, USA.
2) Neergaard, P. 1977. Seed Pathology. Vol. I..Macmillan Press, Cornell University, USA.
3) Agrios, G. N. 1994 -Plant Pathology 2nd edn. Academic Press, New York.
4) Mehrotra, R. S. 1983-Plant Pathology Tata Mc. Graw Hill Pub. Co. Ltd., New Delhi.

5) Rangaswamy, G. and Mahadevan, K. 2002. Diseases of Crop plants in India. Prentice Hall of India Private Limited New Delhi.
6) Agarawal, P. K. 2005. Principles of Seed Technology.2 nd edn. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
7) Basra, A. S. 2006. Handbook of Seed Science and Technology, The Haworth Press, USA.
8) Copeland, L.A. 1995. Principles of Seed Science and Technology- Kluwer Academic Publishers, The Netherlands.
9) Vanangamudi, K., Natarajan, K., Saravanan, T., Natarajan, N., Umarani, R., Bharathi, A. and Srimathi, P. 2006. Advances in Seed Science and Technology: Vol: III: Forest Tree Seed Technology and Management, Agrobios, New Delhi.

BOTANY: IV- SEMESTER- SOFT CORE 4.3
BIO- ANALYTICAL TECHNIQUES

Theory-32 Hrs

Unit- 1: Spectroscopy: Principles of UV-Visible spectroscopy, chromophores and their interaction with UV-visible radiation and their utilization in structural, qualitative and quantitative analysis of drug molecules; Infrared Spectroscopy, Infrared radiation and its interaction with organic molecules, vibrational mode of bonds, instrumentation and applications, interpretation of IR spectra; FTIR and ATR, X-ray diffraction methods.

Unit-2: Nuclear Magnetic Resonance Spectroscopy: Magnetic properties of nuclei, field and precession, instrumentation and applications of NMR; Chromatographic techniques- Principles and applications- types- column, paper, thin layer and gas chromatography, HPLC, HPTLC, size exclusion chromatography, Affinity chromatography, Mass spectrometry, MALDI-TOF.

Unit-3: Electrophoresis: Principle and application of PAGE, SDS PAGE, immunostaining, immuno-electrophoresis, Iso-electric focusing, 2D electrophoresis Centrifugation- Principles, techniques of preparative and analytical centrifugation. Ultracentrifuges, molecular weight determination, sedimentation analysis, RCF. Microscopy- principles and applications of electron microscope (SEM and TEM), CryoEM, Preparations of specimen for electron microscopy- freeze drying, freeze etching, fixing, staining; confocal, fluorescent, flow cytometry - principles and applications.

Unit-4: Molecular Biology Techniques: Primer designing; Principles and applications of PCR; Blotting techniques; Hybridization techniques; Micro-array; Next Generation Sequencing- Nucleic acid sequencing.

Practicals-32 Hrs

1) Calibration of bio-analytical instruments.
2) Principles and instrumentation and applications of imaging techniques:
3) Separation of fatty acids/lipids by TLC/HPTLC.
4) Separation of proteins by PAGE, SDS- PAGE.
5) Agarose gel electrophoresis of DNA/RNA.
6) Immunoelectrophoresis
7) Agar gel diffusion, counter immuno electrophoresis.
8) Verification of Beer Lambert law with the U.V. spectrophotometer.
9) Demonstration of blotting techniques.
10) Performing PCR for amplification of ITS regions of fungi/ bacteria.

References

1) Braithwaite, A. and Smith, F.J. 1996. Chromatographic Methods. 5th edn. Blackie Academic & Professional London.
2) Budzikiewicz, H., Djerassi, C. and Williams, D.H. 1968. Mass Spectrometry of Organic Compounds. Holden-Day, San Francisco, CA
3) Harborne, J.B. 1984. Phytochemical Methods. 2nd edn. Chapman and Hall, London.
4) Harborne J.B. (1973) Phytochemical methods a guide to modern techniques of plants analysis. Chapman and Hall, London Ltd.

BOTANY: II SEMESTER - OPEN ELECTIVE 4.1
PLANT DIVERSITY AND HUMAN WELFARE

Theory-32 Hrs

Unit -1: Plant Diversity and Significance: Role of plant diversity in ameliorating energy crisis and global warming; Types of biodiversity-genetic diversity, species diversity, plant diversity at the ecosystem level; Agro-biodiversity and cultivated plant taxa, wild taxa; **Values and uses of Biodiversity-** Ethical and aesthetic values, precautionary principle, methodologies for valuation, uses of plants and microbes.

Unit -2: Loss of Biodiversity: Major causes of for biodiversity loss; Loss of genetic diversity, Loss of species diversity; Loss of ecosystem diversity; Loss of agro-biodiversity; Projected scenario for biodiversity loss; Management of Plant Biodiversity- Organizations associated with biodiversity management; Methodology for execution-IUCN, UNEP, UNESCO, WWF, NBPGR; Biodiversity legislation and conservations; Biodiversity information management and communication.

Unit -3: Conservation of Biodiversity: Conservation of genetic diversity, species diversity and ecosystem diversity, *In situ* and *ex situ* conservation, Social approaches to conservation, Biodiversity awareness programmes, Conservation of Heritage Trees.

Unit-4: Role of plants in relation to Human Welfare: Importance of forestry their utilization and commercial aspects, Avenue trees, Ornamental plants of India, Alcoholic beverages through ages, Fruits and nuts- Fruit crops of Karnataka and their commercial importance; Wood and its uses.

References:

1) Krishnamurthy K. V. 2007. An Advanced Textbook on Biodiversity: Principles and Practice. Oxford & IHB Publishing Co. Pvt. Ltd. New Delhi.
2) Christian Leveque and Jean-Claude Mounolou, 2003. Biodiversity. John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex PO19 8SQ, England.
3) Jeffries Michael J. 2006. Biodiversity and conservation, 2nd edn. Taylor and Francis Group, New York.

JSS Mahavidyapeetha

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE

OOTY ROAD, MYSURU – 570 025

POSTGRADUATE DEPARTMENT OF CHEMISTRY

SYLLABUS

PROGRAMME: M.Sc. in CHEMISTRY

PROGRAMME CODE: CHE

Under
Choice Based Credit System (CBCS) and
Continuous Assessment Grading Pattern (CAGP)
Effective from 2021-22

GUIDELINES AND REGULATIONS LEADING TO MASTER OF SCIENCE IN CHEMISTRY (TWO YEARS - SEMESTER SCHEME UNDER CBCS-CAGP)

Programme details

Name of the Department	: PG Department of Chemistry
Subject	: Chemistry
Faculty	: Science
Name of the Programme	: Master of Science (M.Sc.) in Chemistry
Duration of the Programme	: 2 years divided into 4 semesters

Programme Objectives

- To provide the latest subject matter both theory as well as practicals in such a way to foster their core competency and discovery learning. A chemistry postgraduate as envisioned in this framework would be sufficiently competent in the field to understand further discipline specific studies as well as to begin domine related employment.
- To mould a responsible citizen who is aware of most basic domain-independent knowledge including critical thinking and communication.
- Enable the graduate to prepare for national as well as international competitive examinations, especially UGC-CSIR NET and UPSC civil service examinations.

Programme Outcomes

- Students will have a strong foundation in the fundamentals and applications of current theoretical and practical chemistry in Analytical, Inorganic, Organic and Physical Chemistry.
- Students will be able to design and carry out scientific experiments and accurately record and analyze the results of the experiments.
- Students will be skilled in problem solving, critical thinking and analytical reasoning as applied to scientific problems.
- Students will be able to explore new areas of research in both chemistry and allied fields such as Biochemistry, Material Chemistry, Pharmaceutical chemistry and Chemical biology and related technology.
- Students will understand the central role of chemistry to our society which includes understanding of safe handling of chemicals, environmental issues and key issues facing our society in energy, health and medicine.

Programme Specific Outcomes

- Global level research opportunities to pursue Ph.D. programme, targeted approach of CSIR – NET and competitive civil service examinations**.**
- Enormous job opportunities at all levels of teaching, chemical, pharmaceutical, food products, life oriented material industries**.**
- Specific placements in R & D and many pharmaceutical & other industries**.**
- Facile development for the synthesis of biologically significant organic molecules using the green route for chemical reactions for sustainable properties**.**
- To inculcate the scientific temperament in the students and outside the scientific community.
- Learnt to handle sophisticated equipment for the determination and characterization of chemical compounds.
- Use of the latest chemistry software to avoid the laborious work in research**.**

Pedagogies used in the programme

- Conventional method such as black board and chalk, and modern methods like power point presentation and information and communications technology (ICT) are used in class room teaching.
- Molecular models are used to teach molecular symmetry, stereochemistry and solid state chemistry topics.
- Each student performs experiments as per the protocol in practical classes.
- For the preparation of new compounds, each student can adopt new experimental setup, and also exposed to different analytical instruments for qualitative and quantitative analyses. In addition to this, students will acquire skill to handle various instruments independently.
- Students will be presenting seminars in each semester.
- Each student will be subjected to viva-voce examinations in every semester.
- Every student will work for project on a small research problem.
- Rigorous training will be giving for every student to interpret spectral data in the respective course including their dissertation.
- Special lectures are delivered by eminent scholars from different intuitions.
- National/International conferences are organized to upgrade the subject knowledge.

GENERAL REQUIREMENTS

Scheme of instructions

1. A Masters Degree programme is of 4 semesters-two Years duration. A candidate can avail a maximum of 8 semesters – 4 years (in one stretch) to complete Masters Degree (including blank semesters, if any). Whenever a candidate opts for blank semesters, he/she has to study the prevailing courses offered by the department when he/she continues his/her studies.

2. A candidate has to earn a minimum of 76 credits, for successful completion of a Master Degree. The 76 credits shall be earned by the candidate by studying Hardcore, Soft Core and Open Elective. A candidate may earn another 04 credits by studying MOOCs/SWAYAM courses.

3. **Minimum for Pass:** In case a candidate secures less than 30% in C_1 and C_2 put together, the candidate is said to have DROPPED the course, and such a candidate is not allowed to appear for C_3.

4. In case a candidate secures less than 30% in C_3, or secures more than 30% in C_3 but less than 50% in C_1, C_2 and C_3 put together, the candidate is said to have not completed the course and he/she may either opt to DROP the course or to utilize PENDING option.

5. **Credits (Minimum) Matrix:** A candidate has to study 42 credits, but not exceeding 52 credits from hard Core, a minimum of 16 credits in Soft Core (sum total of 4 semesters) and 04 credits in Open Elective (III Semester) for the successful completion of the Masters Degree programme.

6. All other rules and regulations hold good which are governed by the University of Mysore from time to time.

Definitions

1. In the Choice Based Credit System – Continuous Assessment Grading Pattern (CBCS-CAGP), programme means a course and a course means a paper.
2. **HC:** Hard Core; **SC:** Soft Core; **OE:** Open Elective

GENERAL SCHEME WITH RESPECT TO ASSESSMENT OF CREDITS

Semester	Hard Core		Soft Core			Open Elective
	Theory			Theory	Practicals	
I	I	3 + 0 + 0 = 3	A	2 + 0 + 0 = 2	0 + 0 + 4 = 4[a]	-
	O	3 + 0 + 0 = 3	I	2 + 0 + 0 = 2	0 + 0 + 4 = 4[a]	
	P	3 + 0 + 0 = 3	O	2 + 0 + 0 = 2	0 + 0 + 4 = 4[a]	
	A	3 + 0 + 0 = 3	P	2 + 0 + 0 = 2	0 + 0 + 4 = 4[a]	
II	I	3 + 0 + 0 = 3	A	2 + 0 + 0 = 2	0 + 0 + 4 = 4[a]	-
	O	3 + 0 + 0 = 3	I	2 + 0 + 0 = 2	0 + 0 + 4 = 4[a]	
	P	3 + 0 + 0 = 3	O	2 + 0 + 0 = 2	0 + 0 + 4 = 4[a]	
	G	3 + 0 + 0 = 3	P	2 + 0 + 0 = 2	0 + 0 + 4 = 4[a]	
III	I	3 + 0 + 0 = 3	A	2 + 0 + 0 = 2	0 + 0 + 2 = 2[ab]	4 + 0 + 0 = 4
	O	3 + 0 + 0 = 3	I	2 + 0 + 0 = 2	0 + 0 + 2 = 2[ab]	
	P	3 + 0 + 0 = 3	O	2 + 0 + 0 = 2	0 + 0 + 2 = 2[ab]	
	G	3 + 0 + 0 = 3	P	2 + 0 + 0 = 2	0 + 0 + 2 = 2[ab]	
IV	I	3 + 0 + 0 = 3	A	2 + 0 + 0 = 2	0 + 0 + 2 = 2[ab]	-
	O	3 + 0 + 0 = 3	I	2 + 0 + 0 = 2	0 + 0 + 2 = 2[ab]	
	P	3 + 0 + 0 = 3	O	2 + 0 + 0 = 2	0 + 0 + 2 = 2[ab]	
	A	3 + 0 + 0 = 3	P	2 + 0 + 0 = 2	0 + 0 + 2 = 2[ab]	
			D	--	0 + 0 + 4 = 4[c]	
Total Credits	48		24			04

NOTE

A–Analytical; I–Inorganic; O–Organic; P–Physical; G-Spectroscopy; D-Dissertation/Project Work; (L+T+P)-Theory + Tutorial + Practical

[a] Compulsory but 50% of the students will attend Analytical/Inorganic Practicals and remaining 50% students will attend Organic/Physical Practicals in I or III Semesters and vice-versa during II or IV Semesters.

[b] Practicals are only for Chemistry students which are compulsory papers.

[c] Dissertation/Project work, which is offered by the department during IV Semester.

SCHEME OF STUDY AND EXAMINATION

FIRST SEMESTER

HARD CORE COURSES

Course Code	Title	Contact Hours/ week	Credits	Max. Marks	Internal Assessment Marks		Semester End Exams (C_3)	
					C_1	C_2	Duration (hrs)	Marks
21CHA10	Concepts & Models of Inorganic Chemistry	3	3	100	15	15	3	70
21CHA11	Stereochemistry & Reaction Mechanism	3	3	100	15	15	3	70
21CHA12	Basic Physical Chemistry	3	3	100	15	15	3	70
21CHA13	Essentials of Analytical Chemistry	3	3	100	15	15	3	70

SOFT CORE PRACTICALS

Course Code	Title	Contact Hours/ week	Credits	Max. Marks	Internal Assessment Marks		Semester End Exams (C_3)	
					C_1	C_2	Duration (hrs)	Marks
21CHA50	Analytical Chemistry Practicals	8	4	100	15	15	6	70
21CHA51	Inorganic Chemistry Practicals	8	4	100	15	15	6	70
21CHA52	Organic Chemistry Practicals	8	4	100	15	15	6	70
21CHA53	Physical Chemistry Practicals	8	4	100	15	15	6	70

NOTE: 50% of students will attend Analytical and Inorganic Practicals and the remaining 50% of students will attend Organic and Physical Practicals in I Semester and vice-versa in II Semester.

SOFT CORE COURSES

Course Code	Title	Contact Hours/ week	Credits	Max. Marks	Internal Assessment Marks		Semester End Exams (C_3)	
					C_1	C_2	Duration (hrs)	Marks
21CHA54	Titrimetric Analysis	2	2	100	15	15	3	70
21CHA55	Chemistry of Selected Elements	2	2	100	15	15	3	70
21CHA56	Chemistry of Natural Products-I	2	2	100	15	15	3	70
21CHA57	Biophysical Chemistry	2	2	100	15	15	3	70

SECOND SEMESTER

HARD CORE COURSES

Course Code	Title	Contact Hours/ week	Credits	Max. Marks	Internal Assessment Marks		Semester End Exams (C_3)	
					C_1	C_2	Duration (hrs)	Marks
21CHB10	Coordination Chemistry	3	3	100	15	15	3	70
21CHB11	Synthetic Organic Chemistry	3	3	100	15	15	3	70
21CHB12	Principles of Physical Chemistry	3	3	100	15	15	3	70
21CHB13	Molecular Symmetry and Spectroscopy	3	3	100	15	15	3	70

SOFT CORE PRACTICALS

Course Code	Title	Contact Hours/ week	Credits	Max. Marks	Internal Assessment Marks		Semester End Exams (C_3)	
					C_1	C_2	Duration (hrs)	Marks
21CHB50	Analytical Chemistry Practicals	8	4	100	15	15	6	70
21CHB51	Inorganic Chemistry Practicals	8	4	100	15	15	6	70
21CHB52	Organic Chemistry Practicals	8	4	100	15	15	6	70
21CHB53	Physical Chemistry Practicals	8	4	100	15	15	6	70

NOTE: Practicals: Same as that of I Semester. Students who have conducted Analytical and Inorganic or Organic and Physical Practicals in the I Semester will get interchanged during II Semester.

SOFT CORE COURSES

Course Code	Title	Contact Hours/ week	Credits	Max. Marks	Internal Assessment Marks		Semester End Exams (C_3)	
					C_1	C_2	Duration (hrs)	Marks
21CHB54	Titrimetric Analysis	2	2	100	15	15	3	70
21CHB55	Chemistry of Selected Elements	2	2	100	15	15	3	70
21CHB56	Chemistry of Natural Products-I	2	2	100	15	15	3	70
21CHB57	Biophysical Chemistry	2	2	100	15	15	3	70

NOTE: Soft Core Theory: All courses are same as that described in first semester.

THIRD SEMESTER

HARD CORE COURSES

Course Code	Title	Contact Hours/ week	Credits	Max. Marks	Internal Assessment Marks		Semester End Exams (C_3)	
					C_1	C_2	Duration (hrs)	Marks
21CHC10	Advanced Inorganic Chemistry	3	3	100	15	15	3	70
21CHC11	Organometallic and Photochemistry	3	3	100	15	15	3	70
21CHC12	Advanced Physical Chemistry	3	3	100	15	15	3	70
21CHC13	Chemical Spectroscopy	3	3	100	15	15	3	70

SOFT CORE PRACTICALS

Course Code	Title	Contact Hours/ week	Credits	Max. Marks	Internal Assessment Marks		Semester End Exams (C_3)	
					C_1	C_2	Duration (hrs)	Marks
21CHC50	Analytical Chemistry Practicals	4	2	100	15	15	6	70
21CHC51	Inorganic Chemistry Practicals	4	2	100	15	15	6	70
21CHC52	Organic Chemistry Practicals	4	2	100	15	15	6	70
21CHC53	Physical Chemistry Practicals	4	2	100	15	15	6	70

NOTE: 50% of students will attend Analytical and Inorganic Practicals and the remaining 50% of students will attend Organic and Physical Practicals in I Semester and vice-versa in II Semester.

SOFT CORE COURSES

Course Code	Title	Contact Hours/ week	Credits	Max. Marks	Internal Assessment Marks		Semester End Exams (C_3)	
					C_1	C_2	Duration (hrs)	Marks
21CHC54	Kinetic and Radiochemical Methods of Analysis	2	2	100	15	15	3	70
21CHC55	Frontiers in Inorganic Chemistry	2	2	100	15	15	3	70
21CHC56	Chemistry of Natural Products-II	2	2	100	15	15	3	70
21CHC57	Material Chemistry	2	2	100	15	15	3	70

OPEN ELECTIVE FOR NON-CHEMISTRY STUDENTS

Course Code	Title	Contact Hours/ week	Credits	Max. Marks	Internal Assessment Marks		Semester End Exams (C_3)	
					C_1	C_2	Duration (hrs)	Marks
21CHC80	General Chemistry	4	4	100	15	15	3	70

FOURTH SEMESTER

HARD CORE COURSES

Course Code	Title	Contact Hours/ week	Credits	Max. Marks	Internal Assessment Marks		Semester End Exams (C_3)	
					C_1	C_2	Duration (hrs)	Marks
21CHD10	Bioinorganic Chemistry	3	3	100	15	15	3	70
21CHD11	Heterocyclic and Bioorganic Chemistry	3	3	100	15	15	3	70
21CHD12	Nuclear, Radiation and Photochemistry	3	3	100	15	15	3	70
21CHD13	Instrumental Methods of Analysis	3	3	100	15	15	3	70

SOFT CORE COURSES

Course Code	Title	Contact Hours/ week	Credits	Max. Marks	Internal Assessment Marks		Semester End Exams (C_3)	
					C_1	C_2	Duration (hrs)	Marks
21CHD50	Analytical Chemistry Practicals	4	2	100	15	15	6	70
21CHD51	Inorganic Chemistry Practicals	4	2	100	15	15	6	70
21CHD52	Organic Chemistry Practicals	4	2	100	15	15	6	70
21CHD53	Physical Chemistry Practicals	4	2	100	15	15	6	70
21CHD54	Dissertation/Project Work	8	4	100	15	15	-	70

NOTE: Practicals: Same as that of III Semester. Students who have conducted Analytical and Inorganic or Organic and Physical Practicals in the III Semester will get interchanged during IV Semester.

SOFT CORE COURSES

Course Code	Title	Contact Hours/ week	Credits	Max. Marks	Internal Assessment Marks		Semester End Exams (C_3)	
					C_1	C_2	Duration (hrs)	Marks
21CHD55	Automated Methods and Real Sample Analysis	2	2	100	15	15	3	70
21CHD56	Bioinorganic Photochemistry	2	2	100	15	15	3	70
21CHD57	Medicinal Chemistry	2	2	100	15	15	3	70
21CHD58	Quantum Chemistry	2	2	100	15	15	3	70

SCHEME OF EXAMINATION FOR C1, C2 AND C3 COMPONENTS

Preamble

In view of the CBCS syllabus, following is the model distribution of marks for C_1, C_2 and C_3 Components. At a glance, the model includes HC, SC and OE courses for the assessment of marks.

The following is the scheme which will be followed for the assessment of marks for HC, SC and OE courses irrespective of the credits associated with each course. 30% of the marks will be assessed for internals (C_1 and C_2) and remaining 70% will be for the Semester end Examinations (C_3). Each course carries 100 marks and hence 30 marks will be allotted to internals and remaining 70 marks will be for Semester end Examinations. Out of 30 marks for internals, 15 marks will be allotted to each C_1 and C_2 components.

Each course (HC/SC/OE) consists of three components namely C_1, C_2 and C_3. C_1 and C_2 are designated as Internal Assessment (IA) and C_3 as Semester end Examination. Each course (HC/SC/OE) carries **100 Marks** and hence the allotment of marks to C_1, C_2 and C_3 Components will be 15, 15 and 70 marks, respectively. i.e.,

C_1 Component	15 Marks	Assessment Marks
C_2 Component	15 Marks	
C_3 Component	70 Marks	Semester end Examination
Total	**100 Marks**	

The above Scheme will be followed for all the HC, SC and OE courses in all the four semesters.

1. HARD CORE (03 CREDIT COURSES)

Distribution of Marks for C_1 and C_2 Components

Assessment Marks ($C_1 + C_2$) consists of 30 marks. It will be divided into three parts *viz.*, ***Internal Test, Home Assignment and Seminar***. Internal tests will be conducted during the 8th week of the semester for C_1 and 16th week of the semester for C_2. Home Assignment will be considered for C_1 Component and Seminar for C_2 Component only. Hence, a teacher from each unit of a course may be given one assignment (or in their personal interest one more may be given). Since each course has three units, the marks shall be divided equally. Allotment of marks for C_1 and C_2 is as follows: Out of 15 Marks for C_1, Internal test will be conducted for 30 Marks (10 Marks from each unit and reduced to 10 Marks) and Home Assignment will be given for 05 Marks (Each Home Assignment from every unit will be assessed for 05 Marks and finally reduced to 05 Marks). Assessment Marks for C_2 will be distributed as follows: Internal test will be conducted for 30 Marks (10 Marks from each unit and reduced to 10 Marks) and Seminar will be assessed for 20 Marks and finally its Marks will be distributed to each theory HC course. i.e.,

C_1		**C_2**	
Internal Test	30 Marks (10+10+10) **Reduced to 10 Marks**	Internal Test	30 Marks (10+10+10) **Reduced to 10 Marks**
Home Assignment	15 Marks (05+05+05) **Reduced to 5 Marks**	Seminar	20 Marks (05+05+05+05) **5 Marks will be distributed to each HC course**
Total	**15 Marks**	**Total**	**15 Marks**

Distribution of Marks for C_3 Component (Semester end Examination)

The question paper is of 3 hrs duration with the Maximum of 70 Marks. The following question paper pattern will be followed for all the theory courses (HC/SC/OE). Question paper will have FIVE main questions. All the questions will cover all the units of the course with equal marks distribution. Q. No. 1 is of Medium/ Short Answer Type questions which will have nine questions and each question carries two marks. A student has to answer any seven questions. Q. No. 2 to 5 carries 14 marks each and a student has to answer all the four questions (*No Choice*). Each main question will have three sub-sections a, b, c. An examiner may set the questions like (4+4+6) or (4+5+5) or as his/her wish. However, sub-section 'c' will have an internal choice. i.e.,

Model Question Paper Pattern

Max. Duration: 3 Hr **Max. Marks: 70**

Note: *Answer all the questions. Each question carries 14 marks.*
Q. No. 1: Nine Medium/ Short Answer Type Questions and any seven should be answered. Each question carries TWO marks. **(7 × 2 = 14)**

Q. No. 2 to 5: All the four questions have to be answered (*No Choice*). Each question carries **FOURTEEN** marks. An examiner may set the questions like (4+4+6) or (4+5+5) or as his/her wish. However, sub-section c will have an internal choice. (*Two marks questions shall be avoided for 2 to 5*). **(4 × 14 = 56)**

a)
b)
c) **OR** c)

2. SOFT CORE (02 CREDIT COURSES)

Distribution of Marks for C_1 and C_2 Components

Assessment Marks (C_1 + C_2) consists of 30 marks. It will be divided into two parts viz., ***Internal Test and Home Assignment***. Internal tests will be conducted during the 8th week of the semester for C_1 and 16th week of the semester for C_2. As far as Home Assignment is concerned, the concerned teacher will assign one or two Home Assignments to each student. Since each course has two units, the marks will be divided equally. Allotment of marks for C_1 and C_2 is as follows: Out of 15 Marks for IA, Internal tests will be conducted for 20 marks and reduced to 10 marks, whereas Home Assignment is for 05 Marks. i.e.,

C_1		**C_2**	
Internal Test	20 Marks (10+10) **Reduced to 10**	Internal Test	20 Marks (10+10) **Reduced to 10**
Home Assignment	10 Marks (05+05) **Reduced to 05**	Home Assignment	10 Marks (05+05) **Reduced to 05**
Total	**15 Marks**	**Total**	**15 Marks**

Distribution of Marks for C_3 Component (Semester End Examination)

The above described pattern (1.2) holds good in this case also.

3. PRACTICALS

The following Scheme will be applicable for all the four semesters (SC for chemistry students only)

Each practical consists of three components namely C_1, C_2 and C_3. C_1 and C_2 are designated as Internal Assessment (IA) and C_3 as Semester End Examination. Each practical carries **100 Marks** and hence the allotment of marks to C_1, C_2 and C_3 Components will be 15, 15 and 70 marks respectively. i.e.,

C_1 Component	15 Marks	Internal Assessment Marks
C_2 Component	15 Marks	
C_3 Component	70 Marks	Semester End Examination
Total	**100 Marks**	

Distribution of Marks for C_1 and C_2 Components

IA consists of **15 Marks**. It will be divided into three parts *viz*., ***Internal Test, Continuous Assessment and Record***. Continuous assessment refers to the daily assessment of each student based on his/her attendance, skill, results obtained etc. Thus, 05 marks are allotted for Continuous Assessment. Internal tests will be conducted for 05 Marks during the 8th week of the semester for C_1 and 16th week of the semester for C_2. Finally, remaining 05 Marks will be for the record. i.e.,

C_1		C_2	
Internal Test	05 Marks	Internal Test	05 Marks
Continuous Assessment	05 Marks	Continuous Assessment	05 Marks
Record	05 Marks	Record	05 Marks
Total	**15 Marks**	**Total**	**15 Marks**

Distribution of Marks for C_3 Component (Semester End Examination)

The end examination will be conducted for **70 Marks/course** with a maximum duration of 6 hours. Two experiments will be given to each student which carries 30 Marks each. Each student will be subjected to Viva-Voce Examination for which 10 Marks is allotted. i.e.,

Two Experiments	30+30 Marks
Viva-Voce	10 Marks
Total	**70 Marks**

Note: Examiners have to set at least one experiment from each part in the semester end Examination (C_3).

4. Evaluation of Dissertation/Project Work:

Each student can take up Project Work/ Dissertation under the guidance of the faculty of the department during the IV Semester as a Soft Core course.

4.1. Distribution of Marks for C_1 and C_2 Components:

IA consists of **fifteen Marks** for each components; it will be divided into three parts viz.,

Attendance, Continuous Assessment and Work Progress. Continuous assessment refers to the daily assessment of each student based on his or her skill, results obtained, literature survey etc. C_1 will be assessed during the 8^{th} Week of the semester and C_2 during the 16^{th} Week of the semester. Hence, the concerned guide will prepare the marks list based on the above said parameters for both C_1 and C_2 Components.

4.2. Distribution of Marks for C_3 Component (Semester End Examination):

The semester end examination will be conducted for **seventy Marks**. Every student is suppose to prepare a hard copy of the findings of the work in the form of report and submitted for evaluation. This part will be assessed for fourth Marks. Each student will be subjected to Viva-Voce Examination for which thirty Marks is allotted. i.e.,

Evaluation of Report	: 40 Marks
Viva-Voce	: 30 Marks
Total	**: 70 Marks**

FIRST SEMESTER
HARD CORE

CONCEPTS AND MODELS OF INORGANIC CHEMISTRY

COURSE CODE: 21CHA10

Objectives

- To study the structures of ionic crystals and simple molecules through VSEPR model.
- To learn acid-base concepts and chemical reactions in non-aqueous, ionic liquids and supercritical fluids as media.
- To study the chemistry of f-block elements.

Course Outcome

- The periodic properties of the elements, structures of ionic solids and their lattice energy calculations. Further, the use of VSEPR concepts in analyzing the structures of simple molecules.
- Various acid-base concepts and their applications in different fields. Also, understand the utility of various non-aqueous solvents in inorganic synthesis.
- Complete understanding of the chemistry of lanthanides, actinides and their applications.

Pedagogy

- Familiarize the students with the periodic properties of the elements using modern periodic table.
- Teaching through conventional method such as black board and chalk, and modern methods like power point presentation.
- For teaching structures of solids, crystal models (MX and MX2 types) are used.

Course content

UNIT-I

[16 HOURS]

Chemical Periodicity: Review of periodic properties

Structures and energetics of ionic crystals: Introduction, MX (NaCl, CsCl, ZnS) and MX_2 (fluorite, rutile, β-crystobalite, cadmium chloride and cadmium iodide) types. The perovskite and spinel structures. Thermodynamics of ionic crystal formation. Hydration energy and solubility of ionic compounds, Lattice energy, Born-Haber cycle, Born-Lande equation. The Kapustinskii's equation, Consequences of lattice enthalpies. Applications of lattice energetics. Ionic radii, factors affecting the ionic radii, radius ratio rules.

Structures and energetics of inorganic molecules: Introduction, Bent's rule, Energetics of hybridization. VSEPR model for explaining structure of molecules including fluxional molecule. M.O. treatment of homo-nuclear and heteronuclear diatomic molecules. M.O. treatment involving delocalized π-bonding (CO_3^{2-}, NO_3^-, NO_2^-, CO_2 and N_3^-), M.O. correlation diagrams (Walsh) for triatomic molecules.

UNIT-II

[16 HOURS]

Modern concepts of acids and bases: Lux-Flood and Usanovich concepts, solvent system and leveling effect. Hard-Soft Acids and Bases, Classification and Theoretical backgrounds.

Non-aqueous solvents: Classification of solvents, Properties of solvents (dielectric constant, donor and acceptor properties) protic solvents (anhydrous H_2SO_4, HF and glacial acetic acid)

aprotic solvents (liquid SO_2, BrF_3 and N_2O_4). Solutions of metals in liquid ammonia, hydrated electron. Super acids and super bases. Heterogeneous acid-base reactions.

Ionic liquids: Molten salt solvent systems, Ionic liquids at ambient temperature, Reactions in and applications of molten salt/ionic liquid media.

Supercritical fluids: Properties of supercritical fluids and their uses as solvents. Supercritical fluids as media for inorganic chemistry

UNIT-III

[16 HOURS]

Lanthanoid Chemistry: General trends, Electronic, optical and magnetic properties. Abundance and extraction, **General principles**: conventional, solvent extraction and ion-exchange methods. Separation from monazite. Chemistry of principal oxidation states (II, III and IV). Stability of tetrahalides, dihalides and aqua ions of simple lanthanide compounds. Redox potentials. **Uses:** lanthanides as shift reagents, lanthanides as probes in biological systems. High temperature super conductors.

Actinoid Chemistry: General trends and electronic spectra**.** Occurrence and preparation of elements, **Isolation of the elements**: thorium and uranium, enrichment of uranium for nuclear fuel, uranium hydrides, oxides and chlorides. Chemical reactivity and trend. Chemistry of trans-uranium elements.

Supramolecular Chemistry: Introduction, selectivity and Supramolecular Interactions.

References

1. Basic Inorganic Chemistry – 3rd edition. F.A. Cotton, G. Wilkinson and P.L. Gaus, John Wiley and Sons (2002).
2. Inorganic Chemistry, 3rd edition. James E. Huheey, Harper and Row Publishers (1983).
3. Inorganic Chemistry, 5th edition. G.L. Miessler, P. J. Fischer and D.A. Tarr, Pearson (2014).
4. Inorganic Chemistry, 6th edition. D.F. Shriver, M. Weller. T. Overton, J. Rourke and F. Armastrong, Oxford University Press (2014).
5. Inorganic Chemistry, 4th edition. C.E. Housecroft and A.G. Sharpe, Pearson Education Ltd. (2012).
6. Introduction to Modern Inorganic Chemistry, K.M. Mackay and R.A. Mackay, Blackie Publication (1989).
7. Concepts and Models of Inorganic Chemistry 3rd edition. B.E. Douglas, D.H. McDaniel and Alexander, Wiley (2001).
8. Ionic liquids-Classes and Properties (Ed) by Scott T. Handy, Intech Publisher (2011).
9. Lanthanide and Actinide Chemistry, Simon Cotton, John Wiley and Sons Ltd., (2006).
10. Supramolecular Chemistry, Peter J. Cragg, Springer (2010).

STEREOCHEMISTRY AND REACTION MECHANISM
COURSE CODE: 21CHA11

Objectives

- To understand detailed molecular structures of organic compounds.
- To learn bonding and chemical reactions of organic compounds.
- To study different chemical reactions involved in organic synthesis.

Course Outcome

- Optical and geometrical isomerism of Organic compounds. Application of stereochemistry in the study of regioselective and regiospecific reactions.
- The study of HMOT and its applications to simple organic molecules, and also understand the concept of aromaticity and methods of determining reaction mechanism.
- Nucleophilic, electrophilic and elimination reactions.

Pedagogy

- Molecular models are used to teach stereochemistry.
- Teaching through conventional method such as black board and chalk, and modern methods like power point presentation.

Course content

UNIT-I

[16 HOURS]

Stereoisomerism: Projection formulae [flywedge, Fischer, Newman and sawhorse], enantiomers, diastereoisomers, mesomers, configurational notations of simple molecules, DL and RS configurational notations.

Conformational analysis: Conformational analysis of ethane, butane, cyclohexane, decalins, 1,2-, 1,3- and 1,4-disubstituted cyclohexane derivatives, Effect of conformation on the course and rate of reactions.

Optical isomerism: Conditions for optical isomerism; Elements of symmetry-plane of symmetry, centre of symmetry, alternating axis of symmetry (rotation-reflection symmetry). Optical isomerism due to chiral centers and molecular dissymmetry, allenes and biphenyls,

Geometrical isomerism: In C=C, C=N and N=N bonds, *E*, *Z* conventions, determination of configuration by physical and chemical methods. Geometrical isomerism in cyclic systems.

Stereoselectivity: Meaning and examples of stereospecific reactions, stereoselective reactions, diastereoselective reactions, regioselective, regiospecific reactions, enantioselective reactions and enantiospecific reactions.

UNIT-II

[16 HOURS]

Basics of organic reactions: Meaning and importance of reaction mechanism, classification and examples for each class.

Bonding in organic systems: Theories of bonding-molecular orbital approaches. Huckel molecular orbital theory and its application to simple π-systems: ethylene, allyl, cyclopropyl, butadienyl, cyclopentadienyl, pentadienyl, hexatrienyl, cyclohexatrienyl, heptatrienyl, cycloheptatrienyl systems. Calculation of the total π-energy, and M.O. coefficients of the systems.

Aromaticity: Concept of aromaticity, Huckel's rule, Polygon rule, annulenes, heteroannulenes and polycyclic systems.

Structure and reactivity: Brief discussion on effects of hydrogen bonding, resonance, inductive and hyperconjugation on strengths of acids and bases.

Methods of determining organic reaction mechanism: Thermodynamic and kinetic requirements for reactions, kinetic and thermodynamic control; Identification of products; Determination of reaction intermediates, isotope labeling and effects of cross over experiments, kinetic and stereochemical evidence, solvent effect. Formation, structure, stability, detection and reactions of carbocations (classical and non-classical), carbanions, free radicals, carbenes, nitrenes, arynes and ylides (Sulphur, nitrogen and phosphorous).

UNIT-III

[16 HOURS]

Aliphatic Nuleophilic Substitution reactions: Kinetics, mechanism and stereochemical factor affecting the rate of S_N1, S_N2, $S_{RN}i$, S_Ni, S_N1', S_N2', S_{N1i} and $S_{RN}1$ reactions; Neighboring group participation.

Electrophilic substitution reactions: Kinetics, mechanism and stereochemical factor affecting the rate of S_E1 & S_E2

Aromatic electrophilic substitution reactions: Mechanism of nitration, halogenation, sulphonation, Friedel-Crafts alkylation and acylation, Mannich reaction, chloromethylation, Vilsmeier Haack reaction, Diazonium coupling, Gattermann–Koch reaction, Mercuration reaction.

Aromatic nucleophilic substitution reactions: S_{N1}, S_{N2} and benzyne mechanism, Bucherer reaction, von Richter reaction.

Mechanism of Addition reactions: Addition to C=C multiple bonds involving electrophiles, nucleophiles. Markownikoff's rule and anti-Markownikoff's rule.

Additions to carbonyl compounds: Addition of water, alcohol, bisulphate, HCN and amino compounds. Hydrolysis of esters.

Elimination reactions: Mechanism and stereochemistry of eliminations - E_1, E_2, E_{1cB}. *cis* elimination, Hofmann and Saytzeff eliminations, competition between elimination and substitution reactions, decarboxylation reactions. Chugaev reaction.

References

1. Stereochemistry of carbon compounds, Ernest L. Eliel.
2. Stereochemistry: P. S. Kalsi.
3. Organic Chemistry, VI edition, Robert T. Morrison, Robert N. Boyd.
4. Organic Chemistry, Vol-I by I. L. Finar.
5. Advance Organic Chemistry, IV edition, Jerry March.
6. Advance Organic Chemistry, III edition, Part-A and Part-B, Francis A. Carey and Rechard J. Sundberg.
7. Organic Chemistry, III edition, V. K. Ahluwalia and Rakesh Kumar Parashar.
8. Reactive intermediates in Organic Chemistry, N. S. Isaacs.

BASIC PHYSICAL CHEMISTRY
COURSE CODE: 21CHA12

Objectives

- To understand thermal properties of chemical compounds.
- To study the rate of chemical reactions including fast reactions and factors influencing the reaction rate.
- To understand the theory of electrochemistry in solution.

Course Outcome

- The completion of this course will enable the students to gain the knowledge on fundamentals and theoretical background on the concepts of chemical thermodynamics, chemical kinetics and electrochemistry of solutions.
- This helps in understanding the stability and energetics of reaction.

Pedagogy

- Teaching through conventional method such as black board and chalk, and modern methods like power point presentation.
- To teach electrochemical aspects through animations.

Course content

UNIT-I

[16 HOURS]

Chemical Thermodynamics: Entropy: Physical significance, entropy changes in an ideal gas. Variation of entropy with temperature, pressure and volume. Entropy changes in reversible and irreversible processes.

Free energy: Helmholtz and Gibbs free energies, Gibbs-Helmholtz equation and its applications, Maxwell‘s relations and its applications. Nernst heat theorem: its consequences and applications. Third law of thermodynamics: statements, applications and comparison with Nernst heat theorem.

Partial molar properties: Physical significance, determination of partial molar volumes by intercept method and from density measurements. Chemical potential and its significance. Variation of chemical potential with temperature and pressure. Formulation of the Gibbs – Duhem equation. Derivation of Duhem-Margules equation.

Fugacity: Relation between fugacity and pressure, variation of fugacity with temperature and pressure. Determination of fugacity of gases.

Activity and activity coefficient: Variation of activity with temperature and pressure. Determination of activity co-efficient by vapour pressure, depression in freezing point, solubility measurements and by electrical methods.

Thermodynamics of dilute solutions: Raoult‘s law, Henry‘s law. Ideal and non-ideal solutions.

UNIT-II

[16 HOURS]

Chemical Kinetics: Complex reactions: Kinetics of parallel, consecutive and reversible reactions. Chain reactions: Branched chain reactions, general rate expression, Auto catalytic reactions (Hydrogen-Oxygen reaction), oscillatory reactions and explosion limits.

Theories of reaction rates: Collision theory and its limitations, Activated complex theory

(postulates -derivation) and its applications to reactions in solution. Energy of activation, other activation parameters - determinations and their significance. Lindemann theory, Hinshelwood's theory of unimolecular reactions.

Potential energy surfaces: Features and construction, theoretical calculations of E_a.

Reactions in solution: Ionic reactions - salt effects, effect of dielectric constant (single and double sphere models). Effect of pressure, volume and entropy change on the rates of reactions. Cage effect with an example.

Fast reactions- Introduction, study of fast reactions by continuous and stopped flow techniques, relaxation methods (T-jump and P-jump methods), flash photolysis, pulse and shock tube methods.

UNIT-III

[16 HOURS]

Electrochemistry of solutions: Factor effecting electrolytic conductance. Debye-Huckel theory - Concept of ionic atmosphere. Debye-Huckel-Onsager equation of conductivity and its validity. Debye-Huckel limiting law (DHL), its modification for appreciable concentrations. A brief survey of Helmholtz-Perrin, Guoy-Chapman and Stern electrical double layer (no derivation). Transference number: True and apparent transference numbers, Abnormal transference numbers, effect of temperature on transference numbers. Liquid junction potential-determination and minimization.

Energetics of cell reactions: Effect of temperature, pressure and concentration on energetics of cell reactions (calculation of ΔG, ΔH and ΔS).

Irreversible electrode process: Introduction, reversible and irreversible electrodes, reversible and irreversible cells. Polarization, over voltage - concentration over voltage, activation over voltage and ohmic over voltage. Experimental determination of over voltage. Equations for concentration over potential, stationary and non-stationary surface. Butler-Volmer equation, Tafel equation. Hydrogen oxygen over voltage. Effect of temperature, current density and *p*H on over voltage. Polarography- Half wave potential, application in qualitative and quantitative analysis.

References

1. Thermodynamics for Chemists by S. Glasstone, Affiliated East-West Press, New Delhi, (1965).
2. Physical Chemistry by P.W. Atkins, ELBS, 5th edition, Oxford University Press (1995).
3. Text Book of Physical Chemistry by Samuel Glasstone, MacMillan Indian Ltd., 2nd edition (1974).
4. Elements of Physical Chemistry by Lewis and Glasstone, 2nd Edn. Macmillan & Co Ltd., New York.
5. Chemical Kinetics by K.J. Laidler, Tata McGraw-Hill Pub, Co Ltd, New Delhi.
6. Chemical Kinetics by Frost and Pearson.
7. Kinetics and Mechanism of Chemical Transformation by J. Rajaram and J.C. Kuriacose, Macmillan, New Delhi.
8. Chemical Kinetics by L.K. Jain.
9. Introduction to Electrochemistry by S. Glasstone, Affiliated East-West Press, New Delhi,
10. Electrochemistry –Principles and Applications by E.G. Potter, Cleaver-Hume press Ltd, London.
11. Modern Electrochemistry Vol. I and II by J.O.M. Bockris and A.K.N. Reddy, Pentium Press, New York (1970).

ESSENTIALS OF ANALYTICAL CHEMISTRY
COURSE CODE: 21CHA13

Objectives

- To familiarize statistical methods to validate analytical methods.
- To learn sampling techniques and conventional volumetric methods.
- To learn extraction and chromatographic methods for the separation and identification of different compounds.

Course Outcome

- To enhance the knowledge on usage of analytical terminologies
- To build the skills on statistical analysis and comparison of results
- To aquire the skills on sampling, purification, separation and data analysis using instrumental techniques.
- To excel the knowledge on various separation techniques
- Explore topics such as experimental design, sampling, calibration strategies, standardization, optimization, statistics and the validation of experimental results

Pedagogy

- Teaching through conventional method such as black board and chalk, and modern methods like power point presentation.
- To evaluate validation parameters, MS-Office tools *viz.,* MS-Excel sheets can be used.

Course Content

Unit-I

Analytical Chemistry – Objectives. Meaning and role of analytical chemists. Quantitative and qualitative analysis. Analytical process and steps in quantitative analysis. Meanings of the terms: analysis, determination and measurement, techniques, methods, procedures and protocols. Calculating and reporting the data. Measurement of central tendency and variability: Mean median, range, standard deviation and variance.

Meaning of error. Determinate and indeterminate errors and minimization of errors. Accuracy and precision, distribution of random errors, the normal error curve. Propagation of determinate and indeterminate errors

Statistical treatment of finite samples- Student's t-test, confidence interval of mean. Comparison of two means and two standard deviations. Comparison of an experimental mean and a true mean. Criteria for the rejection of an observation- Q-test.

Standardization and calibration: Comparison with standards-direct comparison and titrations. External standard calibration-the least squares methods, regression equation and regression coefficient. Internal standard methods and standard-addition methods.

Validation of analytical method: Linearity, accuracy, precision, sensitivity, selectivity, robustness and ruggedness.

Figures of merit of analytical methods – sensitivity, detection and quantitation limit, linear dynamic range.

Obtaining and preparing samples for analysis: Importance of sampling, designing a sample plan-random, judgement, systematic-judgement, stratified and convenience sampling. Type of sample to collect - grab and composite samples. *Insitu* sampling. Size of sample and number of samples. Implementing the sampling plan - solutions, gases and solids. Bringing solid samples into solution - digestion and decomposing.

[16 HOURS]

UNIT – II

Solvent extraction: Theory-Nernst partition law, efficiency and selectivity of extraction.

Extraction systems: Extraction of covalent neutral molecules, extraction of uncharged metal chelates and synergic extraction, extraction of ion-association complexes-non chelated complexes, chelated complexes and oxonium systems. Use of salting out agents. Methods of extraction-batch and continuous extractions. applications.

Solid Phase Extraction (SPE): Principles, apparatus and instrumentation. Solid phase sorbents, extraction formats - Automated solid phase extraction. Solid phase micro extraction (SPME). Applications of SPE and SPME.

Chromatography: Definition, principles and mechanism of separation, classification of chromatographic techniques. General descriptions of column chromatography-frontal analysis, displacement analysis and elution analysis. General theory of column chromatography: characterizing a chromatogram-retention time, retention volume and baseline width. Chromatographic resolution, capacity factor, column selectivity. Column efficiency-band broadening-rate theory and plate theory. Peak capacity, non ideal behavior. Optimizing chromatographic separations using capacity factor, column selectivity and column efficiency- van Deemter equation, and its modern versions, Golay equation and Huber-Knox equations.

Thin layer chromatography (TLC) - Principles and procedures, stationary and mobile phases, solute- detection, alternative TLC procedures and applications of TLC.

[16 HOURS]

Unit-III

Gas chromatography (GC) - Principles and types. Mobile phases, Sample injections, columns and stationary phases. Temperature control and solute detection; thermal conductivity detector (TCD), flame ionization detector (FID), nitrogen-phosphorus detector (NPD) and electron capture detector (ECD). Instrument control and data processing. GC-procedures- temperature programming and special procedures used in GC. Quantitative and qualitative analyses.

High performance liquid chromatography (HPLC): Principles, mobile phases, solvent delivery systems, sample injection system, column and stationary phases. Solute detection-UV- visible, fluorescence, refractive index and electrochemical detectors. Instrument control and data processing. Modes of HPLC. Optimisation of separations, qualitative and quantitative analyses.

Ion-exchange chromatography (IEC): Principles, apparatus and instrumentation, and applications.

Size-exclusion chromatography (SEC): Principles, apparatus and instrumentation, and applications.

Affinity chromatography (AFC): Principles, methodology and applications.

Supercritical fluid chromatography (SFC): Properties of supercritical fluids, instrumentation and operating variables, comparison of SFC with other chromatographic techniques, applications.

Supercritical fluid extraction (SFE): Advantages, instrumentation, choice of supercritical fluids, off-line and on-line extraction, applications.

Electrophoresis (EP) and electrochromatography (EC): Principles- high performance capillary electrophoresis and capillary electrochromatography, running buffers, supporting medium, sample injection, solutes- detection, instrument control and data processing. Modes of EP and EC- capillary zone electrophoresis (CZE), micellar electrokinetic chromatography (MEKC), capillary gel electrophoresis (CZE), capillary isoelectric focusing (CIEF). Capillary electrochromatography (CEC), features, basis of separations. Qualitative analysis by CE and CEC and applications.

[16 Hours]

References:

1. Fundamental of Analytical Chemistry, D.A. Skoog, D.M. West, Holler and Crouch, 8th edition, 2005, Saunders College Publishing, New York.
2. Analytical Chemistry, G.D. Christian, 5th edition, 2001, John Wiley & Sons, Inc, India.
3. Quantitative Analysis, R.A. Day and A.L. Underwood, 6th edition,1993,Prentice Hall, Inc. New Delhi.
4. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, 6th edition, Third Indian Reprint, 2003, Pearson Education Pvt. Ltd., New Delhi.
5. Analytical Chemistry Principles, John H. Kennedy, 2nd edition, Saunders CollegePublishing, California, 1990.
6. Principles and Practice of Analytical Chemistry, F.W. Fifield and Kealey, 3rd edition, 2000, Blackwell Sci., Ltd. Malden, USA.
7. Modern Analytical Chemistry, David Harvey, McGraw Hill, New Delhi, 2000.

SOFT CORE

ANALYTICAL CHEMISTRY PRACTICALS

COURSE CODE: 21CHA50 **[128 HOURS]**

Safety measures in the laboratory; MSDS; reporting of values.

Course Objective

- To understand basic concepts by carrying out analytical experiments.
- The experimental results are subjected to validation of analytical parameters

Course Outcomes

- After studying this course the student to:
- Analyze various samples with different classical and simple instrumental skills.
- Obtain knowledge for selection of analytical methods with suitable technique being adopted for the analysis different samples like, water, laboratory chemicals and reagents, body fluids such as urine etc.
- Distinguish classical and instrumental methods.
- Propose and conduct experiment for quantification of individual analytes

Pedagogy

- Computer aided applications for the evaluation of experimental results.
- Each student performs experiments as per the protocol in practical classes.

PART – I

1. Determination of total acidity of vinegar and wines by acid-base titration.
2. Determination of purity of a commercial boric acid sample, and Na_2CO_3 content of washing soda.
3. Determination of relative equivalent weight of a weak organic acid by titration with NaOH.
4. Determination of ephedrine and aspirin in their tablet preparations by residual acid-base titrimetry.
5. Determination of carbonate and bicarbonate in a mixture by *p*H-metric titration and comparison with visual acid-base titration.
6. Determination of carbonate and hydroxide-analysis of a commercial washing soda by visual and *p*H-titrimetry.
7. Determination of purity of a commercial sample of mercuric oxide by acid-base titration.
8. Determination of benzoic acid in food products by titration with methanolic KOH in chloroform medium using thymol blue as indicator.
9. Determination of the *p*H of hair shampoos and *p*H determination of an unknown soda ash.
10. Analysis of water/ waste water for acidity by visual, *p*H metric and conductometric titrations.
11. Analysis of water/ waste water for alkalinity by visual, *p*H metric and conductometric titrations.
12. Determination of ammonia in house-hold cleaners by visual and conductometric titration.
13. Determination of chromate and dichromate in mixture by acid-base titration: visual and pH metric methods.

14. Potentiometric determination of the equivalent weight and Ka for a pure unknown weak acid.
15. Determination of purity of aniline by non-aqueous acid-base titration by visual and potentiometric methods.
16. Determination of purity of ethylene glycol and glycerol by oxidimetric method using periodate (Malprade reaction).
17. Spectrophotometric determination of creatinine and phosphorus in urine.
18. Flame emission spectrometric determination of sodium, potassium and calcium in river/ lake water.

PART – II

1. Determination of percentage of chloride in a sample by precipitation titration- Mohr, Volhard and Fajan's methods.
2. Determination of silver in an alloy and Na_2CO_3 in soda ash by Volhard method.
3. Mercurimetric determination of chloride in blood or urine.
4. Determination of total hardness, calcium and magnesium hardness and carbonate and bicarbonate hardness of water by complexation titration using EDTA.
5. Determination of calcium in calcium gluconate/ calcium carbonate tablets/ injections and of calcium in milk powder by EDTA titration.
6. Determination of zinc in a sample of foot powder and thallium in a sample of rodenticide by EDTA titration.
7. Analysis of commercial hypochlorite and peroxide solution by iodometric titration.
8. Determination of copper in an ore/ an alloy by iodometry and tin in stibnite by iodimetry.
9. Determination of ascorbic acid in vitamin C tablets by titrations with $KBrO_3$ and of vitamin C in citrus fruit juice by iodimetric titration.
10. Determination of iron in razor blade by visual and potentiometric titration using sodium metavanadate.
11. Determination of iron in pharmaceuticals by visual and potentiometric titration using cerium(IV) sulphate.
12. Determination of nickel in steel by synergic extraction and boron in river water/ sewage using ferroin.
13. Determination of total cation concentration of tap water by ion-exchange chromatography.
14. Determination of magnesium in milk of magnesium tablets by ion-exchange chromatography.
15. Cation exchange chromatographic separation of cadmium and zinc and their estimation by EDTA titration.
16. Gas chromatographic determination of ethanol in beverages.
17. Solvent extraction of zinc and its spectrophotometric determination.
18. Anion exchange chromatographic separation of zinc and magnesium followed by EDTA titration of the metals.
19. Separation and determination of chloride and bromide on an anion exchanger.
20. Separation of *o*- and *p*-nitroaniline and analysis by thin layer chromatography.

References

1. Fundamental of Analytical Chemistry, D.A. Skoog, D.M. West, Holler and Crouch 8th edition, 2005, Saunders College Publishing, New York.
2. Analytical Chemistry, G.D. Christian, 5th edition, 2001 John Wiley & Sons, Inc, India.
3. Quantitative Analysis, R.A. Day and A.L. Underwood, 6th edition, 1993, Prentice Hall, Inc. New Delhi.
4. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, 6th edition, Third Indian Reprint, 2003, Pearson Education Pvt. Ltd., New Delhi.
5. Analytical Chemistry Principles, John H. Kennedy, 2nd edition, Saunders College Publishing, California, 1990.
6. Practical Clinical biochemistry methods and interpretations, R. Chawla, J.P. Bothers Medical Publishers (P) Ltd., 1995.
7. Laboratory manual in biochemistry, J. Jayaraman, New Age International Publishers, New Delhi, 1981.
8. Practical Clinical Biochemistry by Harold Varley and Arnold.Heinmann, 4th edition.

INORGANIC CHEMISTRY PRACTICALS

COURSE CODE: 21CHA51 [128 HOURS]

Objectives

- To understand basic concepts by carrying out different experiments.
- To develop the skill for the qualitative and quantitative analysis of various samples.

Course Outcome

- Determination of various analytes presents in different ore samples by volumetric, gravimetric and spectrophotometric methods.
- The chemistry of redox, complexometric and indirect methods
- The principle in the semi-micro analysis of an inorganic salt mixture

Pedagogy

- Each student performs experiments as per the protocol in practical classes.
- Handling the instrument and pyrolysis for quantitative determination of analyte.

Course experiments

PART – A

1. Determination of iron in haematite using cerium (IV) solution (0.02M) as the titrant, and gravimetric estimation of insoluble residue.
2. Estimation of calcium and magnesium carbonates in dolomite using EDTA titration, and gravimetric analysis of insoluble residue.
3. Determination of manganese dioxide in pyrolusite using permanganate titration.
4. Quantitative analysis of copper-nickel in alloy/mixture:
    i. Copper volumetrically using KIO_3.
    ii. Nickel gravimetrically using DMG

5. Determination of lead and tin in a mixture: Analysis of solder using EDTA titration.
6. Quantitative analysis of chloride and iodide in a mixture:
    i. Iodide volumetrically using KIO_3
    ii. Total halide gravimetrically
7. Gravimetric analysis of molybdenum with 8-hydroxyquinoline.
8. Quantitative analysis of copper(II) and iron(II) in a mixture:
    i. Copper gravimetrically as CuSCN and
    ii. Iron volumetrically using cerium(IV) solution
9. Spectrophotometric determinations of:
    a. Titanium using hydrogen peroxide
    b. Chromium using diphenyl carbazide in industrial effluents
    c. Iron using thiocyanate/1,10-phenanthroline method in commercial samples
    d. Nickel using dimethylglyoxime in steel solution
10. Micro-titrimetric estimation of :
    a) Iron using cerium(IV)
    b) Calcium and magnesium using EDTA
11. Quantitative estimation of copper (II), calcium (II) and chloride in a mixture.
12. Circular paper chromatographic separation of: (Demonstration)
    a. Iron and nickel
    b. Copper and nickel

PART – B

Semimicro qualitative analysis of inorganic mixtures containing **TWO** anions and **TWO** cations (excluding sodium, potassium and ammonium cations) and **ONE** of the following less common cations: W, Mo, Ce, Ti, Zr, V and Li.

References

1. Vogel's Text Book of Quantitative Chemical Analysis – 5th edition, J. Basset, R.C. Denney, G.H. Jeffery and J. Mendhom.
2. A Text Book of Quantitative Inorganic Analysis by A.I. Vogel, 3rd edition.
3. Spectrophotometric Determination of Elements by Z. Marczenko.
4. Vogel's Qualitative Inorganic Analysis – Svelha.
5. Macro and SemimicroInorganicQualitative Analysis by A.I. Vogel.
6. Semimicro Qualitative Analysis by F.J. Welcher and R.B. Halin.
7. Quantitative Chemical Analysis by Daniel C. Harris, 7th edition, (2006).

ORGANIC CHEMISTRY PRACTICALS

COURSE CODE: 21CHA52 [128 HOURS]

Objectives

- To understand synthetic methods by carrying out different experiments.
- To develop the skill for the separation and qualitative analysis of binary mixtures of organic compounds.

Course Outcome

- Students are involved in the multi-step synthesis of different organic compounds.
- Understand the qualitative analysis of binary mixture of organic compounds through separation, identification of functional groups and preparation of solid derivatives.

Pedagogy

- Each student performs experiments as per the protocol in practical classes.
- Experimental setup for the synthesis of organic compounds by every individual.

Course experiments

PART-A

Safety measures in the laboratory; MSDS; reporting of values and demonstration of KingDraw/ ChemDraw

Multistep synthesis

1. Preparation *p*-bromoaniline from acetanilide**.**
2. Preparation of *n*-butyl bromide from *n*-butyl alcohol.
3. Oxidation of cyclohexanol to adipic acid.
4. Esterification: Preparation of benzoccaine from *p*-nitrotoluene.
5. Diazotization (Sandmeyer‘s reaction): Preparation of *p*-chlorobenzoic acid from *p*-toluidine.
6. Preparation benzilic acid from benzoin**.**
7. Preparation of *o*-hydroxy benzophenone from phenyl benzoate *via* Fries rearrangement.
8. Preparation of benzanilide from benzophenone oxime *via* Beckmann rearrangement.
9. Preparation of benzoic acid from benzaldehyde (Cannizzaro Reaction).
10. Preparation of 2,4-dinitrophenylhydrazine from 2,4-dinitrochlorobenzene.
11. Preparation of *m*-nitrobenzoic acid from methylbenzoate.
12. Preparation of chalcone.

PART-B

Qualitative analysis: Separation of binary mixtures, identification of functional groups and preparation of suitable solid derivatives.

References

1. Vogel' text book of practical organic chemistry, V edition, B. S. Furniss, A. J. Hannaford, P. W. G. Smith, A. R. Tatehell.
2. Elementary practical organic chemistry, Part-I: Small scale preparations, Part-II: Qualitative organic analysis, By Arthur I, Vogel.
3. Hand book of organic analysis, H. T. Clarke and Norman Collie.
4. Experiments in Organic Chemistry, Louis F. Fieser.
5. Laboratory manual of Organic Chemistry by B. B. Dey and M. V. Sitaraman.
6. Practical Organic Chemistry by Mann F. G. and Saunders.

PHYSICAL CHEMISTRY PRACTICALS
COURSE CODE: 21CHA53 [128 HOURS]

Objectives

- To understand the rate of chemical reactions and factors influencing the reaction rate by carrying out kinetic experiments.
- To understand basic concepts of electrochemistry by carrying out experiments.

Course Outcome

- After the completion of this course, the students can able to develop the experimental skill and theoretical interpretation of experimental results of many physical chemistry experiments of chemical kinetics in solution phase, thermodynamics, electrochemistry and spectrophotometry.
- This helps in academics, research and industries.

Pedagogy

- Each student performs experiments as per the protocol in practical classes.
- To optimize the reaction conditions for understanding the rate of chemical reactions.

Course experiments

PART - A

1. Study of kinetics of hydrolysis of methyl acetate in presence of two different concentrations of HCl/H_2SO_4 and report the relative catalytic strength.
2. Study of kinetics of reaction between $K_2S_2O_8$ and KI, first order, determination of rate constants at two different temperatures and E_a.
3. To study the kinetics of saponification of ethyl acetate by conductivity method at two different concentrations of NaOH and report the relative catalytic strength.
4. Determination of partial molar volume of salt-water system ($NaCl-H_2O/KCl-H_2O/KNO_3-H_2O$) systems.
5. To study the kinetics of reaction between acetone and iodine - determination of order of reaction with respect to iodine and acetone.
6. Study the kinetics of decomposition of diacetone alcohol by NaOH, determine the catalytic coefficient of the reaction and comparison of strength of alkali.
7. Determination of energy of activation for the bromide-bromate reaction.
8. Kinetics of reaction between sodium formate and iodine and determination of energy of activation.
9. Determination of heat of solution of organic acid (benzoic acid/salicylic acid) by variable temperature method (graphical method).
10. Determination of degree of association of benzoic acid in benzene by distribution method.
11. To determine the eutectic point of a two component system (Naphthalene-*m*-dinitrobenzene system).
12. Analysis of a binary mixture (Gylcerol & Water) by measurement of refractive index.
13. Determination of the molecular weight of a polymer material by viscosity measurements (cellulose acetate/methyl acrylate).

PART – B

1. Conductometric titration of a mixture of HCl and CH_3COOH against NaOH.
2. Conductometric titration of sodium sulphate against barium chloride.
3. pH titration of (a) HCl against NaOH (b) Copper sulphate against NaOH and (c) CH_3COOH/HCOOH against NaOH - determination of K_a.
4. Determination of equivalent conductance of weak electrolyte (CH_3COOH) at infinite

dilution following Kohlrausch law.

5. Determination of dissociation constant and mean ionic activity coefficient of weak acids ($CH_3COOH/HCOOH/ClCH_2COOH$) by conductivity method.
6. Potentiometric titration of KI *vs* $KMnO_4$ solution.
7. Determination of dissociation constant of a weak acid ($CH_3COOH/HCOOH/ClCH_2COOH$) by potentiometric method.
8. Potentiometric titration of a mixture of halides (KCl+KI/KCl+KBr/KBr+KI) against $AgNO_3$.
9. To obtain the absorption spectra of coloured complexes, verification of Beer's law and estimation of metal ions in solution using a spectrophotometer.
10. Potentiometric titration of $K_2Cr_2O_7$ against FAS determination of redox potential and concentration of Fe^{2+} ions.
11. Conductometric titration of oxalic acid against NaOH and NH_4OH.
12. Coulometric titration I_2 vs $Na_2S_2O_3$.
13. Determination of acidic and basic dissociation constant and isoelectric point of an amino acid by pH metric method.
14. Kinetics of photodegradation of indigocarmine (IC) using ZnO/TiO_2 as photocatalyst and study the effect of [ZnO/TiO_2] and [IC] on the rate of photodegradation.

References

1. Practical Physical Chemistry – A.J. Findlay.
2. Experimental Physical Chemistry – F. Daniels *et al*.
3. Selected Experiments in Physical Chemistry – Latham.
4. Experiments in Physical Chemistry – James and Prichard.
5. Experiments in Physical Chemistry – Shoemaker.
6. Advanced Physico-Chemical Experiments – J. Rose.
7. Practical Physical Chemistry – S.R. Palit.
8. Experiments in Physical Chemistry – Yadav, Geol Publishing House.
9. Experiments in Physical Chemistry – Palmer.
10. Experiments in Chemistry – D.V. Jahagirdar, Himalaya Publishing House, Bombay, (1994).
11. Experimental Physical Chemistry – R.C. Das and B. Behera, Tata Mc Graw Hill.

SOFT CORE PAPERS

TITRIMETRIC ANALYSIS

COURSE CODE: 21CHA54

Objective

- To familiarize statistical methods to validate analytical methods.
- To learn sampling techniques and conventional volumetric methods.

Course Outcome

After studying this course the student able to:

- Understand on quantitative and qualitative methods of analysis with relevant equilibrium chemistry.
- Develop the ideas with the fundamental aspects in analytical chemistry.
- Build the interest in students in developing good experimental protocols, and in interpreting

experimental results.

- Gain analytical knowledge for the quantitative analysis of various samples of different origin under titrimetric aspects.
- Learn statistical aspects from which the spirit of assessing the results will be enhanced.
- Learn method development and validation features so that they will become outstanding basement for their career in various industries.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.

Unit-I

Titrimetric analysis: An overview of titrimetry. Principles of titrimetric analysis. Titration curves. Titrations based on acid-base reactions-titration curves for strong acid and strong base, weak acid and strong base and weak base and strong acid titrations. Selecting and evaluating the end point. Finding the end point by visual indicators, monitoring *p*H and temperature. Quantitative applications – selecting and standardizing a titrant, inorganic analysis-alkalinity, acidity and free CO_2 in water and waste waters, nitrogen, sulphur ammonium salts, nitrates and nitrites, carbonates and bicarbonates. Organic analysis-functional groups like carboxylic acid, sulphonic acid, amine, ester, hydroxyl, carbonyl. Air pollutants like SO_2. Quantitative calculations. Characterization applications-equivalent weights and equilibrium constants.

Acid-base titrations in non-aqueous media: Role of solvent in acid-base titrations, solvent systems, differentiating ability of a solvent, some selected solvents, titrants and standards, titration curves, effect of water, determining the equivalence point, typical applications-determination of carboxylic acids, phenols and amines.

Precipitation titrations: Titration curves, feasibility of precipitation titrations, factors affecting shape - titrant and analyte concentration, completeness of the reaction, titrants and standards, indicators for precipitation titrations involving silver nitrate, the Volhard, the Mohr and the Fajan's methods, typical applications.

[16 HOURS]

UNIT – II

Complexometric titrations: Complex formation reactions, stability of complexes, stepwise formation constants, chelating agents, EDTA - acidic properties, complexes with metal ions, equilibrium calculations involving EDTA, conditional formation constants, derivation of EDTA titration curves, effect of other complexing agents, factors affecting the shape of titration curves - completeness of reaction, indicators for EDTA titrations - theory of common indicators, titration methods employing EDTA - direct, back and displacement titrations, indirect determinations, titration of mixtures.

Redox titrations: Balancing redox equations, calculation of the equilibrium constant of redox reactions, calculating titration curves, detection of end point, visual indicators and potentiometric end point detection. Quantitative applications - adjusting the analyte's oxidation state, selecting and

standardizing a titrant. Inorganic analysis - chlorine residuals, dissolved oxygen in water, water in non-aqueous solvents. Organic analysis - chemical oxygen demand (COD) in natural and waste waters, titrations of mercaptans and ascorbic acid with I_3^- and titration of organic compounds using periodate.

Automatic titrators: Principles and theory of CO_2, sulphate, chloride and Karl Fisher titrators.

[16 HOURS]

References

1. Fundamental of Analytical Chemistry, D.A. Skoog, D.M. West, Holler and Crouch, 8th edition, 2005, Saunders College Publishing, New York.
2. Analytical Chemistry, G.D. Christian, 5th edition, 2001, John Wiley & Sons, Inc, India.
3. Quantitative Analysis, R.A. Day and A.L. Underwood, 6th edition,1993,Prentice Hall, Inc. New Delhi.
4. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, 6th edition, Third Indian Reprint, 2003, Pearson Education Pvt. Ltd., New Delhi.
5. Analytical Chemistry Principles, John H. Kennedy, 2nd edition, Saunders CollegePublishing, California, 1990.
6. Principles and Practice of Analytical Chemistry, F.W. Fifield and Kealey, 3rd edition, 2000, Blackwell Sci., Ltd. Malden, USA.
7. Modern Analytical Chemistry, David Harvey, McGraw Hill, New Delhi, 2000.

CHEMISTRY OF SELECTED ELEMENTS
COURSE CODE: 21CHA55

Objectives

- To learn basic chemistry of some selected group elements from periodic table.
- To understand properties of metal-metal bonding and cluster compounds.

Course Outcome

- Understand the chemistry of hydrogen and group 2 elements.
- The chemistry of pseudohalogens, interhalogens and their halogen compounds.
- The chemistry of xenon and other noble gas compounds.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.Course content

UNIT-I

Compounds of hydrogen: The hydrogen and hydride ions, Dihydrogen and hydrogen bonding. Classes of binary hydrides: Molecular hydrides, saline hydrides and metallic hydrides.

The Group 1 elements: Occurrence, extraction and uses. Simple compounds: Hydrides, halides, oxides, hydroxides, oxoacids, nitrides, solubility and hydration and solutions in liquid ammonia. Coordination and organometallic compounds. Applications.

The Group 2 elements: Occurrence, extraction and uses. General properties. Halides, hydrides

and salts of oxo acids. Complex ion in aqueous solution and complexes with amido and alkoxy ligands.

The Group 15 elements: Introduction, oxides and oxoacids of nitrogen and phosphorus.

[16 HOURS]

UNIT-II

The Group 17 elements: Occurrence, recovery and uses. Trends in properties and pseudohalogens. **Interhalogens**: Physical properties and structures, chemical properties, cationic interhalogens. **Compounds with oxygen**: Halogen oxides, oxoacids and oxoanions**.** Trends in rates of redox reactions and redox properties of individual oxidation states**.**

Chemistry of astatine.

The Group 18 elements: Occurrence, recovery and uses. Synthesis and structure of xenon fluorides, Reaction of xenon fluorides, xenon-oxygen compounds, Organoxenon compounds, other compounds of noble gases.

M-M bonds: Multiple metal-metal bonds.

Cluster compounds: carbonyl and carbide clusters.

References

1. Basic Inorganic Chemistry – 3rd edition. F.A. Cotton, G. Wilkinson and P.L. Gaus, John
2. Wiley and Sons (2002).
3. Inorganic Chemistry, 3rd edition. James E. Huheey, Harper and Row Publishers (1983).
4. Inorganic Chemistry, 3rd edition. G.L. Miessler and D.A. Tarr, Pearson Education (2004).
5. Inorganic Chemistry, 4th edition. C.E. Housecroft and A.G. Sharpe, Pearson Education Ltd. (2012).
6. Chemistry of the Elements – N.N. Greenwood and A. Earnshaw, Pergamon Press (1985).
7. Inorganic Chemistry, 6th edition. D.F. Shriver, M. Weller. T. Overton, J. Rourke and F.

CHEMISTRY OF NATURAL PRODUCTS-I
COURSE CODE: 21CHA56

Objectives

- To learn the nomenclature, classification, purification, structure and synthesis of some natural products.
- To understand the biological functions of biomolecules.

Course Outcome

- Acquire the knowledge of chemistry of lipids, prostaglandins and terpenoids.
- Understand the biological importance of chlorophyll and porphyrins.
- Chemistry of flavonoids and isoflavonoids.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern method like power point presentation is used in class room teaching.

Course content

UNIT-I

[16 HOURS]

Lipids: Nomenclature, classification, purification, structure and synthesis of fatty acids, phospholipids, sphingolipids. Biological importance of lipids (Lecithin, sphingolipids, oils and fats).

Prostaglandins: Introduction, classification and biological importance of PG's. Constitution of PGE1. Synthesis of PGE & F series.

Terpenoids: Introduction, classification and general methods of structural elucidation. Chemistry of pinene, camphor, caryophyllene, santonin. Biosynthesis of terpenoids.

UNIT-II

[16 HOURS]

Porphyrins: Introduction, structure and biological functions of haemin. Vitamin B12: structure and as coenzyme in molecular rearrangement reactions; Chlorophyll: structure and biological importance.

Flavonoids and Isoflavonoids: Occurrence, nomenclature and general methods of structure determination. Isolation and synthesis of Apigenin, Luteolin, Kaempferol, Quercetin, wedelolactone, Butein, Daidzein. Biosynthesis of flavonoids and isoflavonoids: Acetate Pathway and Shikimic acid Pathway. Biological importance of flavonoids and isoflavonoids

References

1. Organic Chemistry, VI edition, Robert T. Morrison, Robert N. Boyd.
2. Organic Chemistry, Vol-II by I. L. Finar.
3. Schaum's outline of theory and problems of Organic Chemistry, Harbert Meislich, Howard Nechamkin and Jocob Sharefkin.
4. Natural products: Their chemistry and biological significance, J. Mann, R. S. Davidson, J. B. Banthorpe and J. B. Harborne.
5. Synthetic drugs, Gurdeep R. Chatwal.
6. Heterocyclic chemistry by Achison.
7. Heterocyclic chemistry by Smith and Joule.
8. Heterocyclic chemistry by Pacquete.

BIOPHYSICAL CHEMISTRY

COURSE CODE: 21CHA57

Objectives

- To understand the physico-chemical principles of biological fluids.
- To learn the pharmacokinetics, pharmacodynamics, toxicokinetics of biological systems.

Course Outcome

- After the completion of this course, the students gain the knowledge on theory and principles of biophysical chemistry and pharmacokinetics.
- This course helps to understanding the bio-availability and different pharmacokinetic parameters of drugs in the living system.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.

Course content

UNIT-I

[16 HOURS]

Biophysical Chemistry: Electrophoresis - Principles of free electrophoresis, zone electrophoresis, gel electrophoresis and its applications in qualitative and quantitative study of proteins. Determination of isoelectric point of a protein. Electro-osmosis and streaming potential and its biological significance. Biological significance of Donnan membrane phenomenon. Micelles and its involvement during digestion and absorption of dietary lipids. Diffusion of solutes across bio-membranes and its application in the mechanism of respiratory exchange. –Salting In‖ and –Salting Out‖ of proteins. Osmotic behaviour of cells and osmo-regulation and its application in the evolution of excretory systems of organisms. Effect of temperature and *p*H on the viscosity of bio-molecules (albumin solution). Significance of viscosity in biological systems - mechanism of muscle contraction, polymerization of DNA and nature of blood flow through different vessels. Effect of temperature, solute concentration (amino acids) on surface tension. Biological significance of surface tension - stability of Alveoli in lungs, interfacial tension in living cells (Danielli and Davson model). Application of sedimentation velocity and sedimentation equilibrium method for molecular weight determination of proteins.

UNIT-II

[16 HOURS]

Pharmacokinetics: Introduction, biopharmaceutics, pharmacokinetics, clinical pharmacokinetics, pharmacodynamics, toxicokinetics and clinical toxicology. Measurement of drug concentration in blood, plasma or serum. Plasma level-time curve, significance of measuring plasma drug concentrations.

One compartment open model: Intravenous route of administration of drug, elimination rate constant, apparent volume of distribution and significance. Calculation of elimination rate constant from urinary excretion data, clinical application.

Two compartment model: Plasma level-time curve, relationship between tissue and plasma drug concentrations, Apparent volumes of distribution. Drug clearance, clinical example. Plasma level-time curve for a three compartment open model.

Drug absorption: Factors affecting the rate of drug absorption - nature of the cell membrane, Route of drug administration - Oral drug absorption, Intravenous infusion and intravenous solutions, Effect of food on gastrointestinal drug absorption rate.

References

1. Introduction to Physical Organic Chemistry, R.D. Gilliom, Madison – Wesley, USA (1970).
2. Physical Organic Chemistry- Reaction Rate and Equilibrium Mechanism – L.P. Hammett, McGraw HillBook, Co., (1970).
3. Biophysical Chemistry- Principle and Technique – A. Upadhyay, K. Upadhyay and N. Nath, Himalaya Publishing House, Bombay, (1998).
4. Essentials of Physical Chemistry and Pharmacy – H. J. Arnikar, S. S. Kadam, K.N. Gujan, Orient Longman, Bombay, (1992).
5. Applied Biopharmacokinetics and Pharmacokinetics - Leon Shargel, Andrew YuPrentice-Hall International, Inc (4^{th} edition).
6. Essentials of Physical Chemistry and Pharmacy – H.J. Arnikar, S.S. Kadam, K.N. Gujan, Orient Longman, Bombay, (1992).

SECOND SEMESTER

COORDINATION CHEMISTRY

COURSE CODE: 21CHB10

Objectives

- To understand the preparation, properties, electronic configuration and structural elucidation of coordination compounds.
- To learn the reaction mechanism, stereochemistry and photochemistry of coordination compounds.

Course Outcome

- Gain the knowledge of preparative methods of coordination compounds and geometries of different coordination numbers.
- Understand the CFT and MOT bonding theories of metal complexes.
- Electronic spectra, magnetic properties and infrared spectroscopy of coordination compounds. In addition, understand the reaction mechanism and photochemistry of coordination compounds.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.

Course content

UNIT-I

[16 HOURS]

Preparation of coordination compounds: Introduction, Preparative methods- simple addition reactions, substitution reactions, oxidation-reduction reactions, thermal dissociation reactions. Geometries of metal complexes of higher coordination numbers (2-12).

Stability of coordination compounds: Introduction, trends in stepwise stability constants, factors influencing the stability of metal complexes with reference to the nature of metal ion and ligands, the Irving-William series, chelate effect.

Determination of stability constants: Theoretical aspects of determination of stability constants of metal complexes by spectrophotometric and polarographic methods.

Crystal field theory: Salient features of CFT, d-orbital splitting in octahedral, tetrahedral, square planar and tetragonal complexes, Jahn-Teller distortions, measurement of 10 Dq and factors affecting it. Evidences for metal-ligand covalency.

Molecular Orbital Theory: MOT to octahedral, tetrahedral and square planar complexes without and with pi-bonding.

UNIT-II

[16 HOURS]

Electronic spectra: Introduction, selection rules and intensities, electronic spectra of octahedral and tetrahedral complexes, Term symbols for d^n ions, Orgel and Tanabe-Sugano diagrams, charge-transfer spectra. Ligand-field transition. Charge transfer and energy applications. Optical rotatory dispersion and Circular dichroism. Magnetic circular dichroism.

Magnetic properties: Introduction, magnetic susceptibility and its measurements, spin and orbital contributions to the magnetic moment, the effects of temperature on μeff, spin-cross over, ferromagnetism, anti-ferromagnetism and ferrimagnetism.

Applications of infrared spectroscopy of coordination compounds: Metal complexes of

ammine, nitro, nitrito, hydroxo, carbonato, sulphato, cyano, cyanato and thiocyanato complexes.

UNIT-III

[16 HOURS]

Reactions and Mechanisms: Introduction. Substitution reactions- Inert and labile compounds, mechanisms of substitution. Kinetic consequences of Reaction pathways- Dissociation, interchange and association. Experimental evidence in octahedral substitution- Dissociation, associative mechanisms, the conjugate base mechanism, the kinetic chelate effect.

Stereochemistry of reactions- Substitution in *trans* and its complexes, isomerization of chelate rings. Substitution reactions of square-planar complexes-kinetics and stereochemistry of square-planar substitutions, evidence for associative reactions, explanations of the *trans* effect.

Electron-transfer processes: Inner-sphere mechanism and outer-sphere mechanism, conditions for high and low oxidation numbers.

Photochemistry of coordination compounds: Photochemistry of chromium(III) ammine compounds, Light-induced excited state spin trapping in iron(II) compounds and MLCT photochemistry in pentammineruthenium(II) compounds.

References

1. Physical Inorganic Chemistry- A Coordination Chemistry Approach- S.F.A. Kettle, Spektrum, Oxford, (1996).
2. Inorganic Chemistry-4th edition. C.E. Housecroft and A.G. Sharpe, Pearson Education Ltd. (2012).
3. Inorganic Chemistry-5th edition. G.L. Miessler, P. J. Fischer and D.A. Tarr, Pearson (2014).
4. Inorganic Chemistry-6th edition. D.F. Shriver, M. Weller. T. Overton, J. Rourke and F. Armastrong, Oxford University Press (2014).
5. Inorganic Chemistry- 3rd edition, James E. Huheey, Harper and Row Publishers, (1983).
6. Basic Inorganic Chemistry- 3rd edition, F.A. Cotton, G. Wilkinson and P.L. Gaus, John Wiley and Sons, (2002).
7. Infrared and Raman Spectra of Coordination Compounds, Part-B- 6th edition, K. Nakamoto, John Wiley and Sons (2009).

SYNTHETIC ORGANIC CHEMISTRY
COURSE CODE: 21CHB11

Objectives

- To understand the reactions of organic compounds involving various reagents.
- To learn the synthesis and retro-synthesis of different organic compounds.

Course outcome

- Students are familiar about chemistry of oxidants, reductants and their applications in the organic synthesis.
- Understand the various catalysts in organic synthesis by known naming reactions.
- Retro-synthesis and molecular rearrangement.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern method like power point presentation is used in class room teaching.

Course content

UNIT-I

[16 HOURS]

Oxidation: Oxidation with chromium and manganese reagents (CrO_3, $K_2Cr_2O_7$, PCC, PDC, Sarret reagent, MnO_2, $KMnO_4$), peroxides and peracids, periodic acid, OsO_4, SeO_2, NBS, Oppenauer oxidation, Sharpless epoxidation.

Reduction: Catalytic hydrogenation (homogeneous and heterogeneous) – catalysts (Pt, Pd, Ra-C, Ni, Ru, Rh), solvents and reduction of functional groups, catalytic hydrogen transfer reactions. Wilkinson catalyst, $LiAlH_4$, $NaBH_4$, DIBAL-H, Sodium cyanoborohydride, Birch reduction, Leukart reaction (reductive amination), diborane as reducing agent, Meerwein-Ponndorf-Verley reduction, Wolff-Kishner reduction, Clemensen reduction, stannous chloride, Organoboron compounds: Introduction and preparations; Hydroboration and its applications; Reactions of organoboranes: isomerization reactions, oxidation, protonolysis, carbonylation, cyanidation. Reactions with aldehydes or ketones (*E* and *Z*-alkenes).

UNIT-II

[16 HOURS]

Reagents and reactions in organic synthesis: Use of following reagents in organic synthesis and functional group transformations: Lithium diisopropylamide (LDA), Gilmann reagent, dicyclohexyl carbodimide (DCC), dichlorodicyanoquinone (DDQ), Silane reagents-trialkylsilyl halides, trimethylsilyl cyanide, trimethyl silane; phase transfer catalyst, crown ethers, cyclodextrins, Ziegler-Natta catalyst, diazomethane, Woodward and Prevost hydroxylation, Stark enamine reaction, phosphorous ylides - Wittig and related reactions, Sulphur ylides – reactions with aldehydes and ketones, 1,3-dithiane anions - Umpolung reaction, Peterson reaction. Palladium reagents: Suzuki coupling, Heck reaction, Negishi reaction. Green Chemistry: Definition and principles, planning green synthesis in the laboratory, green preparations- aqueous reactions, solid state (solvent free) reactions, photochemical reactions, enzymatic transformations and reactions in ionic liquids.

UNIT-III

[16 HOURS]

Molecular rearrangements: Introduction Carbon to carbon migration: Pinacol-pinacolone, Wagner-Meerwein, Benzidine, benzylic acid, Favorskii, Fries rearrangement, dienophile rearrangement. Carbon to nitrogen migration: Hofmann, Curtius, Lossen, Schmidt and Beckmann rearrangements. Miscellaneous rearrangements: Wittig, Smiles, Bayer-Villeger rearrangement and Barton reaction.

Retrosynthesis: Introduction to disconnection approach: Basic principles and terminologies used in disconnection approach. One group C-X and two group C-X disconnections. Synthons and synthetic equivalents. Retrosynthesis and synthesis of benzofurans, *p*-methoxy acetophenone, saccharine, α-bisabolene, nuciferal, tetralone, ibuprofen; Functional group transformations in organic synthesis: nitro to keto, nitro to amine, acid to alcohol etc.

References

1. Organic Chemistry, VI edition, Robert T. Morrison, Robert N. Boyd.
2. Organic Chemistry, Vol-I & II by I. L. Finar.
3. Advance Organic Chemistry, IV edition, Jerry March.
4. Advance Organic Chemistry, III edition, Part-A and Part-B, Francis A. Carey and Rechard J. Sundberg.
5. Organic Chemistry, III edition, V. K. Ahluwalia and Rakesh Kumar Parashar.
6. Organic named reactions and molecular rearrangements, Gudeep Raj.
7. Modern synthetic reactions, II edition, H. O. House.
8. Organic synthesis, Jagadamba Singh and L. D. S. Yadav.
9. Green Chemistry, K. R. Desai.
10. Principles of Organic synthesis, R. O. C. Norman and J. M. Coxon.
11. Organic synthesis II edition, V. K. Aluwalia and Renu Agarwal.
12. Organic synthesis, Robert E. Ireland.
13. Schaum's outline of theory and problems of Organic Chemistry, Harbert Meislich, Howard Nechamkin and Jocob Sharefkin.
14. Organic chemistry by Clayden, Greeves, Warren and Wothers.

PRINCIPLES OF PHYSICAL CHEMISTRY
COURSE CODE: 21CHB12

Objectives

- To understand the theoretical calculations of energies of simple molecules.
- To learn the calculation of different energies by statistical thermodynamics.
- To understand the basics of polymers, their kinetics and applications.

Course Outcome

- Principles of Quantum chemistry and theoretical calculations of energies of molecules and chemical reactions.
- Apply solutions of the Schrödinger equation for simple systems (particle in a box, rigid rotor, harmonic oscillator) to real systems (vibrational, rotational, and electronic energy states) in determining the energy of stationary states.
- Explain angular momentum as possessed by atomic or molecular systems, various descriptions of how angular momentum can be coupled, and how conservation of angular momentum is important to spectroscopy.
- Concepts and applicability of statistical thermodynamics in the calculations of different energies in the reacting system. Applications of phase rule for separation of the metals from ore.
- Fundamentals of polymers and their applications in controlling the quality and waste management of polymer product.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern method like power point presentation is used in class room teaching.
- Assigning the students to solve the problems to understand the concepts.

Course content

UNIT-I

[16 HOURS]

Quantum Chemistry: Introduction to quantum mechanics: Schrödinger wave equation, time-independent and time dependent Schrödinger wave equation and the relation between their solutions. Eigen functions and Eigen values. Physical interpretation of wave function. Concept of operators – Laplacian, Hamiltonian, Linear and Hermitian operators. Angular momentum operators and their properties. Commutative and non-commutative operators. Normalization, orthogonality and orthonormality of wave functions. Postulates of quantum mechanics. Solutions of Schrödinger wave equation for free particles, particle in a ring, particle in three dimensional box. Quantum mechanical degeneracy, tunnelling (no derivation). Wave equation for H-atom, separation and solution of R, ϕ and θ equations. Application of Schrodinger equation to rigid rotator and harmonic oscillator. Eigen functions and Eigen values of angular momentum. Ladder operator method for angular momentum.

UNIT-II

[16 HOURS]

Statistical thermodynamics: Objectives of statistical thermodynamics, concept of distribution, types of ensembles. Thermodynamic probability and most probable distribution law. Partition functions – definition, evaluation of translational, rotational and vibrational and electronic partition functions for monoatomic, diatomic and polyatomic gaseous molecules. Sackur-Tetrode equation for entropy of translation function. Calculation of thermodynamic functions and equilibrium constants in terms of partition functions. Different distribution laws (Types of statistics): Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac Statistics (derivation of the three distribution laws). Comparison of Bose-Einstein and Fermi-Dirac Statistics with Maxwell-Boltzmann statistics. Problems and their solutions.

Phase rule studies: Thermodynamic derivation of phase rule. Application of phase rule to the two component systems - compound formation with congruent melting point and incongruent melting points, Roozeboom‘s classification. Application of phase rule to three component systems- systems of three liquids and systems of two salts and water.

UNIT-III

[16 HOURS]

Polymers: Fundamentals of polymers - monomers, repeat units, degree of polymerization. Linear, branched and network polymers. Classification of polymers, Polymerization - condensation, addition, free radical, ionic, co-ordination polymerization and ring opening polymerization. Molecular weight and size, polydispersion. Average molecular weight concepts – number, weight and viscosity average molecular weight. Determination of molecular weights - viscosity method, osmotic pressure method, sedimentation and light scattering methods.

Kinetics of Polymerization - Condensation, addition, free radical, ionic, co-ordination polymerization.

Phase transitions in polymers and thermal characterization: Glass transition, crystallinity and melting- correlation with the polymer structure.

Polymers in solution: Criteria of polymer solubility, thermodynamics of polymer solutions.

Colloids: Types and classification, Micelles: Surface active agents, micellization, hydrophobic interaction, critical micellar concentration (CMC), factors affecting the CMC of surfactants, micellar catalysis.

References

1. Text Book of Physical Chemistry by Samuel Glasstone, MacMillan Indian Ltd., 2nd edition (1974).
2. Quantum Chemistry – A.K. Chandra. 2nd edition, Tata McGraw Hill Publishing Co. Ltd., (1983).
3. Quantum Chemistry – Eyring, Walter and Kimball. John Wiley and Sons, Inc., New York.
4. Quantum Chemistry – I.N. Levine. Pearson Education, New Delhi, (2000).
5. Theoretical Chemistry – S. Glasstone. East West Press, New Delhi, (1973).
6. Quantum Chemistry – R.K. Prasad, New Age International Publishers, (1996).
7. Text Book of Polymer Science, F.W. Billmeyer, Jr., John Wiley, London (1994).
8. Polymer Science. V. R. Gowrikar, N.V. Vishwanathan and J. Sreedhar, Wiley Eastern, New Delhi (1990).
9. Fundamentals of Polymer Science and Engineering. A. Kumar and S.K. Gupta, Tata – McGraw Hill New Delhi (1978).
10. Polymer Characterization, D. Campbell and J.R. White, Chapman and Hall, New York.
11. Fundamental Principles of Polymer Materials, R.L. Rosen, John Wiley and Sons, New York.

MOLECULAR SYMMETRY AND SPECTROSCOPY
COURSE CODE: 21CHB13

Objectives

- To understand the concepts of symmetry and symmetry operations and their application to CFT, hybridization, MOT and vibrational spectroscopy.
- To learn the theory and applications of microwave, vibration and Raman spectroscopy.
- To understand the principles and applications of UV-Visible and resonance Raman spectroscopy.

Course outcome

- Molecular symmetry and applications of group theory to CFT, hybridization, MOT and vibrational spectroscopy.
- Theory and principles of Rotation, Vibration and Raman Spectroscopy.
- Theory and principles Electronic and Resonance Raman spectroscopy.

Pedagogy

- Conventional method such as black board and chalk is used.
- Molecular models are used to teach symmetry aspects of molecules
- Modern methods like power point presentation and animations are used in class room teaching.
- Students will be assigned to solve the numerical problems.

Course content

UNIT-I

[16 HOURS]

Molecular symmetry and group theory: Symmetry elements and symmetry operations.

The Point Groups Used with Molecules: Concept of a group, definition of a point group. Classification of molecules into point groups. Subgroups.

Hermann-Maugin symbols for point groups. Multiplication tables (C_{2V}, C_{2h} and C_{3V}). Matrix notation for the symmetry elements. Classess and similarity transformation.

Representation of groups: The Great Orthogonality theorem and its consequences.

Character tables (C_s, C_i, C_2, C_{2v}, C_{2h} and C_{3v}). Symmetry and dipole moment.

Applications of group theory: Group theory and hybrid orbitals.

Symmetry in Chemical bonding: Group theory to Crystal field theory and Molecular orbital theory (octahedral and tetrahedral complexes).

Symmetry in Vibrational Spectroscopy: Determining the symmetry groups of normal modes for non-linear molecules (H_2O, NH_3, CH_4, trans-N_2F_2) and linear molecules (CO, HCl, HCN and CO_2) (Integration method).

UNIT-II

[16 HOURS]

Microwave spectroscopy: Rotation spectra of diatomic Molecules - rigid and non rigid rotator model. Rotational quantum number and the selection rule. Effect of isotopic substitution on rotation spectra. Classification of polyatomic molecules based on moment of inertia. Rotation spectra of polyatomic molecules (OCS CH_3F and BCl_3). Moment of inertia expression for linear tri-atomic molecules. Applications - Principles of determination of Bond length and moment of inertia from rotational spectra. Stark effect in rotation spectra and determination of dipole

moments.

Vibration spectroscopy*:* Vibration of diatomic molecules, vibrational energy curves for simple harmonic oscillator. Effects of anharmonic oscillation, expressions for fundamental and overtone frequencies. Vibration - rotation spectra of carbon monoxide. Vibration of polyatomic molecules – The number of degrees of freedom of vibration. Parallel and perpendicular vibrations (CO_2 and H_2O). Combination, difference and hot bands. Fermi resonance. Force constant and its significance. Theory of infrared absorption and theoretical group frequency. Intensity of absorption band and types of absorptions. Applications: Structures of small molecules: XY_2 – linear or bent, XY_3 – planar or pyramidal.

Raman spectroscopy: Introduction, Raman and Rayleigh scattering, Stokes and anti-Stokes lines, polarization of Raman lines, depolarization factor, polarizability ellipsoid. Theories of Raman spectra - classical and quantum theory. Rotation-Raman and vibration-Raman spectra. Raman activity of vibrations, rule of mutual exclusion principle. Vibration modes of some simple molecules and their activity.

UNIT-III

[16 HOURS]

UV Visible spectroscopy: Quantitative aspects of absorption – Beer's law, Technology associated with absorption measurements. Limitations – real, chemical, instrumental and personal. Theory of molecular absorption. Vibration-rotation fine structure of electronic spectra. Types of absorption bands: n to π^*, π to π^*, n to σ^* and σ to σ^*, C-T and ligand field. Instrumentation.

Applications: Qualitative and quantitative analysis of binary mixtures, measurements of dissociation constants of acids and bases, determination of molecular weight. Woodwards empirical rules for predicting the wavelength of maximum absorption for olefins, conjugated dienes, cyclic trienes and polyenes, α,ß-unsaturated aldehydes and ketones, benzene and substituted benzene rings.

Resonance Raman Spectroscopy: Resonance Raman Effect and its applications. Non-linear Raman effects: Hyper, stimulated and inverse Raman effects. Coherent Anti-Stokes Raman Scattering and its applications.

References

1. Chemical Applications of Group Theory, 3rd edition, F.A. Cotton, John Wiley and
2. Sons (2006).
3. Molecular Symmetry and Group Theory – Robert L Carter, John Wiley and Sons (2005).
4. Symmetry in Chemistry - H. Jaffe and M. Orchin, John Wiley, New York (1965).
5. Molecular Symmetry – David J. Willock, John Wiley and Sons Ltd., (2009).
6. Group Theoryand its Chemical Applications - P.K. Bhattacharya, Himalaya Publications, New Delhi (1998).
7. Fundamentals of Molecular Spectroscopy, C.N. Banwell and E.M. McCash. 4th edition, Tata McGraw Hill, New Delhi.
8. Fundamentals of molecular spectroscopy, G. M. Barrow, MgGraw Hill, New York (International students Edition), 1974.
9. Theoretical chemistry, S. Glasstone, affiliated East-West Press Pvt. Ltd, New Delhi,

1973.
10. Spectroscopy, B.P. Straughan and S. Walker, John Wiley & Sons Inc., New York, Vol. 1 and 2, 1976.
11. Vibration Spectroscopy Theory and Applications, D.N. Satyanarayana, New Age International, New Delhi (2004).
12. Spectroscopy, B.P. Straughan and S. Salker, John Wiley and Sons Inc., New York, Vol.2, 1976.
13. Organic Spectroscopy, William Kemp, English Language Book society, Macmillan, 1987.
14. Instrumental methods of analysis, H. H. Willard, L. L. Merritt and J. A. Dean, 7th Edition, 1988.
15. Physical methods in inorganic chemistry, R. S. Drago, affiliated East-West press Pvt. Ltd., (Student Edition) 1978.

SOFT CORE
ANALYTICAL CHEMISTRY PRACTICALS

COURSE CODE: 21CHB50 **[128 HOURS]**

Safety measures in the laboratory; MSDS; reporting of values.

Course Objective

- To understand basic concepts by carrying out analytical experiments.
- The experimental results are subjected to validation of analytical parameters

Course Outcomes

- After studying this course the student to:
- Analyze various samples with different classical and simple instrumental skills.
- Obtain knowledge for selection of analytical methods with suitable technique being adopted for the analysis different samples like, water, laboratory chemicals and reagents, body fluids such as urine etc.
- Distinguish classical and instrumental methods.
- Propose and conduct experiment for quantification of individual analytes

Pedagogy

- Computer aided applications for the evaluation of experimental results.
- Each student performs experiments as per the protocol in practical classes.

PART – I

1. Determination of total acidity of vinegar and wines by acid-base titration.
2. Determination of purity of a commercial boric acid sample, and Na_2CO_3 content of washing soda.
3. Determination of relative equivalent weight of a weak organic acid by titration with NaOH.
4. Determination of ephedrine and aspirin in their tablet preparations by residual acid-base titrimetry.
5. Determination of carbonate and bicarbonate in a mixture by *p*H-metric titration and comparison with visual acid-base titration.

6. Determination of carbonate and hydroxide-analysis of a commercial washing soda by visual and *p*H-titrimetry.
7. Determination of purity of a commercial sample of mercuric oxide by acid-base titration.
8. Determination of benzoic acid in food products by titration with methanolic KOH in chloroform medium using thymol blue as indicator.
9. Determination of the *p*H of hair shampoos and *p*H determination of an unknown soda ash.
10. Analysis of water/ waste water for acidity by visual, *p*H metric and conductometric titrations.
11. Analysis of water/ waste water for alkalinity by visual, *p*H metric and conductometric titrations.
12. Determination of ammonia in house-hold cleaners by visual and conductometric titration.
13. Determination of chromate and dichromate in mixture by acid-base titration: visual and pH metric methods.
14. Potentiometric determination of the equivalent weight and Ka for a pure unknown weak acid.
15. Determination of purity of aniline by non-aqueous acid-base titration by visual and potentiometric methods.
16. Determination of purity of ethylene glycol and glycerol by oxidimetric method using periodate (Malprade reaction).
17. Spectrophotometric determination of creatinine and phosphorus in urine.
18. Flame emission spectrometric determination of sodium, potassium and calcium in river/ lake water.

PART – II

1. Determination of percentage of chloride in a sample by precipitation titration- Mohr, Volhard and Fajan's methods.
2. Determination of silver in an alloy and Na_2CO_3 in soda ash by Volhard method.
3. Mercurimetric determination of chloride in blood or urine.
4. Determination of total hardness, calcium and magnesium hardness and carbonate and bicarbonate hardness of water by complexation titration using EDTA.
5. Determination of calcium in calcium gluconate/ calcium carbonate tablets/ injections and of calcium in milk powder by EDTA titration.
6. Determination of zinc in a sample of foot powder and thallium in a sample of rodenticide by EDTA titration.
7. Analysis of commercial hypochlorite and peroxide solution by iodometric titration.
8. Determination of copper in an ore/ an alloy by iodometry and tin in stibnite by iodimetry.
9. Determination of ascorbic acid in vitamin C tablets by titrations with $KBrO_3$ and of vitamin C in citrus fruit juice by iodimetric titration.
10. Determination of iron in razor blade by visual and potentiometric titration using sodium metavanadate.
11. Determination of iron in pharmaceuticals by visual and potentiometric titration using cerium(IV) sulphate.

12. Determination of nickel in steel by synergic extraction and boron in river water/ sewage using ferroin.
13. Determination of total cation concentration of tap water by ion-exchange chromatography.
14. Determination of magnesium in milk of magnesium tablets by ion-exchange chromatography.
15. Cation exchange chromatographic separation of cadmium and zinc and their estimation by EDTA titration.
16. Gas chromatographic determination of ethanol in beverages.
17. Solvent extraction of zinc and its spectrophotometric determination.
18. Anion exchange chromatographic separation of zinc and magnesium followed by EDTA titration of the metals.
19. Separation and determination of chloride and bromide on an anion exchanger.
20. Separation of *o*- and *p*-nitroaniline and analysis by thin layer chromatography.

References

1. Fundamental of Analytical Chemistry, D.A. Skoog, D.M. West, Holler and Crouch 8th edition, 2005, Saunders College Publishing, New York.
2. Analytical Chemistry, G.D. Christian, 5th edition, 2001 John Wiley & Sons, Inc, India.
3. Quantitative Analysis, R.A. Day and A.L. Underwood, 6th edition, 1993, Prentice Hall, Inc. New Delhi.
4. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, 6th edition, Third Indian Reprint, 2003, Pearson Education Pvt. Ltd., New Delhi.
5. Analytical Chemistry Principles, John H. Kennedy, 2nd edition, Saunders College Publishing, California, 1990.
6. Practical Clinical biochemistry methods and interpretations, R. Chawla, J.P. Bothers Medical Publishers (P) Ltd., 1995.
7. Laboratory manual in biochemistry, J. Jayaraman, New Age International Publishers, New Delhi, 1981.
8. Practical Clinical Biochemistry by Harold Varley and Arnold.Heinmann, 4th edition.

INORGANIC CHEMISTRY PRACTICALS

COURSE CODE: 21CHB51 [128 HOURS]

Objectives

- To understand basic concepts by carrying out different experiments.
- To develop the skill for the qualitative and quantitative analysis of various samples.

Course Outcome

- Determination of various analytes presents in different ore samples by volumetric, gravimetric and spectrophotometric methods.
- The chemistry of redox, complexometric and indirect methods
- The principle in the semi-micro analysis of an inorganic salt mixture

Pedagogy

- Each student performs experiments as per the protocol in practical classes.
- Handling the instrument and pyrolysis for quantitative determination of analyte.

Course experiments

PART – A

1. Determination of iron in haematite using cerium (IV) solution (0.02M) as the titrant, and gravimetric estimation of insoluble residue.
2. Estimation of calcium and magnesium carbonates in dolomite using EDTA titration, and gravimetric analysis of insoluble residue.
3. Determination of manganese dioxide in pyrolusite using permanganate titration.
4. Quantitative analysis of copper-nickel in alloy/mixture:
    a. Copper volumetrically using KIO_3.
    b. Nickel gravimetrically using DMG
5. Determination of lead and tin in a mixture: Analysis of solder using EDTA titration.
6. Quantitative analysis of chloride and iodide in a mixture:
    a. Iodide volumetrically using KIO_3
    b. Total halide gravimetrically
7. Gravimetric analysis of molybdenum with 8-hydroxyquinoline.
8. Quantitative analysis of copper(II) and iron(II) in a mixture:
    a. Copper gravimetrically as CuSCN and
    b. Iron volumetrically using cerium(IV) solution
9. Spectrophotometric determinations of:
    e. Titanium using hydrogen peroxide
    f. Chromium using diphenyl carbazide in industrial effluents
    g. Iron using thiocyanate/1,10-phenanthroline method in commercial samples
    h. Nickel using dimethylglyoxime in steel solution
10. Micro-titrimetric estimation of :
    c) Iron using cerium(IV)
    d) Calcium and magnesium using EDTA
11. Quantitative estimation of copper (II), calcium (II) and chloride in a mixture.
12. Circular paper chromatographic separation of: (Demonstration)
    c. Iron and nickel
    d. Copper and nickel

PART – B

Semimicro qualitative analysis of inorganic mixtures containing **TWO** anions and **TWO** cations (excluding sodium, potassium and ammonium cations) and **ONE** of the following less common cations: W, Mo, Ce, Ti, Zr, V and Li.

References

1. Vogel's Text Book of Quantitative Chemical Analysis – 5th edition, J. Basset, R.C. Denney, G.H. Jeffery and J. Mendhom.
2. A Text Book of Quantitative Inorganic Analysis by A.I. Vogel, 3rd edition.
3. Spectrophotometric Determination of Elements by Z. Marczenko.
4. Vogel's Qualitative Inorganic Analysis – Svelha.
5. Macro and SemimicroInorganicQualitative Analysis by A.I. Vogel.
6. Semimicro Qualitative Analysis by F.J. Welcher and R.B. Halin.
7. Quantitative Chemical Analysis by Daniel C. Harris, 7th edition, (2006).

ORGANIC CHEMISTRY PRACTICALS

COURSE CODE: 21CHB52 [128 HOURS]

Objectives

- To understand synthetic methods by carrying out different experiments.
- To develop the skill for the separation and qualitative analysis of binary mixtures of organic compounds.

Course Outcome

- Students are involved in the multi-step synthesis of different organic compounds.
- Understand the qualitative analysis of binary mixture of organic compounds through separation, identification of functional groups and preparation of solid derivatives.

Pedagogy

- Each student performs experiments as per the protocol in practical classes.
- Experimental setup for the synthesis of organic compounds by every individual.

Course experiments

PART-A

Safety measures in the laboratory; MSDS; reporting of values and demonstration of KingDraw/ ChemDraw

Multistep synthesis

1. Preparation *p*-bromoaniline from acetanilide**.**
2. Preparation of *n*-butyl bromide from *n*-butyl alcohol.
3. Oxidation of cyclohexanol to adipic acid.
4. Esterification: Preparation of benzoccaine from *p*-nitrotoluene.
5. Diazotization (Sandmeyer‘s reaction): Preparation of *p*-chlorobenzoic acid from *p*-toluidine.
6. Preparation benzilic acid from benzoin**.**
7. Preparation of *o*-hydroxy benzophenone from phenyl benzoate *via* Fries rearrangement.
8. Preparation of benzanilide from benzophenone oxime *via* Beckmann rearrangement.
9. Preparation of benzoic acid from benzaldehyde (Cannizzaro Reaction).
10. Preparation of 2,4-dinitrophenylhydrazine from 2,4-dinitrochlorobenzene.
11. Preparation of *m*-nitrobenzoic acid from methylbenzoate.
12. Preparation of chalcone.

PART-B

Qualitative analysis: Separation of binary mixtures, identification of functional groups and preparation of suitable solid derivatives.

References

1. Vogel' text book of practical organic chemistry, V edition, B. S. Furniss, A. J. Hannaford, P. W. G. Smith, A. R. Tatehell.
2. Elementary practical organic chemistry, Part-I: Small scale preparations, Part-II: Qualitative organic analysis, By Arthur I, Vogel.
3. Hand book of organic analysis, H. T. Clarke and Norman Collie.
4. Experiments in Organic Chemistry, Louis F. Fieser.
5. Laboratory manual of Organic Chemistry by B. B. Dey and M. V. Sitaraman.
6. Practical Organic Chemistry by Mann F. G. and Saunders.

PHYSICAL CHEMISTRY PRACTICALS
COURSE CODE: 21CHB53 [128 HOURS]

Objectives

- To understand the rate of chemical reactions and factors influencing the reaction rate by carrying out kinetic experiments.
- To understand basic concepts of electrochemistry by carrying out experiments.

Course Outcome

- After the completion of this course, the students can able to develop the experimental skill and theoretical interpretation of experimental results of many physical chemistry experiments of chemical kinetics in solution phase, thermodynamics, electrochemistry and spectrophotometry.
- This helps in academics, research and industries.

Pedagogy

- Each student performs experiments as per the protocol in practical classes.
- To optimize the reaction conditions for understanding the rate of chemical reactions.

Course experiments

PART - A

1. Study of kinetics of hydrolysis of methyl acetate in presence of two different concentrations of HCl/H_2SO_4 and report the relative catalytic strength.
2. Study of kinetics of reaction between $K_2S_2O_8$ and KI, first order, determination of rate constants at two different temperatures and E_a.
3. To study the kinetics of saponification of ethyl acetate by conductivity method at two different concentrations of NaOH and report the relative catalytic strength.
4. Determination of partial molar volume of salt-water system ($NaCl-H_2O/KCl-H_2O/KNO_3-H_2O$) systems.
5. To study the kinetics of reaction between acetone and iodine - determination of order of reaction with respect to iodine and acetone.
6. Study the kinetics of decomposition of diacetone alcohol by NaOH, determine the catalytic coefficient of the reaction and comparison of strength of alkali.
7. Determination of energy of activation for the bromide-bromate reaction.
8. Kinetics of reaction between sodium formate and iodine and determination of energy of activation.
9. Determination of heat of solution of organic acid (benzoic acid/salicylic acid) by variable temperature method (graphical method).
10. Determination of degree of association of benzoic acid in benzene by distribution method.
11. To determine the eutectic point of a two component system (Naphthalene-*m*-dinitrobenzene system).
12. Analysis of a binary mixture (Gylcerol & Water) by measurement of refractive index.
13. Determination of the molecular weight of a polymer material by viscosity measurements (cellulose acetate/methyl acrylate).

PART – B

1. Conductometric titration of a mixture of HCl and CH_3COOH against NaOH.
2. Conductometric titration of sodium sulphate against barium chloride.
3. pH titration of (a) HCl against NaOH (b) Copper sulphate against NaOH and (c) $CH_3COOH/HCOOH$ against NaOH - determination of K_a.
4. Determination of equivalent conductance of weak electrolyte (CH_3COOH) at infinite

dilution following Kohlrausch law.

5. Determination of dissociation constant and mean ionic activity coefficient of weak acids (CH_3COOH/HCOOH/$ClCH_2COOH$) by conductivity method.
6. Potentiometric titration of KI *vs* $KMnO_4$ solution.
7. Determination of dissociation constant of a weak acid (CH_3COOH/HCOOH/$ClCH_2COOH$) by potentiometric method.
8. Potentiometric titration of a mixture of halides (KCl+KI/KCl+KBr/KBr+KI) against $AgNO_3$.
9. To obtain the absorption spectra of coloured complexes, verification of Beer's law and estimation of metal ions in solution using a spectrophotometer.
10. Potentiometric titration of $K_2Cr_2O_7$ against FAS determination of redox potential and concentration of Fe^{2+} ions.
11. Conductometric titration of oxalic acid against NaOH and NH_4OH.
12. Coulometric titration I_2 vs $Na_2S_2O_3$.
13. Determination of acidic and basic dissociation constant and isoelectric point of an amino acid by pH metric method.
14. Kinetics of photodegradation of indigocarmine (IC) using ZnO/TiO_2 as photocatalyst and study the effect of [ZnO/TiO_2] and [IC] on the rate of photodegradation.

References

1. Practical Physical Chemistry – A.J. Findlay.
2. Experimental Physical Chemistry – F. Daniels *et al*.
3. Selected Experiments in Physical Chemistry – Latham.
4. Experiments in Physical Chemistry – James and Prichard.
5. Experiments in Physical Chemistry – Shoemaker.
6. Advanced Physico-Chemical Experiments – J. Rose.
7. Practical Physical Chemistry – S.R. Palit.
8. Experiments in Physical Chemistry – Yadav, Geol Publishing House.
9. Experiments in Physical Chemistry – Palmer.
10. Experiments in Chemistry – D.V. Jahagirdar, Himalaya Publishing House, Bombay, (1994).
11. Experimental Physical Chemistry – R.C. Das and B. Behera, Tata Mc Graw Hill.

SOFT CORE PAPERS

TITRIMETRIC ANALYSIS

COURSE CODE: 21CHB54

Objective

- To familiarize statistical methods to validate analytical methods.
- To learn sampling techniques and conventional volumetric methods.

Course Outcome

After studying this course the student able to:

- Understand on quantitative and qualitative methods of analysis with relevant equilibrium chemistry.
- Develop the ideas with the fundamental aspects in analytical chemistry.
- Build the interest in students in developing good experimental protocols, and in interpreting

experimental results.

- Gain analytical knowledge for the quantitative analysis of various samples of different origin under titrimetric aspects.
- Learn statistical aspects from which the spirit of assessing the results will be enhanced.
- Learn method development and validation features so that they will become outstanding basement for their career in various industries.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.

Unit-I

Titrimetric analysis: An overview of titrimetry. Principles of titrimetric analysis. Titration curves. Titrations based on acid-base reactions-titration curves for strong acid and strong base, weak acid and strong base and weak base and strong acid titrations. Selecting and evaluating the end point. Finding the end point by visual indicators, monitoring *p*H and temperature. Quantitative applications – selecting and standardizing a titrant, inorganic analysis-alkalinity, acidity and free CO_2 in water and waste waters, nitrogen, sulphur ammonium salts, nitrates and nitrites, carbonates and bicarbonates. Organic analysis-functional groups like carboxylic acid, sulphonic acid, amine, ester, hydroxyl, carbonyl. Air pollutants like SO_2. Quantitative calculations. Characterization applications-equivalent weights and equilibrium constants.

Acid-base titrations in non-aqueous media: Role of solvent in acid-base titrations, solvent systems, differentiating ability of a solvent, some selected solvents, titrants and standards, titration curves, effect of water, determining the equivalence point, typical applications-determination of carboxylic acids, phenols and amines.

Precipitation titrations: Titration curves, feasibility of precipitation titrations, factors affecting shape - titrant and analyte concentration, completeness of the reaction, titrants and standards, indicators for precipitation titrations involving silver nitrate, the Volhard, the Mohr and the Fajan's methods, typical applications.

[16 HOURS]

UNIT – II

Complexometric titrations: Complex formation reactions, stability of complexes, stepwise formation constants, chelating agents, EDTA - acidic properties, complexes with metal ions, equilibrium calculations involving EDTA, conditional formation constants, derivation of EDTA titration curves, effect of other complexing agents, factors affecting the shape of titration curves - completeness of reaction, indicators for EDTA titrations - theory of common indicators, titration methods employing EDTA - direct, back and displacement titrations, indirect determinations, titration of mixtures.

Redox titrations: Balancing redox equations, calculation of the equilibrium constant of redox reactions, calculating titration curves, detection of end point, visual indicators and potentiometric end point detection. Quantitative applications - adjusting the analyte's oxidation state, selecting and

standardizing a titrant. Inorganic analysis - chlorine residuals, dissolved oxygen in water, water in non-aqueous solvents. Organic analysis - chemical oxygen demand (COD) in natural and waste waters, titrations of mercaptans and ascorbic acid with I_3^- and titration of organic compounds using periodate.

Automatic titrators: Principles and theory of CO_2, sulphate, chloride and Karl Fisher titrators.

[16 HOURS]

References

1. Fundamental of Analytical Chemistry, D.A. Skoog, D.M. West, Holler and Crouch, 8th edition, 2005, Saunders College Publishing, New York.
2. Analytical Chemistry, G.D. Christian, 5th edition, 2001, John Wiley & Sons, Inc, India.
3. Quantitative Analysis, R.A. Day and A.L. Underwood, 6th edition,1993,Prentice Hall, Inc. New Delhi.
4. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, 6th edition, Third Indian Reprint, 2003, Pearson Education Pvt. Ltd., New Delhi.
5. Analytical Chemistry Principles, John H. Kennedy, 2nd edition, Saunders CollegePublishing, California, 1990.
6. Principles and Practice of Analytical Chemistry, F.W. Fifield and Kealey, 3rd edition, 2000, Blackwell Sci., Ltd. Malden, USA.
7. Modern Analytical Chemistry, David Harvey, McGraw Hill, New Delhi, 2000.

CHEMISTRY OF SELECTED ELEMENTS
COURSE CODE: 21CHB55

Objectives

- To learn basic chemistry of some selected group elements from periodic table.
- To understand properties of metal-metal bonding and cluster compounds.

Course outcome

- Understand the chemistry of hydrogen and group 2 elements.
- The chemistry of pseudohalogens, interhalogens and their halogen compounds.
- The chemistry of xenon and other noble gas compounds.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.Course content

UNIT-I

Compounds of hydrogen: The hydrogen and hydride ions, Dihydrogen and hydrogen bonding. Classes of binary hydrides: Molecular hydrides, saline hydrides and metallic hydrides.

The Group 1 elements: Occurrence, extraction and uses. Simple compounds: Hydrides, halides, oxides, hydroxides, oxoacids, nitrides, solubility and hydration and solutions in liquid ammonia. Coordination and organometallic compounds. Applications.

The Group 2 elements: Occurrence, extraction and uses. General properties. Halides, hydrides

and salts of oxo acids. Complex ion in aqueous solution and complexes with amido and alkoxy ligands.

The Group 15 elements: Introduction, oxides and oxoacids of nitrogen and phosphorus.

[16 HOURS]

UNIT-II

The Group 17 elements: Occurrence, recovery and uses. Trends in properties and pseudohalogens. **Interhalogens**: Physical properties and structures, chemical properties, cationic interhalogens. **Compounds with oxygen**: Halogen oxides, oxoacids and oxoanions**.** Trends in rates of redox reactions and redox properties of individual oxidation states**.**

Chemistry of astatine.

The Group 18 elements: Occurrence, recovery and uses. Synthesis and structure of xenon fluorides, Reaction of xenon fluorides, xenon-oxygen compounds, Organoxenon compounds, other compounds of noble gases.

M-M bonds: Multiple metal-metal bonds.

Cluster compounds: carbonyl and carbide clusters.

References

1. Basic Inorganic Chemistry – 3rd edition. F.A. Cotton, G. Wilkinson and P.L. Gaus, John
2. Wiley and Sons (2002).
3. Inorganic Chemistry, 3rd edition. James E. Huheey, Harper and Row Publishers (1983).
4. Inorganic Chemistry, 3rd edition. G.L. Miessler and D.A. Tarr, Pearson Education (2004).
5. Inorganic Chemistry, 4th edition. C.E. Housecroft and A.G. Sharpe, Pearson Education Ltd. (2012).
6. Chemistry of the Elements – N.N. Greenwood and A. Earnshaw, Pergamon Press (1985).
7. Inorganic Chemistry, 6th edition. D.F. Shriver, M. Weller. T. Overton, J. Rourke and F.

CHEMISTRY OF NATURAL PRODUCTS-I
COURSE CODE: 21CHB56

Objectives

- To learn the nomenclature, classification, purification, structure and synthesis of some natural products.
- To understand the biological functions of biomolecules.

Course Outcome

- Acquire the knowledge of chemistry of lipids, prostaglandins and terpenoids.
- Understand the biological importance of chlorophyll and porphyrins.
- Chemistry of flavonoids and isoflavonoids.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern method like power point presentation is used in class room teaching.

Course content

UNIT-I

[16 HOURS]

Lipids: Nomenclature, classification, purification, structure and synthesis of fatty acids, phospholipids, sphingolipids. Biological importance of lipids (Lecithin, sphingolipids, oils and fats).

Prostaglandins: Introduction, classification and biological importance of PG's. Constitution of PGE1. Synthesis of PGE & F series.

Terpenoids: Introduction, classification and general methods of structural elucidation. Chemistry of pinene, camphor, caryophyllene, santonin. Biosynthesis of terpenoids.

UNIT-II

[16 HOURS]

Porphyrins: Introduction, structure and biological functions of haemin. Vitamin B12: structure and as coenzyme in molecular rearrangement reactions; Chlorophyll: structure and biological importance.

Flavonoids and Isoflavonoids: Occurrence, nomenclature and general methods of structure determination. Isolation and synthesis of Apigenin, Luteolin, Kaempferol, Quercetin, wedelolactone, Butein, Daidzein. Biosynthesis of flavonoids and isoflavonoids: Acetate Pathway and Shikimic acid Pathway. Biological importance of flavonoids and isoflavonoids

References

1. Organic Chemistry, VI edition, Robert T. Morrison, Robert N. Boyd.
2. Organic Chemistry, Vol-II by I. L. Finar.
3. Schaum's outline of theory and problems of Organic Chemistry, Harbert Meislich, Howard Nechamkin and Jocob Sharefkin.
4. Natural products: Their chemistry and biological significance, J. Mann, R. S. Davidson, J. B. Banthorpe and J. B. Harborne.
5. Synthetic drugs, Gurdeep R. Chatwal.
6. Heterocyclic chemistry by Achison.
7. Heterocyclic chemistry by Smith and Joule.
8. Heterocyclic chemistry by Pacquete.

BIOPHYSICAL CHEMISTRY

COURSE CODE: 21CHB57

Objectives

- To understand the physico-chemical principles of biological fluids.
- To learn the pharmacokinetics, pharmacodynamics, toxicokinetics of biological systems.

Course Outcome

- After the completion of this course, the students gain the knowledge on theory and principles of biophysical chemistry and pharmacokinetics.
- This course helps to understanding the bio-availability and different pharmacokinetic parameters of drugs in the living system.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.

Course content

UNIT-I

[16 HOURS]

Biophysical Chemistry: Electrophoresis - Principles of free electrophoresis, zone electrophoresis, gel electrophoresis and its applications in qualitative and quantitative study of proteins. Determination of isoelectric point of a protein. Electro-osmosis and streaming potential and its biological significance. Biological significance of Donnan membrane phenomenon. Micelles and its involvement during digestion and absorption of dietary lipids. Diffusion of solutes across bio-membranes and its application in the mechanism of respiratory exchange. –Salting In‖ and –Salting Out‖ of proteins. Osmotic behaviour of cells and osmo-regulation and its application in the evolution of excretory systems of organisms. Effect of temperature and *p*H on the viscosity of bio-molecules (albumin solution). Significance of viscosity in biological systems - mechanism of muscle contraction, polymerization of DNA and nature of blood flow through different vessels. Effect of temperature, solute concentration (amino acids) on surface tension. Biological significance of surface tension - stability of Alveoli in lungs, interfacial tension in living cells (Danielli and Davson model). Application of sedimentation velocity and sedimentation equilibrium method for molecular weight determination of proteins.

UNIT-II

[16 HOURS]

Pharmacokinetics: Introduction, biopharmaceutics, pharmacokinetics, clinical pharmacokinetics, pharmacodynamics, toxicokinetics and clinical toxicology. Measurement of drug concentration in blood, plasma or serum. Plasma level-time curve, significance of measuring plasma drug concentrations.

One compartment open model: Intravenous route of administration of drug, elimination rate constant, apparent volume of distribution and significance. Calculation of elimination rate constant from urinary excretion data, clinical application.

Two compartment model: Plasma level-time curve, relationship between tissue and plasma drug concentrations, Apparent volumes of distribution. Drug clearance, clinical example. Plasma level-time curve for a three compartment open model.

Drug absorption: Factors affecting the rate of drug absorption - nature of the cell membrane, Route of drug administration - Oral drug absorption, Intravenous infusion and intravenous solutions, Effect of food on gastrointestinal drug absorption rate.

References

1. Introduction to Physical Organic Chemistry, R.D. Gilliom, Madison – Wesley, USA (1970).
2. Physical Organic Chemistry- Reaction Rate and Equilibrium Mechanism – L.P. Hammett, McGraw HillBook, Co., (1970).
3. Biophysical Chemistry- Principle and Technique – A. Upadhyay, K. Upadhyay and N. Nath, Himalaya Publishing House, Bombay, (1998).
4. Essentials of Physical Chemistry and Pharmacy – H. J. Arnikar, S. S. Kadam, K.N. Gujan, Orient Longman, Bombay, (1992).
5. Applied Biopharmacokinetics and Pharmacokinetics - Leon Shargel, Andrew YuPrentice-Hall International, Inc (4^{th} edition).
6. Essentials of Physical Chemistry and Pharmacy – H.J. Arnikar, S.S. Kadam, K.N. Gujan, Orient Longman, Bombay, (1992).

THIRD SEMESTER

ADVANCED INORGANIC CHEMISTRY
COURSE CODE: 21CHC10

Objectives

- To understand the fundamental concepts of organometallic chemistry and general principles of homogeneous and heterogeneous catalysis.
- To learn the concepts of metal clusters, silicates and silicones.

Course Outcome

- Fundamental concepts of organometallic chemistry and synthesis, structure and bonding in different organometallics and their applications.
- Homogeneous and heterogeneous catalysts and their applications in the synthesis of organic compounds in industries.
- Chemistry of main group elements, metal clusters, silicates and silicones and their applications in day to day life.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.

Course content

UNIT-I

[16 HOURS]

Fundamental concepts: Introduction, Classification of organometallic compounds by bond type, nomenclature, the effective atomic number rule, complexes that disobey the EAN rule, common reactions used in complex formation.

Organometallics of transition metals: Preparation, bonding and structures of nickel, cobalt, iron and manganese carbonyls. Preparation and structures of metal nitrosyls.

Ferrocene: Preparation, structure and bonding**. Metal-carbene and metal-carbyne complexes**. **Complexes containing alkene, alkyne, arene and allyl ligands**: Preparation, structure and bonding.

UNIT-II

[16 HOURS]

General principles of Catalysis: Language of catalysis. Homogeneous and heterogeneous catalysts.

Homogeneous catalysis - Industrial Applications: Alkene hydrogenation and hydroformylation, The Wacker‘s process, Monsanto acetic acid process and L-DOPA synthesis, alkene oligomerizations, water-gas shift reactions. The Reppe reaction.

Heterogeneous catalysis –The nature of heterogeneous catalysts. Alkene polymerization: Ziegler-Natta catalysis, Fischer-Tropsch carbon chain growth. New directions in heterogeneous catalysis.

Zeolites as catalysts for organic transformation: Uses of ZSM – 5.

Alkene metathesis, hydroboration, arylation or vinylation of olefins (Heck reaction).

Biological and Medicinal Applications: Organomercury, organoboron, organosilicon and organoarsenic compounds.

UNIT-III

[16 HOURS]

Chemistry of main group elements: Diborane and its reactions, polyhedral boranes(preparation, properties, structure and bonding). Wade‘s rules, carboranes andmetallocarboranes. Borazines. Phosphazenes, S-N compounds.

Metal clusters: Evidences and factors favoring of M-M bonding, Wade‘s-Mingo‘s-Lauherrules, bi, tri, tetra, penta and hexa nuclear metal carbonyl clusters.

Low and high nuclearity carbonyl clusters. Electron counting schemes in carbonyl clusters. The isolobal analogy.

Silicates: Structure, classification - silicates with discrete anions, silicates containing chain anion, silicates with layer structure, silicones with three dimensional net-work and applications.

Silicones: General methods of preparation, properties. Silicone polymers - silicone fluids, silicone greases, silicone resins, silicone rubbers and their applications.

References

1. Organometallic Chemistry, 2nd edition, R.C. Mehrothra and A. Singh, New Age International Publications (2006).
2. Fundamental Transition Metal Organometallic Chemistry - Charles M. Lukehart, Brooks, Cole Publishing Company (1985).
3. The Organometallic Chemistry of the Transition Metals, 4th edition, Robert H. Crabtree, Wiley Interscience, (2005).
4. Organometallics - A Concise Introdution, 2nd edition, ChistophElschenbroich and Albert Salzer VCH, (1992).
5. Inorganic Chemistry, 2nd edition, C.E. Housecroft and A.G. Sharpe, Pearson Education Ltd., (2005).
6. Inorganic Chemistry- 3rd edition, G.L. Miessler and D.A. Tarr, Pearson Education,(2004).
7. Basic Organometallic Chemistry - B.D. Gupta and A.J. Elias, Universities Press (2010).
8. Inorganic Chemistry Principles of Structure and Reactivity: James E. Huheey, Ellen A.
9. Keiter, Richard L. Keiter, Okhil K. Medhi, Delhi University, New Delhi (2006)
10. Chemistry of the Elements – N.N. Greenwood and A. Earnshaw, Pergamon Press (1985).
11. Inorganic Chemistry, 6th edition. D.F. Shriver, M. Weller. T. Overton, J. Rourke and F. Armastrong, Oxford University Press (2014).
12. Organometallic Chemistry and Catalysis, Didier Astruc, Springer (2007).
13. Transition Metal Organometallic Chemistry, Francois Mathey, Springer (2013).

ORGANOMETALLIC AND PHOTOCHEMISTRY
COURSE CODE: 21CHC11

Objectives

- To understand the fundamental concepts of photochemistry and pericyclic reactions.
- To learn the synthesis and reactions of organometallic compounds.
- To learn the asymmetric synthesis of organic compounds.

Course Outcome

- Basic concepts of photochemistry and pericyclic reactions and their usefulness in the synthesis of many organic compounds.
- Synthesis of organic compounds using different organometallic compounds as catalysts.
- Asymmetric synthesis of organic compounds using chiral compounds.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation is used in class room teaching.

Course content

UNIT-I

[16 HOURS]

Photochemistry: Light absorption and electronic transitions, Jablonski diagram, intersystem crossing, energy transfer, sensitizers, quenchers. Photochemistry of olefins, conjugated dienes, aromatic compounds, ketones-Norrish type-I and Norrish type-II reactions, enones, Paterno-Buchi reaction, di-pi methane rearrangement, photooxidation, photoreduction.

Pericyclic reactions: Electrocyclic reactions: Stereochemistry, symmetry and Woodward-Hofmann rules for electrocyclic reactions, FMO theory of electrocyclic reactions, correlation diagram for butadiene to cyclobutene and hexatriene to cyclohexadiene systems. Cycloaddition reactions: Classification, analysis by FMO and correlation diagram method. Cycloaddition reactions: [2+2] and [4+2] cycloadditions-FMO and correlation diagram method, Deil's-Alder reaction, hetero Diels-Alder reaction and their applications. Intra and intermolecular 1,3-dipolar cycloadditions: involving nitrile oxide, nitrile imine, nitrile ylide and their application in organic synthesis. Sigmatropic reactions: Classification, stereochemistry and mechanisms. suprafacial and antarafacial shifts of H and carbon moieties. [3,3] and [5,5]-sigmatropic rearrangement, Claisen, Cope and aza-Cope rearrangement.

UNIT-II

[16 HOURS]

Chemistry of organometallic compounds: Synthesis and reactions of organolithium (n-BuLi, PhLi), organocadmium, organomagnesium (Grignard reagent), organoselenium and organotellurium. Organoaluminium reagents: Preparation, site selective and stereoselective additions of nucleophiles mediated by organoaluminum reagents, reaction with acid chlorides, allyl vinyl ethers, 1,2-addition to imines and application in the synthesis of natural products. Organocopper reagents: Gilmann reagent, preparation, reactions with aldehydes, ketones and imines. Application in the synthesis of brevicomin, Organozinc reagents: Preparation - oxidative addition and transmetallation, addition reactions of alkyl, aryl, allylic and propargylic zinc reagents, diastereoselective and enantioselective addition reaction with aldehydes, Reformatsky reaction. Organotin reagents: tributyltin hydride, Barton decarboxylation reaction, Barton deoxygenation reaction, Stille coupling, Stille-Kelley coupling reactions, Barton McCombie reaction, Keck stereoselective allylation and other applications.

UNIT-III

[16 HOURS]

Asymmetric synthesis: Definition, importance, mechanism, energy consideration, advantages and limitations, methods of determination of enantiomeric excess. Methods of asymmetric induction:

Topocity-Prochirality: Substrate selectivity - Diastereoselectivity and enantioselectivity-Substrate controlled methods-use of chiral substrates - examples

Auxiliary controlled methods: Use of chiral auxiliaries - Chiral enolates-alkylation of chiral imines - Asymmetric Diels - Alder reaction

Reagent controlled methods: Use of chiral reagents - Asymmetric oxidation – Sharpless epoxidation - Asymmetric reduction - Use of lithium aluminium hydride and borate reagents. Synthesis and applications of oxazaborolidines, IPC-BBN, IPC2BH, (*S*)-BINAP-DIAMINE and (*R*)-BINAL-H. Use of (*R,R*)-DIPAMP, (*S,S*)-CHIRAPHOS, (*R,R*)-DIOP, SAMP, RAMP, *S*-Proline, *S*-PBMgCl, (-)-BOAlCl2, (+) and (-)-DET.

References

1. Organic Chemistry, VI edition, Robert T. Morrison, Robert N. Boyd.
2. Advance Organic Chemistry, IV edition, Jerry March.
3. Advance Organic Chemistry, III edition, Part-A and Part-B, Francis A. Carey and Rechard J. Sundberg.
4. Organic Chemistry, III edition, V. K. Ahluwalia and Rakesh Kumar Parashar.
5. Schaum's outline of theory and problems of Organic Chemistry, Harbert Meislich, Howard Nechamkin and Jocob Sharefkin.
6. Asymmetric synthesis, Garry Procter.
7. Mechanism in Organic Chemistry, VI edition, Peter Sykes.
8. Molecular reactions and photochemistry, Charles H. Depuy, Orville L. Chopman.
9. Modern methods of Organic synthesis, III edition, W. Carruthers.
10. Organometallics in Organic synthesis, J. M. Swan and D. Stc Black.
11. Organic chemistry by Clayden, Greeves, Warren and Wothers.

ADVANCED PHYSICAL CHEMISTRY
COURSE CODE: 21CHC12

Objectives

- To understand the concepts of enzyme kinetics, industrial catalysis and linear free energy relationship.
- To learn the electrochemical aspects of batteries and electroplating.
- To understand the mechanism of corrosion prevention of metals by different methods.
- To understand the fundamentals of X-ray crystallography.

Course Outcome

- Applications of reaction kinetics help in correlating the rates of biological and chemical reactions.
- Theory and applications of electrochemical systems helps in the field of e-waste management and protection of metals.
- Fundamentals of X-ray crystallography and structural interpretation by various X-ray diffraction techniques.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animation are used in class room teaching.
- Students will be assigned to solve the numerical problems to understand the concepts.

Course content

UNIT-I

[16 HOURS]

Homogeneous Catalysis: Electronic and structural effects on acidity and basicity. Hard and soft acids and bases. Acidity functions: Hammet acidity function, Zucker-Hammet hypothesis, Bonnett hypothesis. Industrial catalysis: Catalyst carrier, promoter, inhibitor and catalyst poison.
Enzyme kinetics: Effect of substrate concentration (Michaelis - Menton equation), Effect of pH, effect of catalysts and inhibitors (substrate, zeolite, Cr^{3+}, Fe^{2+} ZnO, U.V light), effect of temperature. A brief kinetic and mechanistic applications of glucose oxidase in the oxidation of glucose.
Linear Free Energy Relationship: Hammett equation, Taft equation, Okemoto Brown equation and its application to oxidation of amino acids and aromatic amines. Swain-Scott and Edward equation. Winstein - Grunwald relationship. Isokinetic relationship and significance of isokinetic temperature, Exner criterion.
Kinetic Isotope Effect: Theory of kinetic isotope effect - normal and inverse isotope effect, primary isotope effect, secondary isotope effect, solvent isotope effect.

UNIT-II

[16 HOURS]

Electrochemical cells and batteries: Introduction, galvanic and electrolytic cells, schematic representation of cells. Faradays's law, mass transfer in cells. Batteries: Classification, characteristics, primary, secondary and lithium batteries, fuel cells.
Electroplating: Definition, theory and mechanism of electroplating, effect of plating variables on the properties of electro deposits, comparative account of complexing and non-complexing baths (general treatment), additives on plating baths and their significance.
Metallic coating: Preparation of substrate surface, electroplating of Cu and Cr. Application of

Au and Ag plating.

Corrosion: Types of corrosion, basis of electrochemical corrosion, theories and mechanism of wet corrosion. Thermodynamic aspects of corrosion. Current – potential relations (Evan diagram) in corrosion cells. Factors influencing the rate of corrosion: Metal and environmental factors. Kinetic aspects corrosion: Corrosion rate measurement by different methods – chemical and electrochemical methods. General aspects of corrosion prevention and control – designing aspects, effect of allying and surface modification. Corrosion prevention by painting, phosphating and anodic (passivation) and cathodic protection. Corrosion inhibitors: Introduction, classification, Characteristics and requirements of efficient corrosion inhibitors, Green inhibitors and their significance, Corrosion inhibition mechanism.

UNIT-III

[16 HOURS]

Fundamentals of X-ray crystallography: Law of interfacial angles, laws of symmetry, Miller indices, Bragg equation (No derivation), Experimental methods – powder and rotating crystal methods, indexing of powder and rotating crystal photographs. Atomic scattering factor, structure factor, Fourier synthesis and electron density diagrams. Electron diffraction of gases, experimental technique, Scattering-Intensity curves, Wierl equation (no derivation), Radial distribution method determination of bond lengths and bond angles.

Imperfections in atomic packing: Types of imperfections, classification of imperfections, point defects, Schottky defects, Frenkel defects, disordered crystals, line defects, dislocation types, plane defects, small-angle and large-angle boundaries, stacking faults, crystal growth and twinning, non-stoichiometry.

Imperfections and physical properties: electrical, optical, magnetic, thermal and mechanical properties.

References

1. Chemical Kinetics by K.J. Laidler, Tata McGraw-Hill Pub, Co Ltd, New Delhi.
2. Fundamentals of Chemical Kinetics, M. R. Wright, Harwood publishing, Chichesrer, 1999.
3. Kinetics and Mechanism of Chemical Transformation by J. Rajaram and J.C. Kuriacose, Macmillan, New Delhi.
4. Electrochemistry –Principles and Applications by E.G. Potter, Cleaver-Hume press Ltd, London.
5. Chemical and Electrochemical energy systems, R. Narayan and B. Viswanathan (University Press), 1998.
6. Industrial Electrochemistry, D. Pletcher and F. C. Walsh, Chapman and Hall, 2nd Edn, 1984.
7. An Introduction to Metallic Corrosion and its Prevention, Raj Narayan (Oxford –IBH, New Delhi), 1983.
8. Fundamentals of metallic corrosion, Philips A. Schweitzer, CRC press Taylor and Francis group, New York.
9. Corrosion prevention and control, Baldev Raj, U Kamachi Mudali & S. Rangarajan, Narora Publishing House, India.
10. Solid State Chemistry and its applications – A.R. West, John Wiley & Sons.
11. New Directions in Solid State Chemistry – CNR Rao and J. Gopalakrishna, Cambridge University Press.
12. Solid state chemistry, N. B. Hannay, PHI, New Delhi.
13. Principles of the Solid State – H.V. Keer, Wiley Eastern.

CHEMICAL SPECTROSCOPY
COURSE CODE: 21CHC13

Objectives

- To understand the basic concepts of spectroscopic techniques such as NMR, ESR, NQR, Mossbauer and photoelectron spectroscopy.
- To familiarize with the IR and mass spectroscopy.

Course Outcome

- Understand the spectroscopic techniques such as NMR, IR, UV, and MS for recording and interpretation of spectra.
- Understand the characterization of chemical compounds.
- To learn electric and magnetic properties of radiation, molecules and bulk matter and solve the problems related to these properties.
- Understanding various fragmentation reactions of organic molecules.
- Predict the NMR, IR, UV, and MS spectra from a given molecular structure, including fragment-ions in MS.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animation are used in class room teaching.
- Students will be assigned to solve the spectroscopic problems to understand the interpretation of spectra.

Course content

UNIT-I

[16 HOURS]

NMR Spectroscopy: Magnetic properties of nuclei (magnetic moment, g factor, nuclear spin), effect of external magnetic field on spinning nuclei, Larmor precession frequency, resonance conditions, population of nuclear magnetic energy levels, relaxation processes, relaxation time, line width and other factors affecting line width. Chemical Shift: Standards employed in NMR, factors influencing chemical shift: electronegativity, shielding and deshielding, van der Walls deshielding magnetic anisotropy, H-bonding, diamagnetic and paramagnetic anisotropies, spin-spin coupling, chemical shift values and correlation for protons bonded to carbon and other nuclei, Instrumentation. Chemical shift equivalence and magnetic equivalence, effects of chiral centre, Karplus curve-variation of coupling constants with dihedral angle. Complex NMR Spectra: Simplification of complex spectra-isotopic substitution, increased magnetic field strength, double resonance and lanthanide shift reagents, Nuclear Overhauser Effect (NOE), FT-NMR Spectroscopy and advantages. ^{13}C-NMR Spectroscopy: multiplicity-Proton decoupling-Off resonance decoupling; Chemical shift, application of ^{13}C, ^{19}F, ^{31}P, ^{11}B and ^{15}N. Applications of NMR: Structural diagnosis, conformational analysis, keto-enol tautomerism, H-bonding. Solid state NMR and its applications.

Multiple resonance spectroscopy: Introduction to 2D-techniques: DEPT, COSY and NOESY.

UNIT-II

[16 HOURS]

Electron Spin Resonance Spectroscopy: Basic principles, hyperfine couplings, the g values, factors affecting g values, isotropic and anisotropic hyperfine coupling constants, Zero

Field splitting and Kramer's degeneracy. Measurement techniques and applications to simple inorganic and organic free radicals and to inorganic complexes.

NQR Spectroscopy: Introduction, Principles, Quadrupolar nuclei, electric field gradient, nuclear quadrupole coupling constants, energies of quadrupolar transitions, effect of magnetic field. Applications.

Mössbauer spectroscopy: The Mössbauer effect, chemical isomer shifts, quadrupole interactions, magnetic splitting, measurement techniques and spectrum display, application to the study of $Fe^{2+}$and Fe $^{3+}$compounds; iron in very high oxidation states-Fe(V) and Fe(VI) nitride complexes; $Sn^{2+}$and Sn^{4+}compounds, nature of M-L bond, coordination number and structure, detection of oxidation states and an inter halogen compound $I_2Br_2Cl_4$.

Photoelectron Spectroscopy: Introduction, principles, chemical shifts, photoelectron spectra of simple molecules. X-ray photoelectron and Auger electron spectroscopy- Principles and applications.

UNIT-III

[16 HOURS]

IR spectroscopy: Introduction, instrumentation, sample handling, Characteristic group frequencies and skeletal frequencies. Finger print region, Correlation chart. Identification of functional groups-alkanes, alkenes, alkynes, aromatics, carbonyl compounds (aldehydes, ketones, esters and lactones), halogen compounds, sulphur and phosphorous compounds, alcohols, amides, lactums, amino acids and amines, Factors affecting group frequencies and band shapes: conjugation, resonance and inductance, hydrogen bonding and ring strain. tautomerism, *Cis-trans* isomerism. Applications of IR spectroscopy.

Mass Spectrometry: Basic principles, Instrumentation-Mass spectrometer, interpretation of mass spectra, resolution, molecular ions, meta-stable ions, Nitrogen rule and isotope ions. Different methods of ionization (chemical ionization, electron impact, field ionization-FAB and MALDI). Fragmentation processes-representation of fragmentation, basic fragmentation types and rules. Factors influencing fragmentations and reaction pathways. McLafferty rearrangement. Fragmentations (fragmentation of organic compounds with respect to their structure determination) associated with functional groups-alkanes, alkenes, cycloalkanes, aromatic hydrocarbons, halides, alcohols, phenols, ethers, acetals, ketals, aldehydes, ketones, quinines, carboxylic acids, esters, amides, acid chlorides, nitro compounds, amines & nitrogen heterocycles. Fragmentation patterns of glucose, myrcene, nicotine, retro Diels-Alder fragmentation. Composite problems involving the applications of UV, IR, ^{1}H and ^{13}C-NMR and mass spectroscopic techniques for the structural elucidation of organic compounds.

References

1. Organic Spectroscopy-3rd Ed.-W. Kemp (Pagrave Publishers, New York), 1991.
2. Spectrometric Identification of Organic Compounds - Silverstein, Bassler & Monnill (Wiley) 1981.
3. Spectroscopy of Organic Compounds-3rd Ed.-P.S. Kalsi (New Age, New Delhi) 2000.
4. E.A.V. Ebsworth, D.W.H. Ranklin and S. Cradock: Structural Methods in Inorganic Chemistry, Blackwell Scientific, 1991.
5. J. A. Iggo: NMR Spectroscopy in Inorganic Chemistry, Oxford University Press, 1999.
6. C. N. R. Rao and J. R. Ferraro: Spectroscopy in Inorganic Chemistry, Vol I & II (Academic) 1970.
7. Spectroscopy, B. P. Straughan and S. Salker, John Wiley and Sons Inc., New York, Vol.2, 1976.
8. Application of Absorption Spectroscopy of Organic Compounds, John R. Dyer, Prentice/Hall of India Private Limited, New Delhi, 1974.
9. Organic Spectroscopy, V. R. Dani, Tata McGraw-Hall Publishing Company Limited, New Delhi. 1995.

10. Interpretation of Carbon-13 NMR Spectra, F.W. Wehrli and T. Wirthin, Heyden, London, 1976.
11. NMR spectroscopy-Powai

SOFT CORE

ANALYTICAL CHEMISTRY PRACTICALS

COURSE CODE: 21CHC50 [64 HOURS]

Objectives

- To familiarize with the handling of instruments in the quantitative analysis of various samples.
- To understand the analysis of real samples like waste water, soil samples and biological samples and mixtures

Course Outcomes

After studying this course, the student to:

- Get experience on analysis of various complex mixtures by following multistep reactions.
- Acquire the knowledge on handling instruments and to overcome the general problems arises during the analysis.
- Acquire industrial skills required for sampling, analytical and interpretation and presentation of results.
- Possess adequate knowledge on literature search for developed analytical methods.

Pedagogy

- Each student performs experiments as per the protocol in practical classes.
- Computer aided applications are used for the evaluation of experimental results.

[128 HOURS]

PART – III

1. Determination of calcium in limestone by redox, acid-base and complexation titrations.
2. Determination of vitamin C in orange juice by titration with cerium(IV) and with 2,6-dichlorophenol indophenol.
3. Determination of mercury in an algaecide by EDTA titration; and arsenic in ant control preparation by redox titration.
4. Determination of aluminium and magnesium in antacids by EDTA titration.
5. Analysis of a copper-nickel alloy sample for copper and nickel by EDTA titration using masking and selective demasking reactions.
6. Determination of saccharin in tablets by precipitation titration.
7. Determination of iodine value and saponification value of edible oils.
8. Determination of ascorbic acid in goose berry/bitter gourd by titrimetry and spectrophotometry using *N*-bromosuccinimide (NBS).
9. Analysis of a mixture of iron(II) and iron(III) by EDTA titration using *p*H control.

10. Determination of sulpha drugs by potentiometry using $NaNO_2$ and iodometric assay of penicillin.
11. Solvent extraction method for determination of silver as ion-associate with 1,10-phenanthroline and bromopyragallol red.
12. Electrolytic determination of copper and lead in brass.
13. Polarographic determination of copper and zinc in brass.
14. Determination of sodium, potassium and calcium in mineral waters by atomic emission spectrometry.
15. Determination of iron in mustard seeds and phosphorus in peas by spectrophotometry.
16. Analysis of waste water for anionic detergents and phenol by spectrophotometry.
17. Fluorimetric determination of riboflavin (vit.B_2) in tablets.
18. Colorimetric analysis of procaine by diazotization and coupling reaction.
19. Determination of manganese in steel by extraction-free spectrophotometry and molybdenum in steel by extractive spectrophotometry.
20. Determination of ethanol in wine by titrimetric and spectrophotometric dichromate methods

PART – IV

1. Analysis of waste waters for DO and COD by titrimetry.
2. Analysis of a ground water sample for sulphate by titrimetry (EDTA) and turbidimetry.
3. Potentiometric determination of formula and stability constant of a silver-ammonia complex ion.
4. Determination of aspirin, phenacetin and caffeine in mixture and APC tablets by solvent extraction and UV spectrophotometry.
5. Kinetic determination of urinary creatinine and purity of a commercial H_2O_2 sample.
6. Determination of chromium(III) and iron(III) in a mixture by kinetic masking methods.
7. Catalytic determination of traces of selenium in biological materials and iodide in blood serum.
8. Photometric and potentiometric titration of iron(III) with EDTA.
9. Photometric and potentiometric titration of copper with EDTA.
10. Determination of copper(II) and iron(III) in mixture by photometric titration with EDTA.
11. Analysis of brackish water for chloride content by a) spectrophotometry (mercuric thiocyanate method), b) conductometry (silver nitrate) and c) potentiometry (silver nitrate).
12. Conductometric titration of sodium acetate with HCl and NH_4Cl with NaOH.
13. Ascorbic acid determination in natural orange juice by coulometry.
14. Spectrophotometric determination of iron in natural waters using thiocyanate and 1,10-phenanthroline as reagents.
15. Determination of fluoride in drinking water/ground water by spectrophotometry(alizarin red lake method).
16. Analysis of waste water for
    a) Phosphate by molybdenum blue method

b) ammonia-nitrogen by Nessler's method
c) nitrite-nitrogen by NEDA method

15. Analysis of a soil sample for
    a) Calcium carbonate and organic carbon by titrimetry.
    b) Calcium and magnesium by EDTA titration.
16. Analysis of a soil sample for
    a) Nitrogen content by Kjeldahl method
    b) Available phosphorus by spectrophotometry.
    c) Nitrate-nitrogen/nitrite nitrogen/ammonia nitrogen by spectrophotometry.
    d) Sodium and potassium by flame photometry.
17. Analysis of urine for
    a) Urea and uric acid by titrimetrysnd spectrophotometry.
    b) Sulphate by precipitation titration after ion-exchange separation.
    c) Sugar by Benedict's reagent.
18. Analysis of blood for
    a) cholesterol by spectrophotometry
    b) Bicarbonate by acid-base titration.
19. Fluorimetric determination of quinine in an antimalarial tablet.

References

1. Fundamental of Analytical Chemistry, D.A. Skoog, D.M. West, Holler and Crouch 8thedition, 2005, Saunders College Publishing, New York.
2. Analytical Chemistry, G.D. Christian, 5th edition, 2001 John Wiley & Sons, Inc. India.
3. Quantitative Analysis, R.A. Day and A.L. Underwood, 6th edition, 1993, prentice Hall, Inc. New Delhi.
4. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D.Barnes and M.J.K. Thomas, 6th edition, Third Indian Reprint, 2003 Pearson EducationPvt. Ltd., New Delhi.
5. Analytical Chemistry Principles, John H. Kennedy, 2nd edition, Saunders CollegePublishing, California, 1990.
6. Quantitative Analysis of Drugs in Pharmaceutical Formulations, P. D. Sethi, 3rdedition, CBS Publishers & Distributors, New Delhi, 1997.
7. Practical Clinical biochemistry methods and interpretations, R. Chawla, J.P. BothersMedical Publishers (P) Ltd., 1995.
8. Laboratory Manual in Biochemistry, J. Jayaraman, New Age International Publishers,New Delhi, 1981.
9. Experiments on Water Pollution, D.I.Williams and D. Anglesia, Wayland Publishers Ltd., England, 1978.
10. Experiments on Land Pollution, D.I. Williams and D. Anglesia, Wayland PublishersLtd., England, 1978.

15. Experiments in Environmental Chemistry, P.D. Vowler and D.W. Counel, PergamonPress,Oxford 1980.
16. Manual Soil Laboratory Testing, vol.I, K.H. Head, Pentech Press, London 1980.

INORGANIC CHEMISTRY PRACTICALS
COURSE CODE: 21CHC51 [64 HOURS]

Objectives

- To familiarize with the instrumental methods of analysis for determining metals present in the different samples.
- To familiarize with the preparation and characterization of different inorganic complexes.

Course Outcome

- Determination of alloy samples and understanding the electrochemical deposition of metals.
- Preparation and characterization of coordination compounds.
- Determination of composition, stability constant and magnetic susceptibility of metal complexes.

Pedagogy

- Each student performs experiments as per the protocol in practical classes.
- Spectroscopic tools are applied for the characterization of the synthesized complexes.

Course experiments

PART-A

1. Determination of bismuth, cadmium and lead in a mixture: Analysis of a low melting alloy (Wood‘s alloy).
2. Simultaneous spectrophotometric determination of chromium and manganese in a steel solution.
3. Determination of chromium(III) and iron(III) in a mixture: Kinetic masking method.
4. Electrogravimetric determination of:
   a) Copper in copper sulphate
   b) Nickel in nickel suphate
   c) Copper and nickel in alloy solution
   d) Lead in lead nitrate.
5. Flame photometric determination of the following metal ions from different samples: a) sodium b) potassium and c) sodium and potassium in a mixture.
6. Polarographic estimation of cadmium and zinc.
7. Determination of iron as the 8-hydroxyquinolate by solvent extraction method.
8. Quantitative determination of nickel using dithizone and 1,10-phenanthroline by synergistic extraction.
9. Spectrophotometric determination of the *p*Ka value of methyl red.
10. Semimicro gravimetric determination of aluminium.

PART-B

1. Preparation and characterization of:
   a) Chloropentammine cobalt(III) chloride
   b) Estimation of chloride in a complex by potentiometric or ion-exchange method

c) Record the electronic absorption spectrum of a complex and verify TanabeSugano diagram.

2. Preparation of *cis*- and *trans*- dichlorobis(ethylenediammine) cobalt(III)chloride. Record the UV-Vis spectra and compare it with *cis*-form. Measure the molar conductance.
3. Preparation of hexammine cobalt(III) chloride and estimate cobalt ion.
4. Determination of magnetic susceptibility of any two compounds/complexes by Gouy method.
5. Determination of the composition of iron-phenanthroline complex by:
   (a) Job's method
   (b) mole-ratio method and
   (c) Slope-ratio method.
6. Determine the stability constant of iron-tiron/iron-phenanthroline by Turner-Anderson method.
7. Preparation of potassium tris(oxalato)ferrate(III) and estimate the metal ion.
8. Preparation of acetyl acetonatomanganese(III) complex.
9. Preparation of tris(en)nickel(II) chloride and hexamine nickel(II) chloride complexes. Record electronic spectra and evaluate spectrochemical series.
10. Using chloropentammine cobalt(III) chloride, prepare nitro and nitritopentammine cobalt(III) chloride. Record the IR spectra of the isomers and interpret.
11. Estimate the chloride ion in a given complex by silver nitrate titration after ion-exchange separation.
12. Demonstration Experiments:
    (a) Recording and interpretation of IR and NMR spectra of complexes.
    (b) Spectrochemical series- Evaluation of Dq value.
    (c) DNA interaction with metal complexes by UV-visible absorption and viscosity methods.

References

1. Advanced Physico-Chemical Experiments – J. Rose.
2. Instrumental Analysis Manual - Modern Experiments for Laboratory – G.G. Guilbault and L.G. Hargis.
3. A Text Book of Quantitative Inorganic Analysis – A.I. Vogel, 5th edition.
4. Experimental Inorganic Chemistry – G. Palmer.
5. Inorganic Synthesis – O. Glemser.
6. Experimental Inorganic/Physical Chemistry- Mounir A. Malati.
7. Quantitative Chemical Analysis – Daniel C. Harris, (2006) 7th edition.
8. Spectrophotometric Determination of Elements – Z. Marczenko

ORGANIC CHEMISTRY PRACTICALS
COURSE CODE: 21CHC52 [64 HOURS]

Objectives

- To understand the concepts of isolation and purification of natural products.
- To familiarize with the estimation of different functional groups in organic compounds.

Course Outcome

- The isolation of caffeine, carotene, lycopene, cincole, azelaic acid and piperine from respective natural sources.
- Estimation of ketones, sugars, nitro and amino groups in natural products.
- Interpret UV, IR, NMR and MS data of different organic compounds.

Pedagogy

- Each student performs experiments as per the protocol in practical classes.
- Spectroscopic tools are applied for the characterization of isolated natural products.

Course experiments

PART-A

1. Fractional crystallization: separation of mixture of naphthalene and biphenyl.
2. Thin layer chromatography: Separation of plant pigments.
3. Column chromatography: Separation of *o*- and *p*-nitro aniline
4. Isolation of piperine from pepper.
5. Isolation of caffeine from tea.
6. Isolation of azelaic acid from castor oil.
7. Isolation of carotene from carrot.
8. Isolation of lycopene from tomato.
9. Isolation of cincole from eucalyptus leaves.

PART-B

Isolation of natural products & estimations:

1. Estimation of ketones by haloform reaction.
2. Estimation of sugars by Bertrand's method.
3. Estimation of nitro groups.
4. Estimation of amino group.
5. Determination of enol content by Meyer's method.
6. Determination of iodine value of an oil or fat.
7. Determination of saponification value of oil.
8. Determination of equivalent weight of carboxylic acid by silver salt method

Interpretation of Spectra: Structural elucidation of some simple organic compounds by UV, IR, NMR and mass. Spectra have to be provided by the Teachers/ Examiners.

References

1. Vogel' text book of practical organic chemistry, V edition, B. S. Furniss, A. J. Hannaford, P. W. G. Smith, A. R. Tatehell.
2. Elementary practical organic chemistry, Part-III: Quantitative organic analysis, By Arthur I, Vogel.
3. Laboratory manual of Organic Chemistry by B. B. Dey and M. V. Sitaraman.
4. Practical Organic Chemistry by Mann F. G. and Saunders.
5. Natural products: A laboratory guide by Raphael Ikhan.

PHYSICAL CHEMISTRY PRACTICALS

Objectives **COURSE CODE: 21CHC53** **[64 HOURS]**

- To understand the significance of various factors influencing the reaction rate in proposing the reaction mechanism.
- To understand electrochemical and spectrophotometric methods of quantification of samples, and also determination of physico-chemical parameters of some important samples.

Course Outcome

- Students can able to develop experimental skill and interpretation of plausible mechanisms of reactions.
- Gain practical knowledge on the theoretical basis of electrochemistry, thermodynamics, and spectrophotometry experiments.
- This helps in academics, research and industries.

Pedagogy

- Each student performs experiments as per the protocol in practical classes.
- Electrochemical and spectrophotometric tools are used to conduct the experiments.

Course experiments

PART-A

1. Determination of order of reaction for the acid hydrolysis of methyl acetate and evaluation of activation parameters.
2. Evaluation of Arrhenius parameters for the reaction between $K_2S_2O_8$ and KI (First order reaction).
3. Study of kinetics of autocatalytic reaction between oxalic acid and $KMnO_4$ and determine the order of reaction with respect to $KMnO_4$.
4. Kinetics of saponification of ethyl acetate by conductivity method and study the effect of dielectric constant of the medium (using CH_3OH).
5. Study of effect of salt (ionic strength) on the kinetics of reaction between potassium persulphate and potassium iodide (second order reaction).
6. Spectrophotometric kinetics of oxidation of indigocarmine (IC) by chloramine-T (CAT) – Determination of order of reaction with respect to [CAT] and [IC].
7. To study the acid catalysed kinetics of oxidation of glycine by chloramine-T (CAT) - determination of order of reaction with respect to [CAT] and [glycine].
8. Study the phase diagram of three component system (Glacial acetic acid-Chloroform-water system / Glacial acetic acid-Acetone-Water system).
9. Study the rate of corrosion and inhibition efficiency of an inhibitor (thiourea) on mild steel/Al/Cu by weight loss method.

PART-B

1. Conductometric titration of orthophosphoric acid against NaOH.
2. Conductometric titration of a mixture of HCl, CH_3COOH and $CuSO_4$ against NaOH.
3. Conductometric titration of thorium nitrate with potassium tartarate.
4. Potentiometric titration of mixture of weak acids (acetic acid and monochloroacetic acid) against NaOH.
5. Dwtermination of pK_a values of phosphoric acid by potentiometric / pH metric method.

6. Potentiometric titration of mixture of KCl+KBr+KI against $AgNO_3$.
7. Potentiometric titration of FAS against ceric sulphate and sodium metavenadate, determine the concentration of FAS and redox potential.
8. Potentiometric titration of lead nitrate against EDTA and determine the concentration of lead nitrate solution.
9. Determination of *p*K value of an indicator (methyl orange/methyl red).
10. Spectrophotometric analysis of a mixture of (a) $KMnO_4$ and $K_2Cr_2O_7$.
11. Study of complex formation between ferric salt and salicylic acid.

References

1. Practical Physical Chemistry – A.J. Findlay.
2. Experimental Physical Chemistry – F. Daniels *et al*.
3. Selected Experiments in Physical Chemistry – Latham.
4. Experiments in Physical Chemistry – James and Prichard.
5. Experiments in Physical Chemistry – Shoemaker.
6. Advanced Physico-Chemical Experiments – J. Rose.
7. Practical Physical Chemistry – S.R. Palit.
8. Experiments in Physical Chemistry – Yadav, Geol Publishing House.
9. Experiments in Physical Chemistry – Palmer.
10. Experiments in Chemistry – D.V. Jahagirdar, Himalaya Publishing House, Bombay, (1994).
11. Experimental Physical Chemistry – R.C. Das and B. Behera, Tata Mc Graw Hill.

SOFT CORE
KINETIC AND RADIOCHEMICAL METHODS OF ANALYSIS

COURSE CODE: 21CHC54

Objectives

- To learn aspects of kinetic and radiochemical methods for analysis
- To understand the knowledge of applied aspects of recent needs by simple techniques

Course Outcome

- To understand the reaction kinetics
- To gain the principles of radiochemical methods
- To understand the applicability of radiometric assays

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and information and communications technology are used in class room teaching.
- Students will be assigned to solve the numerical problems to understand electrochemical concepts.

Course Content

Unit-I **[16 HOURS]**

Kinetic methods of analysis: Analytical uses of reaction rates relative, basis of reaction rate

methods, rate laws-first and second order reactions relative rates of reactions, analytical utilityof first or pseudo first order reactions, determination of reaction rates, types of kinetic methods– differential methods, integral methods, multicomponent analysis-neglect of reaction of slow- reacting component, logarithmic extrapolation method, reaction rate method, applications- catalyzed reactions, measurement methods for catalyzed reactions, micro determination of inorganic species like iodide, selenium, cobalt & mercury in complex materials, determination of organic species, non-catalytic reactions. Applications of enzyme-catalysed reactions for the analysis of substratesstoichiometric and rate methods, determination of urea, uric acid, blood glucose, galactose and blood alcohol, determination of enzymes-LDH, GOT and GPT. A brief outline of IR, UV, NMR, Mass spectroscopy as tools for kineticstudy.

UNIT – II [16 HOURS]

Radiometric methods: Radioactive isotopes. Nuclear emissions-αandβ-particles, neutrons, gamma rays and miscellaneous nuclear particles. Nuclear reactions, radiochemical decay and activity. Instrumentation and measurement of radioactivity. Radiation detectors-gas ionization, scintillation and semiconductor detectors. Pulse height analysis. Autoradiography. Statistics of radioactive measurements.

Radiochemical analysis: **Neutron activation methods**-neutrons and their sources. Interaction of neutrons with matter. Theory, experimental considerations and applications.

Isotope dilution methods-direct isotope dilution and inverse isotope dilution methods and their applications. Radiometric titrations. Radiorelease methods. Radioactive tracers.

Radio immunoassay: Principles of immunoassay. Specificity of immuno assays. Preparation of the antibody, incubation period for the assay, separation of the bound and free antigen. Fluorescence immunoassay. Enzyme immunoassay.

References:

1. Fundamental of Analytical Chemistry, D.A. Skoog, D.M. West, Holler and Crouch 8th edition, 2005, Saunders College Publishing, New York.
2. Analytical Chemistry, G.D. Christian, 5th edition, 2001 John Wiley & Sons, Inc. India.
3. Quantitative Analysis, R.A. Day and A.L. Underwood, 6th edition,1993 Prentice Hall, Inc. New Delhi.
4. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, 6th edition, Third Indian Reprint, 2003 Pearson Education Pvt. Ltd., New Delhi.
5. Analytical Chemistry Principles, John H. Kennedy, 2nd edition, Saunders CollegePublishing, California, 1990.
6. Instrumental Methods of Analysis by H.H. Willard, L.L. Merritt and J.A. Dean,7th edition, (1988).
7. Principles and Practice of Analytical Chemistry, F.W. Fifield and Kealey, 3rd edition, 2000, Blackwell Sci., Ltd. Malden, USA.
8. Modern Analytical Chemistry, David Harvey, McGraw Hill, New Delhi, 2000.

9. Introduction to Instrumental Analysis, Braun, Pharm. Med. Press. India.
10. Instrumental Method of Analysis, W. M. Dean and Settle, 7th edition, 1986, CBS Publishers, New Delhi.
11. Instant Notes of Analytical Chemistry, Kealey and Haines, Viva books Pvt. Ltd., 2002.
12. Soil Chemical Analysis, M.L. Jackson, Prentice Hall of India Pvt. Ltd., New Delhi, 1973.
13. Clinical Chemistry, Principles and Procedures, J.S. Annino, 2nd edition, Boston: Little, Brown, 1960.
14. Methods of Geochemical Analysis, D. Click, Ed., A Multivolume series, NewYork, Interscience.
15. Clinical Chemistry, Principles and Techniques, R.J. Henry, D.C. Cannon and J.W. Winkleman, Eds., 2nd edition,Hagerstorm, M.D: Harper and Row, 1974.
16. Fundamentals of Clinical Chemistry, N.W. Tietz, Ed., 2nd edition, Philaddphia: W.B. Saunders, 1976.

FRONTIERS IN INORGANIC CHEMISTRY

COURSE CODE: 21CHC55

Objectives

- To understand the basic concepts, synthesis and applications of materials.
- To learn the properties, fabrication and characterization of nanomaterials.

Course Outcome

- Gain knowledge on design and synthesis of new inorganic materials.
- Fabrication and characterization of nanomaterials.
- Applications of ceramics, pigments, silicates and biomaterials.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.

Course content

UNIT-I

[16 HOURS]

Materials chemistry: Historical Perspectives. Design of new materials through a Critical Thinking Approach. Materials sustainability.
Synthesis of materials: The formation of bulk material by different methods.
Defects and ion transport: Extended defects. Atom and ion diffusion. Solid electrolytes.
Metal oxides, nitrides and fluorides: Monoxides of the 3d metals, higher oxides and complex oxides, oxide glasses, nitrides and fluorides.
Sulfides, intercalation compounds and metal rich phases: Layered MS2 compounds and intercalation, Chevrel phases.
Ceramic materials: Sol-gel process and applications of biomaterials of ceramics.
Inorganic pigments: Coloured pigments, white and black inorganic materials.
Molecular materials and fullerides: Fullerides, Molecular material chemistry.
Silicates: Structure, classification - silicates with discrete anions, silicates containing chain anion, silicates with layer structure, silicones with three dimensional net work and applications.

UNIT-II

Nanomaterials-Introduction. **[16 HOURS]**

Fundamentals-Terminology and history.

Characterization and fabrication: Top-down and bottom-up fabrication. Solution based synthesis of nanoparticles. Vapour-phase synthesis of nanoparticles. Templated synthesis of nanomaterials using frameworks, supports and substrates. Sonochemical microwave methods for the synthesis of nanoparticles.

Structural study of nanocomposites by different methods.

Nanostructures and properties

One-dimensional control: carbon nanotubes and inorganic nanowires.

Two-dimensional control: grapheme, quantum wells and solid-state super lattices.

Three-dimensional control: mesoporous materials and composites.

Some applications of inorganic/organic/polymeric materials: Optical, electrical, magnetic, and chemical and biosensors.

References

1. Inorganic Chemistry, 4th edition. P. Atkins, T. Overton, J. Rourke, M. Weller and F. Armstrong, Oxford University Press (2006).
2. Inorganic Chemistry Principles of Structure and Reactivity: James E. Huheey, Ellen A. Keiter, Richard L. Keiter, Okhil K. Medhi, Delhi University, New Delhi (2006).
3. Chemistry of the Elements – N.N. Greenwood and A. Earnshaw, Pergamon Press (1985).
4. Industrial Inorganic Chemistry – 2nd edition. K.H. Buchel, H.H. Moretto and P. Woditsh, Wiley - VCH (2000).
5. Basic Inorganic Chemistry – 3rd edition. F.A. Cotton, G. Wilkinson and P.L. Gaus, John Wiley and Sons (2002).
6. Inorganic Chemistry, 3rd edition. James E. Huheey, Harper and Row Publishers (1983).
7. Inorganic Chemistry, 3rd edition. G.L. Miessler and D.A. Tarr, Pearson Education (2004).
8. Inorganic Chemistry, 2nd edition. C.E. Housecroft and A.G. Sharpe, Pearson Education.

CHEMISTRY OF NATURAL PRODUCTS-II
COURSE CODE: 21CHC56

Objectives

- To familiarize with the chemical concepts of alkaloids and steroids.
- To learn the structural elucidation and biological importance of alkaloids and steroids.

Course Outcome

- Chemistry of alkaloids and their biological significances.
- Synthesis and characterization of several alkaloids and steroids.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.

Course content

UNIT-I

[16 HOURS]

Alkaloids: Introduction, classification, isolation and general methods of structural elucidation of alkaloids. Classification of alkaloids. Biological importance of alkaloids. Structural elucidation of nicotin, papavarine, quinine, reserpine and morphine. Biosynthesis of alkaloids (nicotin, conine and cocaine).

UNIT-II

[16 HOURS]

Steroids: Introduction, Structural elucidation of cholesterol, bile acids, Ergosterol and its irradiation products. Sex hormones and corticosteroids: Synthesis of estrone, progesterone, androsterone, testosterone. Barton reaction for the synthesis of aldosterone. Brief discussion of homosteroids, norsteroids and oral contraceptives. Biological significance of anabolic steroids.

References

1. Organic Chemistry, VI edition, Robert T. Morrison, Robert N. Boyd.
2. Organic Chemistry, Vol-II by I. L. Finar.
3. Schaum's outline of theory and problems of Organic Chemistry, Harbert Meislich, Howard Nechamkin and Jocob Sharefkin.
4. Natural products: Their chemistry and biological significance, J. Mann, R. S. Davidson, J. B. Banthorpe and J. B. Harborne.

MATERIALS CHEMISTRY
COURSE CODE: 21CHC57

Objectives

- To familiarize with the preparation and characterization of different types of nanomaterials.
- To learn the properties and applications of semiconductors and superconductors.

Course Outcome

- Understand the fundamentals and importance of different types of nanomaterials, their methods of preparation and characterization by different techniques.
- Basic aspects of semiconductors and superconductors, their properties and applications.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.

Course content

UNIT-I

[16 HOURS]

Chemistry of nanomaterials: Fundamentals and importance, metal nanoclusters, magic numbers, theoretical modelling of nanoparticles, geometric structure, electronic structure, reactivity, fluctuations, magnetic clusters, bulk to nano transitions. Semiconducting nanoparticles: optical properties, photo fragmentation, Coulombic explosion.

Carbon nanoparticles: Introduction, carbon molecules, nature of carbon bond, new carbon structure. Carbon clusters: Small carbon clusters, C_{60}: Discovery, structure, alkali doping, super conductivity. Fullerenes and other bulky balls. Carbon nano-tubes: Fabrication structure, electrical properties, vibrational properties, mechanical properties. Quantum dots, Graphene, and applications of nanomaterials.

Methods of preparation: Plasma arc, Chemical vapour deposition (CVD), sol-gel, silica-gel, hydrolysis, condensation, polymerization of monomers to form nanoparticles, solvothermal, and hydrothermal methods, electrochemical, ball milling and pulsed laser methods. Characterization of nanomaterials (X- ray, IR, UV and SEM).

UNIT-II

[16 HOURS]

Semiconductors: Metals, insulators and semiconductors. Band theory, energy bands, intrinsic and extrinsic semiconductors. Conductivity: electrons and holes, temperature dependence on conductivity, Optical properties: absorption spectrum, photoconductivity, photovoltaic effect and luminescence. Junction properties: metal-metal junctions, metal-semiconductor junctions, p-n junctions, transistors, industrial applications of semiconductors: Mixed oxides, spinels and other magnetic materials.

Superconductors: Introduction, critical temperature and zero resistivity, Meissner effect, critical magnetic field and its variation with temperature. Type - I and II super conductors, specific heat, isotope effect, basic concepts of BCS theory. High temperature (Tc) superconductors and its applications.

References

1. Introduction to Nanotechnology, Charles P. Poole. Jr. and Frank J. Owens, Wiley-Interscience, Joh Wiley and Sons Inc, 2006.
2. Nanotechnology, Richard Booker and Earl Boysen, Wiley.
3. Nanometerials, A.K. Bandopadhyay, New Age International, 2nd edition.
4. Nanotechnology - Importance and Applications, M. H. Fulekar, Ink International publishing.
5. Solid State Chemistry – N.B. Hannay.
6. Introduction to Solids – Azaroff.
7. Solid State Chemistry and its applications – A.R. West.
8. Principles of the Solid State – H.V. Keer.
9. Basic Solid State Chemistry, 2nd edition, Anthony R. West.
10. Solid State Chemistry: An Introduction, 3rd edition, Lesley E. Smart and Elaine A. Moore.
11. Introduction to Solid state Physics-C. Kittel, 5th edition, Wiley Eastern, Limited.
12. C.N.R. Rao and J. Gopalakrishna –New Directions in solid state chemistry| Cambridge University Press, Cambridge (1999).

OPEN ELECTIVE (FOR NON-CHEMISTRY STUDENTS ONLY)
GENERAL CHEMISTRY
COURSE CODE: 21CHC80

Objectives

- To understand the basic concepts of chemistry including periodic properties of elements, structure and bonding.
- To learn the applications of synthetic products and biological importance of natural products. .
- To understand the basic concepts of thermodynamics, chemical kinetics, ionic equilibria and electrochemistry.
- To learn the statistical evaluation of experimental data. Applications of titrimetric methods and separation techniques.

Course Outcome

- Periodic properties of elements, structure and bonding of ionic compounds as well as various concepts of acids and bases.
- Hybridization, bonding and molecular structure of simple organic molecules. And also, biological importance of natural products.
- Basic concepts of thermodynamics, chemical kinetics, electrochemistry and ionic equilibria and their applications.
- Statistical evaluation of experimental data, concept of titrimetric and chromatographic methods.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.
- Students will be assigned to solve the numerical problems to understand the concepts.

Course content

UNIT-I

[16 HOURS]

Periodic table and chemical periodicity: Periodic properties of elements, State of Matter, their resources. Important periodic properties of the elements, covalent radii, ionic radii, ionization potential, electron affinity and electronegativity.

Structure and Bonding: Properties of ionic compounds, structure of crystal lattices (NaCl, CsCl, ZnS, Wurtzite and rutile), Lattice energy, Born-Haber Cycle, radius ratio rules and their limitations.MO treatment for homo- and heteronuclear diatomic molecules. VSEPR model to simple molecules. Factors affecting the radii of ions, covalent character in ionic bonds, hydration energy and solubility of ionic compounds.

Concepts of Acids and Bases: Review of acid base concepts**.** Lux-Flood and solvent system concepts. Hard-soft acids and bases. Applications.

UNIT-II

[16 HOURS]

Bonding and molecular structure: Introduction to organic chemistry, atomic orbitals, sigma and pi bond formation-molecular orbital (MO) method, sp, sp^2 and sp^3 hybridization, bond length, bond dissociation energies and bond angles (open chain and cyclic compounds). Electronegativity and polarity of the bonds. Classifications and reactions of organic compounds (with examples).

Acids and bases: Hydrogen bonding, resonance and inductive effective on strengths of acids and bases.

Biological importance of natural products: Amino acids, proteins, carbohydrates (cellulose, starch, glycogen), lipids (fats and oils, phospholipids), prostaglandins, nucleic acids, steroids, alkaloids, vitamins, flavonoids.

Applications of synthetic products: Dyes, drugs, polymers (plastics), soaps and detergents, pesticides and pheromones.

UNIT-III

[16 HOURS]

Thermodynamics: First and second laws of thermodynamics. Concept of entropy and free energy, entropy as a measure of unavailable energy. Entropy and free energy changes and spontaneity of process.

Chemical kinetics: Rate and order of reaction. Factor affecting the rate of reaction. and determination Order of reaction. Energy of activation and its determination. Brief account of collision and activated complex theories.

Ionic equilibria: pH scale, buffer solutions, calculation of pH of buffer solutions, buffer capacity and buffer index, buffer mixtures.

Solutions: Concentration units, solutions of liquids in liquids, Raoult‘s law, ideal and non-ideal solutions.

Electrochemistry: Electrolytic conductance, specific, equivalent and molar conductance, ionic mobility and transference number, factors affecting the electrolytic conductance, Arrhenius theory of strong and weak electrolytes, assumptions of Debye-Huckel theory of strong electrolytes. Single electrode potential, reference electrodes, galvanic cells, emf of galvanic cells and construction of electrochemical cells.

UNIT-IV

[16 HOURS]

Basic Statistics and Data Handling: Significant figures, accuracy and precision. Types of errors: Determinate error and indeterminate error. Definitions for statistics. Quantifying random error: Confidence limits, variance. Rejection of results.

Applications of titrimetric methods: Introduction, theory and applications of acid base titrimetry, complexometric titrations and redox titrimetry

Separation techniques: Purification-Crystallization, sublimation, fractional crystallization, distillation techniques (simple distillation, steam distillation, distillation under reduced pressure, and fractional distillation), solvent extraction.

Chromatography: Thin layer chromatography and ion-exchange chromatography and their applications in the separation of the components from the mixture.

References

1. Text Book of Physical Chem., by Samuel Glasstone, MacMillan Indian Ltd., 2nd Ed., (1974).
2. Elements of Physical Chem., by Lewis and Glasstone, 2nd Edn. Macmillan & Co Ltd.
3. Organic Chemistry, VI edition, Robert T. Morrison, Robert N. Boyd.
4. Organic Chemistry, Vol-I by I. L. Finar.
5. Vogel' text book of practical organic chemistry, V edition, B. S. Furniss, A. J. Hannaford, P. W. G. Smith, A. R. Tatehell.
6. Laboratory manual of Organic Chemistry by B. B. Dey and M. V. Sitaraman.
7. Practical Organic Chemistry by Mann F. G. and Saunders.
8. Fundamentals of analytical Chem., 8th Edition, D. A. Skoog, West, Holler and Crouch.
9. Principles and Practice of Analytical Chemistry, F.W. Fifield and Kealey, 3rd edition, 2000, Blackwell Sci., Ltd. Malden, USA.
10. Modern Analytical Chemistry, David Harvey, McGraw Hill, New Delhi, 2000.

FOURTH SEMESTER
HARD CORE
BIOINORGANIC CHEMISTRY
COURSE CODE: 21CHD10

Objectives

- To understand the structural parameters of metallo-proteins and their biological role.
- To learn the biological properties of metal complexes in chemo and radio therapeutics.

Course Outcome

- Structural building blocks of proteins, nucleic acids and their metal ion interactions. Biological role of Na/K channel, Ca, Vit B12, and coenzymes.
- Biochemical reactions of several metallo-enzymes and oxygen transport proteins.
- Medicinal applications of metals and metal complexes, and also treatment of toxicity due to heavy metal ions.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.

Course content

UNIT-I

[16 HOURS]

Structural and molecular biology: Introduction, The structural building blocks of proteins, the structural building block of nucleic acids. Metal ion interactions with nucleosides and nucleotides. General features of DNA - metal complex interaction.

Bioenergetics: Introduction, Redox reactions in metabolism, the central role of ATP in metabolism. Kinetic stability of ATP, Mitochondrial flow of electrons from NADH to O_2. Phosphorylation and respiratory chain. Oxidative phosphorylation.

Sodium and potassium-channels and pumps: Introduction, transport across membranes. Potassium and sodium channels, The sodium-potassium ATPase, Macrocyclic crown ether compounds, cryptands and ionophores.

Biochemistry of calcium: Introduction - comparison of Ca^{2+} and Mg^{2+}. Biological roles of calcium, binding sites of calcium and proteins, storage of calcium, calcium in muscle contraction, calcium in blood clotting process.

Vitamin B12 and Coenzymes: Structural feature, names of different forms, chemistry of cobalamin, biochemical functions of cobalamins, model compounds. Special characteristics of B12 co-enzyme. Photosystems.

UNIT-II

[16 HOURS]

Metal ion transport and storage: Iron storage and transport: Transferrin, ferritin, phosvitin and gastroferrin. Iron transport in microbes: siderophores, *in vivo* microbial transport of iron.

Oxygen transport and oxygen uptake proteins: Properties of dioxygen (O2): thermodynamic and kinetic aspects of dioxygen as an oxidant, activation of dioxygen through complexation with metal ions. Haemoglobin (Hb) and Myoglobin (Mb) in oxygen transport mechanism: Introduction to porphyrin system, substituent effects on porphyrin rings, functions of Hb and Mb. Characteristics of O_2^--binding interaction with Hb and Mb. Model compounds for oxygen

carriers (Vaska's complex and cobalt(III) – Schiff base complexes). Hemerythrin and hemocyanin.

Electron transport proteins and redox enzymes: Iron – sulfur proteins (rubredoxins and ferredoxins) and cytochromes including cytochrome P450. Catalase and peroxidase: Structure and reactivity. **Superoxide dismutase**: Structure and reactivity.

Molybdenum containing enzymes: Aspects of molybdenum chemistry, Xanthine oxidase, aldehyde oxidase, sulfite oxidase, nitrogenase and nitrite reductase.

Non-redox metalloenzymes - Structure and reactivity: Carboxypeptidase-A, alcohol dehydrogenase, leucineaminopeptidase and carbonic anhydrase.

UNIT-III

[16 HOURS]

Medicinal Inorganic Chemistry: State of the Art, New Trends, and a Vision of the Future: Introduction, metals and human biochemistry, general requirements.

Disease due to metal deficiency and treatment: Iron, zinc, copper, sodium, potassium, magnesium, calcium and selenium.

Metal complexes as drugs and therapeutic agents: Introduction, Antibacterial agents, Antiviral agents, **Cancer Therapy**: Current Status and Mechanism of Action of Platinum-Based Anticancer Drugs. Non-platinum anticancer agents.

Gold-Based Therapeutic Agents: **A New Perspective**: Uses for the treatment of rheumatoid arthritis, **Diabetes**: Vanadium and diabetes,

Metal-Based Radiopharmaceuticals: Metal complexes as radio diagnostic agents.

Treatment of toxicity due to inorganics: General aspects of mechanism of metal ion toxicity,

(i) Mechanism of antidote complex with poison, rendering it inert: arsenic, lead, mercury, iron and copper.

(ii) Antidote accelerated metabolic conversion of poison to non-toxic product: cyanide and carbon monoxide.

References

1. The Inorganic Chemistry of Biological Process- 2nd edition, M. N. Hughes, John Wiley and Sons, (1988).
2. Bioinorganic Chemistry - R.W. Hay, Ellis Horwood Ltd., (1984).
3. Biological Inorganic Chemistry – An Introduction, R.R. Crichton, Elsevier, (2008).
4. Bioinorganic Chemistry - A.K. Das, Books and Allied (P) Ltd, (2007).
5. Bioinorganic Chemistry - K. Hussain Reddy, New Age International Ltd. (2003).
6. Bioinorganic Chemistry: A Survey - EiichiroOchiai, Academic Press, (2008).
7. Bioinorganic Chemistry: A Short Course - 2nd edition, R.M. Roat-Malone, Wiley Interscience, (2007).
8. Medicinal Applications of Coodination Chemistry - Chris Jones and John Thornback, RSC Publishing, (2007).
9. Transition Metal Complexes as Drugs and Chemotherapeutic Agents - N. Farrell, Kluwer Academic Publishers (1989).
10. The Biological Chemistry of the Elements: The Inorganic Chemistry of Life - 2nd edition, J.J.R. Frausto da Silva and R.J.P. Williams, Oxford University Press, (2001).
11. Essentials of Inorganic Chemistry, K. A. Strohfeldt, John Wiley and Sons Ltd.,(2015).
12. Bioinorganic Medicinal Chemistry (Ed) EnzoAlessio, Wiley-VCH Verlag and Co., (2011).

HETEROCYCLIC AND BIOORGANIC CHEMISTRY

COURSE CODE: 21CHD11

Objectives

- To familiarize with the chemistry of heterocyclic compounds.
- To learn the synthesis and biological importance of carbohydrates, proteins and nucleic acid.

Course Outcome

- Structure, reactivity and synthesis of several heterocyclic compounds.
- Synthesis, industrial and biological importance of carbohydrates.
- General synthesis of amino acids, peptides, nucleic acids and their biological significance.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.

Course content

UNIT-I

[16 HOURS]

Heterocyclic compounds: Nomenclature; Structure, reactivity, synthesis and reactions of furan, pyrrole, thiophene, indole, pyridine, quinoline, isoquinoline, pyrazole, imidazole, pyrone, coumarin, chromones, pyrimidines, purines. Synthesis and synthetic applications of azirines & aziridines, azetidines, oxazolines, isoxazolines, isoxazole, triazole and azepines and benzodiazepines.

UNIT-II

[16 HOURS]

Protecting groups: Protection of hydroxyl, carboxyl, carbonyl, thiol and amino groups. Illustration of protection and deprotection in synthesis.

Carbohydrates: Introduction, Ring size determination of monosaccharides, configuration and conformations of monosaccharides, anomeric effect, Hudson‘s rules, epimerization and mutarotation. Synthesis, industrial and biological importance of glycosides, amino sugars, sucrose, maltose and lactose. Polysaccharides: General methods of structure elucidation. Industrial importance and biological importance of cellulose, starch, glycogen, dextran, hemicellulose, pectin, agar- agar. Photosynthesis and biosynthesis of carbohydrates.

UNIT-III

[16 HOURS]

Amino Acids: General structure, physiological properties, protection of functional groups. **Peptides**: Structure and conformation of peptide bond, peptide synthesis: Solution phase and Merrifield’s solid phase synthesis, Racemization and use of HOBt, Synthesis of oxytocin and vasopressin, biological importance of insulin, selective cleavage of polypeptide bonds (chemical and enzymatic). Proteins: Structure determination: *C* and *N* terminal residue determination, primary, secondary, tertiary and quaternary structure determination, denaturing and renaturing of proteins.

Nucleic acids: Introduction, structure and synthesis of nucleosides and nucleotides, protecting groups for hydroxy group in sugar, amino group in the base and phosphate functions. Methods of formation of internucleotide bonds: DCC, phosphodiester approach and phosphoramide methods. Solid phase synthesis of oligonucleotides. Structure of RNA and DNA, Crick-Watson model, role of nucleic acids in the biosynthesis of proteins.

References

1. Organic Chemistry, VI edition, Robert T. Morrison, Robert N. Boyd.
2. Organic Chemistry, Vol-II by I. L. Finar.
3. Schaum's outline of theory and problems of Organic Chemistry, Harbert Meislich, Howard Nechamkin and Jocob Sharefkin.
4. Natural products: Their chemistry and biological significance, J. Mann, R. S. Davidson, J. B. Banthorpe and J. B. Harborne.
5. A text book of synthetic drugs, O. D. Tyagi and M. Yadav.
6. Synthetic drugs, Gurdeep R. Chatwal.
7. Carbohydrate Chemistry and applications of carbohydrates, K. M. Lokanatha Rai.
8. Heterocyclic chemistry by Achison.
9. Heterocyclic chemistry by Smith and Joule.
10. Heterocyclic chemistry by Pacquete.

NUCLEAR, RADIATION AND PHOTOCHEMISTRY
COURSE CODE: 21CHD12

Objectives

- To understand the theory and applications of photochemistry.
- To learn the fundamentals and physico-chemical applications of radiation chemistry.
- To familiarize with the concepts of nuclear chemistry including radiochemical separation techniques and nuclear power reactors.

Course Outcome

- Understand the principles of photochemistry, its experimental techniques and applications.
- Fundamentals of radiation chemistry, experimental methods of detection of radiation and applications of radioisotopes.
- General aspects of nuclear chemistry, different types of nuclear reactions, production and separation of radioisotopes and also basic features of different types of nuclear reactors.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.

Course content

UNIT-I

[16 HOURS]

Nuclear chemistry: Nuclear stability – nuclear forces, packing fraction, binding energy, liquid drop, shell and collective models. Radioactive decay – General characteristics, decay kinetics, parent –daughter decay growth relationships, determination of half-lives. Brief survey of alpha, beta and gamma decays. Nuclear reactions – Bethe‘s notation, types of nuclear reactions – specific nuclear reactions, photonuclear reactions, Oppenheimer – Phillips process, spallation reactions, Szilard-Chalmers process. Definition of Curie and related calculations. Production of radioisotopes and labelled compounds by bombardment.

Radiochemical separation techniques: carriers, solvent extraction and ion ion-exchange methods.

Nuclear power reactors: Types of nuclear power reactors, basic features and components of nuclear power reactors. An introduction to breeder reactors.

UNIT-II

[16 HOURS]

Radiation chemistry: Introduction, units, interaction of electromagnetic radiation with matter, G-value, LET of radiation. Chemical dosimetry - Fricke and ceric sulphate dosimeters. Radiolysis - cysteine, water and biphenyl. Radioisotopes as tracers, use of isotopic tracers in the elucidation of reaction mechanism, structure determination and solubility of sparingly soluble substances. ^{14}C dating, medical applications of isotopic tracers. Physico-chemical applications – isotope dilution method, activation analysis and radiometric titrations. Hazards in radiochemical work and radiation protection.

Radiation detection and measurement: Experimental techniques in the assay of radioisotopes. Radiation detectors – ionization chambers, proportional and Geiger-Muller counters – G.M. Plateau, dead time, coincidence loss, determination of dead time. Scintillation and semiconductor radiation detectors.

UNIT-III

[16 HOURS]

Photochemistry: Introduction to photochemistry, laws of photochemistry, laws of light absorption, quantum yield and its determination, factors affecting quantum yield, Actinometry - Uranyloxalate and potassium ferrioxalate actinometers, acetone and diethylketone actinometers. Term symbols for atoms and its significance. Photochemical properties of electronically excited molecules, nature of changes on electronic excitation, shapes of absorption band and Frank Condon principle. Experimental techniques to determine the intermediates in photochemical reactions. Photosensitization: by mercury, dissociation of H_2. Photochemical kinetics of: Decomposition of CH_3CHO, dissociation of HI and formation of HCl. Fluorescence and phosphorescence – theory and applications. Resonance fluorescence and quenching of fluorescence, Kinetics of colliosional quenching (Stern-Volmer equation).

Photocatalyst – Principle, application of ZnO/TiO_2 photocatalysts in the photo cleavage of dyes, environmentally hazardous waste and industrial effluents. Effect of photo degradation on COD value.

References

1. Photochemistry, Calvert and Pitts, Wiley, New York (1996).
2. Fundamentals of Photochemistry, Gohatgi-Mukherjee, New Age International Ltd., 1986.
3. Principles and Applications of Photochemistry, R. P. Wayne, Elsevier, New York (1970).
4. Photochemistry, Paul Suppan, RSC, London (1994).
5. Introduction to Semiconductor Materials and devices, M. S. Tyagi, John Wiley & Sons, 1991.
6. Nuclear Chemistry by Friedlander and Kennedy, John Wiley and Sons (1987).
7. Essentials of Nuclear Chemistry by H.J. Arnikar, Eastern Wiley (1990).
8. Nuclear Chemistry by U.N. Dash, Sultan Chand and Sons (1991).
9. Fundamentals of Radiochemistry by D.D. Sood, A.V.R. Reddy and N. Ramamoorthy.
10. Nuclear Radiation Detectors by S.S. Kapoor and Ramamoorthy, Wiley Eastern (1986).

INSTRUMENTAL METHODS OF ANALYSIS

COURSE CODE: 21CHD13

Objectives

- To understand the theory, instrumentation and applications of atomic emission spectroscopy.
- To get excel the knowledge on electro analytical techniques
- To learn the principles, instrumentation and applications of thermal methods of analysis.

Course Outcomes

After studying this course, the student to:

- Gain the knowledge on the differences between classical and instrumental methods of chemical analysis.
- Explain different types of instrumental methods employed in chemical analysis.
- Develop an understanding of the range and theories of instrumental methods available in analytical chemistry.
- Make clear distinctions among spectrometric, electro-analytical, thermal and microscopic methods.
- Gain knowledge pertaining to the appropriate instrumental techniques.
- Obtain the practical experience in selected instrumental methods of analysis.
- Develop the skills on instrumental methods for planning, developing, conducting, reviewing, conducting experimentsand reporting results.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.
- Students will be assigned numerical problems to understand the concepts.

UNIT – I

Flame photometry and Atomic absorption spectrometry: Energy level diagrams-atomic absorption spectra. Flame characteristics.Flame atomizers and electrothermal atomization.Comparison of spectral interferences, chemical and physical interferences in FP and AAS.Background correction methods in AAS.Use of organic solvents. Quantitative techniques-calibration curve procedure and the standard addition technique. Typical commercial instruments for FP and AAS (Single and double beam atomic absorption spectrophotometers), applications of FES and AAS.Qualitative analysis and quantitative evaluations.Relative detectabilities of atomic absorption and flame emission spectrometry.

Molecular luminescence spectrometry: Theoretical basis for fluorescence and phosphorescence. Singlet and triplet excited states. Variables affecting luminescence-quantum efficiency, transition types, structure and structural rigidity, temperature and solvent effects, effect of *p*H, dissolved

oxygen and concentration effect. Excitation spectra *vs* emission spectra.Origin of fluorescence, relationship between fluorescence and concentration.Fluorescence instrumentation-fluorometers and spectrofluorometers.Sensitivity and selectivity.Modification necessary to measure phosphorescence.Applications of fluorometry: inorganic and organic analyses.

Nephelometry and turbidometry: Principles, instrumentation and applications.

[16 HOURS]

UNIT – II

Electroanalytical methods: Classification. Potentiometers, galvanostats and potentiostats.

Potentiometric methods of analysis.Potentiometric electrochemical cells.The Nernst equation.Liquid junction potentials.Reference electrodes-SHE, calomel electrode and silver/ silver chloride electrode.Metallic indicator electrodes-electrodes of first kind and second kind.Redox electrodes.Membrane electrodes –membrane potential, selectivity of membranes.Glass ion selective electrodes.Crystalline solid state ion selective electrodes.Liquid-based ion selective electrodes.Gas sensing electrodes.Potentiometric biosensors.Quantitative applications.Activity *vs* concentration.Quantitative analysis using external standards and the method of standard additions.Measurement of*p*H.Clinical and environmental applications.

Electrogravimetric analysis: Theory, apparatus, cell processes, deposition and separation, electrolytic separation of metals, applications.

Coulometric methods of analysis: General discussion, coulometry at controlled potential, apparatus and general technique, applications,coulometric titrations (amperometriccoulometric)-principles, apparatus, comparison of coulometric titrations with conventional titrations, automatic coulometric titrations, applications.

Amperometric titrations: Principle, titration curve, apparatus and techniques, applications.

Voltammetry: Fundamentals of voltammetry. Cyclic voltammetry**:** Principles and applications. Stripping analysis: Stripping voltammetry-basic principles, electrodes used for stripping analysis, apparatus for stripping analysis, applications, determination of lead in water voltammetry with micro electrodes.

[16 HOURS]

UNIT – III

Thermal method of analysis: Introduction,

Thermogravimetric analysis (TGA): Types of thermogravimetric analysis, principles and general thermal decomposition curve. Factors affecting the results-heating rate, furnace, instrument control/ data handling. Applications-purity and thermal stability, evaluation of correct drying temperature, analysis of complex mixture and determination of kinetic parameters of thermal degradation.

Differential thermal analysis (DTA): General principles. Theory-variables affecting the DTA curves. Instrumentation. Applications-analysis of the physical mixtures and thermal behaviour study. Determination of melting point, boiling point and decomposition point.

Differential scanning calorimetry (DSC): Basic principle. Instrumentation-power compensated DSC, Heat flux DSC. Applications- studies of thermal transitions and isothermal crystallization. Testing the purity of the pharmaceutical samples.

Thermomechanical analysis. Dynamic mechanical analysis**.**

Enthalpimetric analysis: Thermometric titrations and direct injection enthalpimetry: Principles,

apparatus and applications.

Microscopic analysis: Principle and mechanism in characterization of compounds by scanning electron and transmission electron microscopic (SEM & TEM) techniques. Components of instruments of SEM and TEM.

[16 HOURS]

References

1. Fundamental of Analytical Chemistry, D.A. Skoog, D.M. West, Holler and Crouch 8th edition, 2005, Saunders College Publishing, New York.
2. Analytical Chemistry, G.D. Christian, 5th edition, 2001 John Wiley & Sons, Inc. India.
3. Quantitative Analysis, R.A. Day and A.L. Underwood, 6th edition,1993 Prentice Hall, Inc. New Delhi.
4. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, 6th edition, Third Indian Reprint, 2003 Pearson Education Pvt. Ltd., New Delhi.
5. Analytical Chemistry Principles, John H. Kennedy, 2nd edition, Saunders CollegePublishing, California, 1990.
6. Instrumental Methods of Analysis by H.H. Willard, L.L. Merritt and J.A. Dean,7th Edition, CBS Publishers, New Delhi, 1988.
7. Principles and Practice of Analytical Chemistry, F.W. Fifield and Kealey, 3rd edition, 2000, Blackwell Sci., Ltd. Malden, USA.
8. Modern Analytical Chemistry, David Harvey, McGraw Hill, New Delhi, 2000.
9. Introduction to Instrumental Analysis, Braun, Pharm. Med. Press. India.
10. Instant Notes of Analytical Chemistry, Kealey and Haines, Viva Books Pvt. Ltd., New Delhi, 2002.
11. Analytical Transmission Electron Microscopy, An Introduction for OperatorsThomas, Jürgen, Gemming, Thomas., Springer, 2014.
12. Scanning Transmission Electron Microscopy, Imaging and Analysis.Pennycook, Stephen J., Nellist, Peter D. (Eds.), Springer, 2011.

SOFT CORE
ANALYTICAL CHEMISTRY PRACTICALS

COURSE CODE: 21CHD50 [64 HOURS]

Objectives

- To familiarize with the handling of instruments in the quantitative analysis of various samples.
- To understand the analysis of real samples like waste water, soil samples and biological samples and mixtures

Course Outcome

After studying this course, the student to:

- Get experience on analysis of various complex mixtures by following multistep reactions.
- Acquire the knowledge on handling instruments and to overcome the general problems arises during the analysis.
- Acquire industrial skills required for sampling, analytical and interpretation and presentation of results.
- Possess adequate knowledge on literature search for developed analytical methods.

Pedagogy

- Each student performs experiments as per the protocol in practical classes.
- Computer aided applications are used for the evaluation of experimental results.

[128 HOURS]

PART – III

1. Determination of calcium in limestone by redox, acid-base and complexation titrations.
2. Determination of vitamin C in orange juice by titration with cerium(IV) and with 2,6-dichlorophenol indophenol.
3. Determination of mercury in an algaecide by EDTA titration; and arsenic in ant control preparation by redox titration.
4. Determination of aluminium and magnesium in antacids by EDTA titration.
5. Analysis of a copper-nickel alloy sample for copper and nickel by EDTA titration using masking and selective demasking reactions.
6. Determination of saccharin in tablets by precipitation titration.
7. Determination of iodine value and saponification value of edible oils.
8. Determination of ascorbic acid in goose berry/bitter gourd by titrimetry and spectrophotometry using *N*-bromosuccinimide (NBS).
9. Analysis of a mixture of iron(II) and iron(III) by EDTA titration using *p*H control.
10. Determination of sulpha drugs by potentiometry using $NaNO_2$ and iodometric assay of penicillin.
11. Solvent extraction method for determination of silver as ion-associate with 1,10-phenanthroline and bromopyragallol red.
12. Electrolytic determination of copper and lead in brass.

13. Polarographic determination of copper and zinc in brass.
14. Determination of sodium, potassium and calcium in mineral waters by atomic emission spectrometry.
15. Determination of iron in mustard seeds and phosphorus in peas by spectrophotometry.
16. Analysis of waste water for anionic detergents and phenol by spectrophotometry.
17. Fluorimetric determination of riboflavin (vit.B_2) in tablets.
18. Colorimetric analysis of procaine by diazotization and coupling reaction.
19. Determination of manganese in steel by extraction-free spectrophotometry and molybdenum in steel by extractive spectrophotometry.
20. Determination of ethanol in wine by titrimetric and spectrophotometric dichromate methods

PART – IV

1. Analysis of waste waters for DO and COD by titrimetry.
2. Analysis of a ground water sample for sulphate by titrimetry (EDTA) and turbidimetry.
3. Potentiometric determination of formula and stability constant of a silver-ammonia complex ion.
4. Determination of aspirin, phenacetin and caffeine in mixture and APC tablets by solvent extraction and UV spectrophotometry.
5. Kinetic determination of urinary creatinine and purity of a commercial H_2O_2 sample.
6. Determination of chromium(III) and iron(III) in a mixture by kinetic masking methods.
7. Catalytic determination of traces of selenium in biological materials and iodide in blood serum.
8. Photometric and potentiometric titration of iron(III) with EDTA.
9. Photometric and potentiometric titration of copper with EDTA.
10. Determination of copper(II) and iron(III) in mixture by photometric titration with EDTA.
11. Analysis of brackish water for chloride content by a) spectrophotometry (mercuric thiocyanate method), b) conductometry (silver nitrate) and c) potentiometry (silver nitrate).
12. Conductometric titration of sodium acetate with HCl and NH_4Cl with NaOH.
13. Ascorbic acid determination in natural orange juice by coulometry.
14. Spectrophotometric determination of iron in natural waters using thiocyanate and 1,10-phenanthroline as reagents.
15. Determination of fluoride in drinking water/ground water by spectrophotometry(alizarin red lake method).
16. Analysis of waste water for
    a) Phosphate by molybdenum blue method
    b) ammonia-nitrogen by Nessler's method
    c) nitrite-nitrogen by NEDA method
15. Analysis of a soil sample for
    a) Calcium carbonate and organic carbon by titrimetry.
    b) Calcium and magnesium by EDTA titration.

16. Analysis of a soil sample for
    a) Nitrogen content by Kjeldahl method
    b) Available phosphorus by spectrophotometry.
    c) Nitrate-nitrogen/nitrite nitrogen/ammonia nitrogen by spectrophotometry.
    d) Sodium and potassium by flame photometry.
17. Analysis of urine for
    a) Urea and uric acid by titrimetry and spectrophotometry.
    b) Sulphate by precipitation titration after ion-exchange separation.
    c) Sugar by Benedict's reagent.
18. Analysis of blood for
    a) cholesterol by spectrophotometry
    b) Bicarbonate by acid-base titration.
19. Fluorimetric determination of quinine in an antimalarial tablet.

References

1. Fundamental of Analytical Chemistry, D.A. Skoog, D.M. West, Holler and Crouch 8thedition, 2005, Saunders College Publishing, New York.
2. Analytical Chemistry, G.D. Christian, 5th edition, 2001 John Wiley & Sons, Inc. India.
3. Quantitative Analysis, R.A. Day and A.L. Underwood, 6th edition, 1993, prentice Hall, Inc. New Delhi.
4. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, 6th edition, Third Indian Reprint, 2003 Pearson Education Pvt. Ltd., New Delhi.
5. Analytical Chemistry Principles, John H. Kennedy, 2nd edition, Saunders College Publishing, California, 1990.
6. Quantitative Analysis of Drugs in Pharmaceutical Formulations, P. D. Sethi, 3rdedition, CBS Publishers & Distributors, New Delhi, 1997.
7. Practical Clinical biochemistry methods and interpretations, R. Chawla, J.P. BothersMedical Publishers (P) Ltd., 1995.
8. Laboratory Manual in Biochemistry, J. Jayaraman, New Age International Publishers, New Delhi, 1981.
9. Experiments on Water Pollution, D.I. Williams and D. Anglesia, Wayland Publishers Ltd., England, 1978.
10. Experiments on Land Pollution, D.I. Williams and D. Anglesia, Wayland Publishers Ltd., England, 1978.
15. Experiments in Environmental Chemistry, P.D. Vowler and D.W. Counel, Pergamon Press, Oxford 1980.
16. Manual Soil Laboratory Testing, vol.I, K.H. Head, Pentech Press, London 1980.

INORGANIC CHEMISTRY PRACTICALS
COURSE CODE: 21CHD51 [64 HOURS]

Objectives

- To familiarize with the instrumental methods of analysis for determining metals present in the different samples.
- To familiarize with the preparation and characterization of different inorganic complexes.

Course Outcome

- Determination of alloy samples and understanding the electrochemical deposition of metals.
- Preparation and characterization of coordination compounds.
- Determination of composition, stability constant and magnetic susceptibility of metal complexes.

Pedagogy

- Each student performs experiments as per the protocol in practical classes.
- Spectroscopic tools are applied for the characterization of the synthesized complexes.

Course experiments

PART-A

1. Determination of bismuth, cadmium and lead in a mixture: Analysis of a low melting alloy (Wood's alloy).
2. Simultaneous spectrophotometric determination of chromium and manganese in a steel solution.
3. Determination of chromium(III) and iron(III) in a mixture: Kinetic masking method.
4. Electrogravimetric determination of:
   a) Copper in copper sulphate
   b) Nickel in nickel suphate
   c) Copper and nickel in alloy solution
   d) Lead in lead nitrate.
5. Flame photometric determination of the following metal ions from different samples: a) sodium b) potassium and c) sodium and potassium in a mixture.
6. Polarographic estimation of cadmium and zinc.
7. Determination of iron as the 8-hydroxyquinolate by solvent extraction method.
8. Quantitative determination of nickel using dithizone and 1,10-phenanthroline by synergistic extraction.
9. Spectrophotometric determination of the *p*Ka value of methyl red.
10. Semimicro gravimetric determination of aluminium.

PART-B

1. Preparation and characterization of:
   a) Chloropentammine cobalt(III) chloride
   b) Estimation of chloride in a complex by potentiometric or ion-exchange method
   c) Record the electronic absorption spectrum of a complex and verify Tanabe Sugano diagram.
2. Preparation of *cis*- and *trans*- dichlorobis(ethylenediammine) cobalt(III)chloride. Record the UV-Vis spectra and compare it with *cis*-form. Measure the molar conductance.

3. Preparation of hexammine cobalt(III) chloride and estimate cobalt ion.
4. Determination of magnetic susceptibility of any two compounds/complexes by Gouy method.
5. Determination of the composition of iron-phenanthroline complex by:
   (d) Job's method
   (e) mole-ratio method and
   (f) Slope-ratio method.
6. Determine the stability constant of iron-tiron/iron-phenanthroline by Turner-Anderson method.
7. Preparation of potassium tris(oxalato)ferrate(III) and estimate the metal ion.
8. Preparation of acetyl acetonatomanganese(III) complex.
9. Preparation of tris(en)nickel(II) chloride and hexamine nickel(II) chloride complexes. Record electronic spectra and evaluate spectrochemical series.
10. Using chloropentammine cobalt(III) chloride, prepare nitro and nitritopentammine cobalt(III) chloride. Record the IR spectra of the isomers and interpret.
11. Estimate the chloride ion in a given complex by silver nitrate titration after ion-exchange separation.
12. Demonstration Experiments:
   (d) Recording and interpretation of IR and NMR spectra of complexes.
   (e) Spectrochemical series-Evaluation of Dq value.
   (f) DNA interaction with metal complexes by UV-visible absorption and viscosity methods.

References

1. Advanced Physico-Chemical Experiments – J. Rose.
2. Instrumental Analysis Manual - Modern Experiments for Laboratory – G.G. Guilbault and L.G. Hargis.
3. A Text Book of Quantitative Inorganic Analysis – A.I. Vogel, 5th edition.
4. Experimental Inorganic Chemistry – G. Palmer.
5. Inorganic Synthesis – O. Glemser.
6. Experimental Inorganic/Physical Chemistry- Mounir A. Malati.
7. Quantitative Chemical Analysis – Daniel C. Harris, (2006) 7th edition.
8. Spectrophotometric Determination of Elements – Z. Marczenko

ORGANIC CHEMISTRY PRACTICALS
COURSE CODE: 21CHD52 [64 HOURS]

Objectives

- To understand the concepts of isolation and purification of natural products.
- To familiarize with the estimation of different functional groups in organic compounds.

Course Outcome

- The isolation of caffeine, carotene, lycopene, cincole, azelaic acid and piperine from respective natural sources.
- Estimation of ketones, sugars, nitro and amino groups in natural products.
- Interpret UV, IR, NMR and MS data of different organic compounds.

Pedagogy

- Each student performs experiments as per the protocol in practical classes.
- Spectroscopic tools are applied for the characterization of isolated natural products.

Course experiments

PART-A

1. Fractional crystallization: separation of mixture of naphthalene and biphenyl.
2. Thin layer chromatography: Separation of plant pigments.
3. Column chromatography: Separation of *o*- and *p*-nitro aniline
4. Isolation of piperine from pepper.
5. Isolation of caffeine from tea.
6. Isolation of azelaic acid from castor oil.
7. Isolation of carotene from carrot.
8. Isolation of lycopene from tomato.
9. Isolation of cincole from eucalyptus leaves.

PART-B

Isolation of natural products & estimations:

1. Estimation of ketones by haloform reaction.
2. Estimation of sugars by Bertrand's method.
3. Estimation of nitro groups.
4. Estimation of amino group.
5. Determination of enol content by Meyer's method.
6. Determination of iodine value of an oil or fat.
7. Determination of saponification value of oil.
8. Determination of equivalent weight of carboxylic acid by silver salt method

Interpretation of Spectra: Structural elucidation of some simple organic compounds by UV, IR, NMR and mass. Spectra have to be provided by the Teachers/ Examiners.

References

1. Vogel' text book of practical organic chemistry, V edition, B. S. Furniss, A. J. Hannaford, P. W. G. Smith, A. R. Tatehell.
2. Elementary practical organic chemistry, Part-III: Quantitative organic analysis, By Arthur I, Vogel.
3. Laboratory manual of Organic Chemistry by B. B. Dey and M. V. Sitaraman.
4. Practical Organic Chemistry by Mann F. G. and Saunders.
5. Natural products: A laboratory guide by Raphael Ikhan.

PHYSICAL CHEMISTRY PRACTICALS

Objectives **COURSE CODE: 21CHD53** **[64 HOURS]**

- To understand the significance of various factors influencing the reaction rate in proposing the reaction mechanism.
- To understand electrochemical and spectrophotometric methods of quantification of samples, and also determination of physico-chemical parameters of some important samples.

Course Outcome

- Students can able to develop experimental skill and interpretation of plausible mechanisms of reactions.
- Gain practical knowledge on the theoretical basis of electrochemistry, thermodynamics, and spectrophotometry experiments.
- This helps in academics, research and industries.

Pedagogy

- Each student performs experiments as per the protocol in practical classes.
- Electrochemical and spectrophotometric tools are used to conduct the experiments.

Course experiments

PART-A

1. Determination of order of reaction for the acid hydrolysis of methyl acetate and evaluation of activation parameters.
2. Evaluation of Arrhenius parameters for the reaction between $K_2S_2O_8$ and KI (First order reaction).
3. Study of kinetics of autocatalytic reaction between oxalic acid and $KMnO_4$ and determine the order of reaction with respect to $KMnO_4$.
4. Kinetics of saponification of ethyl acetate by conductivity method and study the effect of dielectric constant of the medium (using CH_3OH).
5. Study of effect of salt (ionic strength) on the kinetics of reaction between potassium persulphate and potassium iodide (second order reaction).
6. Spectrophotometric kinetics of oxidation of indigocarmine (IC) by chloramine-T (CAT) – Determination of order of reaction with respect to [CAT] and [IC].
7. To study the acid catalysed kinetics of oxidation of glycine by chloramine-T (CAT) - determination of order of reaction with respect to [CAT] and [glycine].
8. Study the phase diagram of three component system (Glacial acetic acid-Chloroform-water system / Glacial acetic acid-Acetone-Water system).
9. Study the rate of corrosion and inhibition efficiency of an inhibitor (thiourea) on mild steel/Al/Cu by weight loss method.

PART-B

1. Conductometric titration of orthophosphoric acid against NaOH.
2. Conductometric titration of a mixture of HCl, CH_3COOH and $CuSO_4$ against NaOH.
3. Conductometric titration of thorium nitrate with potassium tartarate.
4. Potentiometric titration of mixture of weak acids (acetic acid and monochloroacetic acid) against NaOH.
5. Dwtermination of pK_a values of phosphoric acid by potentiometric / pH metric method.

6. Potentiometric titration of mixture of KCl+KBr+KI against $AgNO_3$.
7. Potentiometric titration of FAS against ceric sulphate and sodium metavenadate, determine the concentration of FAS and redox potential.
8. Potentiometric titration of lead nitrate against EDTA and determine the concentration of lead nitrate solution.
9. Determination of *p*K value of an indicator (methyl orange/methyl red).
10. Spectrophotometric analysis of a mixture of (a) $KMnO_4$ and $K_2Cr_2O_7$.
11. Study of complex formation between ferric salt and salicylic acid.

References

1. Practical Physical Chemistry – A.J. Findlay.
2. Experimental Physical Chemistry – F. Daniels *et al*.
3. Selected Experiments in Physical Chemistry – Latham.
4. Experiments in Physical Chemistry – James and Prichard.
5. Experiments in Physical Chemistry – Shoemaker.
6. Advanced Physico-Chemical Experiments – J. Rose.
7. Practical Physical Chemistry – S.R. Palit.
8. Experiments in Physical Chemistry – Yadav, Geol Publishing House.
9. Experiments in Physical Chemistry – Palmer.
10. Experiments in Chemistry – D.V. Jahagirdar, Himalaya Publishing House, Bombay, (1994).
11. Experimental Physical Chemistry – R.C. Das and B. Behera, Tata Mc Graw Hill.

SOFT CORE

DISSERTATION/PROJECT WORK–SOFT CORE

COURSE CODE: 21CHD54

Course Outcome

After studying this course, a student will be to:

- Carry out literature survey on the problem/s to be solved.
- Learn and follow suitable research methodologies to propose and to perform Experiments.
- Attain the state of ability to take up research work.
- Better understanding about research articles, patents, book chapters or books on relevant research problem.
- Acquire skills of writing research reports in the form of articles or thesis.

Student may take up Project Work/ Dissertation under the guidance of the faculty of the department during the IV Semester as a Soft Core course.

SOFT CORE
AUTOMATED METHODS AND REAL SAMPLE ANALYSIS
COURSE CODE: 21CHD55

Course content

Objectives

- To understand the instrumentation and applications of automated methods of analysis.
- To familiarize with analysis of real samples and clinical analysis.

Course Outcome

- Understand various types of automated methods of analysis.
- Identify activities that can be fully or partially automated.
- Automated chemical analysis will be very helpful in the clinical as well as pharmaceutical field to perform the purity analysis of the sample, although the sample size is very small, expensive and fast analysis.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.
- Students will be assigned numerical problems to understand the concepts.

UNIT-I

[16 HOURS]

Automated methods of analysis: An overview, definition, distinction between automatic and automated systems, advantages and disadvantages by automation, types of automated techniques. Nondiscrete techniques, segmented flow methods and basic equipment, special techniques and devices, theoretical considerations and problems, applications. Single channel and multi channel auto analysers, BUN analyzers, automatic glucose analyzers and ammonia in water analyzers, COD analyzers, CFA in industry. Non-segmented flow methods: Flow injection analysis. Principles, types of dispersion, factors affecting dispersion, applications of small, medium and large dispersions. Stopped flow methods, flow injection titrations. Discrete methods: Centrifugal fast scan analyzer, automatic multipurpose analyzers, Automatic elemental analyzer, automated analyzer based on multi layer film-principles, film structure, instrumentation applications. Comparison of discrete and non-discrete methods. Advantages of flow injection measurements over continuous flow measurements.

UNIT-II

[16 HOURS]

Analysis of real samples-real sample, choice of analytical method-defining the problem, investigating the literature, choosing or devising a method, testing the procedure, analysis of standard samples, using other methods, standard addition to the sample. Accuracy in the analysis of complex materials.

Decomposing and dissolving the sample- sources of error in decomposing and dissolution. Decomposing samples with inorganic acids. Microwave decomposition. Combustion methods for decomposing organic samples. Decomposition of inorganic materials with fluxes.

Clinical Analysis- Introduction, features of clinical analysis. Composition of blood, collection and preservation of samples. Common determinations - serum electrolytes, blood glucose and blood urea nitrogen, uric acid, albumin and globulins, acid and alkaline phosphates, barbiturates,

chloride, sodium and potassium, bicarbonate, serum creatinine and cholesterol. Urine analysis-Principle components. Sample collection and preservation. Determination of creatinine, chloride, uric acid, ammonia, ascorbic acid, bilirubin and calcium.

References

1. Fundamental of Analytical Chemistry, D.A. Skoog, D.M. West, Holler and Crouch 8th edition, 2005, Saunders College Publishing, NewYork.
2. Analytical Chemistry, G.D. Christian, 5th ed., 2001 John Wiley & Sons, Inc,India.
3. Quantitative Analysis, R.A. Day and A.L. Underwood, 6th edition,1993 prenticeHall, Inc. NewDelhi.
4. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney,J.D. Barnes and M.J.K. Thomas, 6th edition, Third Inidan Reprint.2003 PearsonEducation Pvt. Ltd., NewDelhi.
5. Analytical Chemistry Principles, John H. Kennedy, 2nd edition, Saunders College Publishing, California,1990.
6. Principles and practice of analytical chemistry. Fifield andKealey.
7. Instant Notes of Analytical Chemistry, Kealey and Haines, Viva Books Pvt.Ltd.,2002.

BIOINORGANIC PHOTOCHEMISTRY
COURSE CODE: 21CHD56

Objectives

- To understand the photochemistry of inorganic compounds.
- To familiarize with the applications of fluorescents and chromogenic sensing and labeling.
- To learn photodynamic inactivation of microorganisms.

Course Outcome

- Basic concepts of photochemistry and photochemical reactions.
- Understand many organometallic compounds as fluorescent agents in the detection of cations, anions and toxic ions in the living system.
- Theory of photodynamics, and photocatalysis.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.

Course content

UNIT-I **[16 HOURS]**

Introduction, Philosophy of bioinorganic photochemistry

Fundamentals: Light and matter. Nature of light, Accessible light sources and Interaction between light and matter.

Formation and properties of electronic excited states: Wave mechanics and quantum numbers and Electronic excitation.

Photophysical deactivation of electronic excited states: Spontaneous deactivation, Quenching and Coordination and organometallic compounds.

Photochemical reactions: Photochemical reaction channels, Intramolecular photoreactions, Photodissociation and photoionization, Photoisomerization, Intermolecular photoreactions, the coordination compound specificity. Ligand field photochemistry, Photochemistry from LC or LLCT states, Inner-sphere charge transfer photochemistry, Outer-sphere charge transfer photochemistry, Photosensitized reactions, Homogeneous photocatalysis.

Natural photo-processes involving inorganic compounds

From interstellar space to planetary atmospheres: Homogeneous systems: from interstellar space to planetary atmospheres and primitive soup models. Heterogeneous photochemistry in ice phases.

UNIT-II

[16 HOURS]

Applications: Fluorescent and chromogenic sensing and labeling: Cations as targets in biochemical sensing Cations common in biological systems, Fluorescent detection of toxic cations, Fluorescent and chromogenic sensing of anions, Common anions and Toxic anions. Optical detection of neutral molecules. Nanoparticles in biochemical sensing and labeling.

Therapeutic strategies; Photobio-stimulation, Photo-activation of drugs, Photodynamic therapy, Mechanisms of PDT and PTT. Photosensitizers, Inorganic photosensitizers, Supporting role of metal ions in photodynamic therapy, and Combination of polypyrrolic photosensitizers and metallo-pharmaceuticals, Recent PDT development and Nanomedical methods.

Photodynamic inactivation of microorganisms: Bacteria, Viruses, Fungi and Parasites.

Phototoxicity and photoprotection: Chemical and physical photoprotection. Inorganic sunscreens.

Photocatalysis in environmental protection: Development of homo- and heterogeneous methods. Homogeneous photocatalysis and heterogeneous photocatalysis. Water and air detoxification. Other applications of photocatalysis.

References

1. Bioinorganic Photochemistry- Grazyna Stochel, Malgorzata Brindell, Wojciech Macyk, Zofia Stasicka, Konrad Szacilowski. Wiley Publishers (2009).
2. Photochemistry and Photophysics of Coordination Compounds I-Volume Editors: Balzani, V., Campagna, Springer Publications.Vol.280, 2007.
3. Photochemistry and Photophysics of Coordination Compounds II - Volume Editors: Balzani, V., Campagna, Springer Publications.Vol.281, 2007.

MEDICINAL CHEMISTRY

COURSE CODE: 21CHD57

Objectives

- To familiarize with the methods of isolation, structural elucidation and synthesis of carotenoids and vitamins.
- To learn the basics of medicinal chemistry.
- To understand the synthesis and applications of synthetic drugs.

Course Outcome

- To acquire the knowledge of biological significances of Carotenoids and vitamins.
- Understand the pharmacodynamics, pharmacokinetics and chemotherapy of several drugs.
- Synthesis and mechanism of drug actions of antimalarial, anticancer agents and cardiovascular drugs.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.

Course content

UNIT-I

[16 HOURS]

Carotenoids: Methods of isolation. Structure elucidation and synthesis of β-carotene. Structural relationship of α-, β- and γ-carotenes.

Vitamins: Introduction, constitution, synthesis and biological significance of thiamine, riboflavin, pyridoxine, biotin, ascorbic acid, vitamin A_1 & A_2, E_1 and E_2 , B_{12} and K groups.

UNIT-II

[16 HOURS]

Medicinal chemistry: Introduction, pharmacodynamics, pharmacokinetics, chemotherapy, metabolites antimetabolites, agonists and antagonists. Classification of drugs on the basis of therapeutic action. Concept of pro drug and soft drug. Theories of drug activity: Occupancy theory, rate theory, induced fit theory, concept of drug receptors. Evaluation methods: Free-Wilson analysis, Hansch-analysis, ID_{50} and IC_{50} (mathematical derivation of equation excluded).

Antipyretics: Aspirin, paracetamol, phenacetin, novalgin and their mechanism of action.

Antimalarials: Structure, synthesis and mechanism of action of quinine and chloroquine.

Hypnotics: Analgesics and sedatives: phenoborbitol, chlordiazepoxide, meprobamate.

Stimulants: Structure, action and synthesis of caffeine.

Antineoplastics: Structure, pharmacological action and synthesis of 5-flurouracil, chlorambucil, cyclophosphaminde and podophyllotoxin.

Cardiovascular drugs: Introduction, synthesis of dithiazem, verapamil, methyldopa, atenolol and oxprenolol.

References

1. Organic Chemistry, VI edition, Robert T. Morrison, Robert N. Boyd.
2. Organic Chemistry, Vol-II by I. L. Finar.
3. A text book of synthetic drugs, O. D. Tyagi and M. Yadav.
4. Synthetic drugs, Gurdeep R. Chatwal.
5. Medicinal chemistry by Graham Patrick.

QUANTUM CHEMISTRY AND BIOSENSORS

COURSE CODE: 21CHD58

Objectives

- To understand the applications of quantum mechanics to HMO theory.
- To learn the basics of biosensors and their applications.

Course Outcome

- Applications of quantum chemical methods in the theoretical evaluation of energies of molecules and reactions.
- Development of chemical and biochemical sensors and their applications in the determination of biomolecules.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are also used in class room teaching.
- Students will be assigned to solve the numerical problems.

Course content

UNIT-I

16 HOURS]

Applications of quantum mechanics: Variation theorem: Statement and proof, application of variation theorem to a particle in one dimensional box, linear oscillator, H and He-atoms. Molecular orbital theory, LCAO-MO approximation, application to hydrogen molecule ion (H^{2+}), energy levels of H^{2+}, bonding and antibonding molecular orbitals, energy distribution, potential energy diagrams. Valence bond theory (VB), theory of H_2 molecule, Heitler-London method, energy levels, various modifications of Heitler-London wave function. Comparison of MO and VB theories. SCF method for many electron atom. Slater Orbitals –Effective nuclear charge (ENC), expressions for slater orbitals for 1s, 2s, 3s, 2p and 3d electrons (no derivation), Slater's rules for calculation of ENC. Theories of valence – Introduction, linear and non-linear variation functions, secular equations, coulombic, exchange, normalization and overlap integrals, secular determinants.

Huckel molecular orbital theory: Outline of method, assumptions. Application to ethylene, allyl radical, cyclopropenyl radical, butadiene, cyclobutadine, bicyclobutadine and benzene. Calculation of delocalization energy, charge density, π-mobile bond order and free valence.

UNIT-II

[16 HOURS]

Biosensors: Introduction, electrochemical biosensors: Amperometric, potentiometric and conductometric biosensors. Optical based biosensors: Surface plasma resonance, chemiluminesence, fibre optic biosensors, piozoelectronic sensors, mass selective and thermal sensors. Bio-recognition elements in biosensors, immobilization methods, principles of biorecognition, natural, semi-synthetic and synthetic biorecognition elements. Metabolism sensors: Glucose sensors, galactose sensors. Determination alcohol, ascorbic acid, D-isocitrate, oxalate, oxaloacetate, nitrite, nitrate, carbon monoxide, glycerol, triglycerides and sucrose. Biosensors using coupled enzyme reactions.

Applications of biosensors: Determination of glucose in blood, survey of biosensor methods for the determination of glucose. Determination of copper (I) in water using anodic stripping voltammetry.

References

1. Introductory Quantum Chemistry – A.K. Chandra. Second Edition, Tata McGraw Hill Publishing Co. Ltd., (1983).
2. Quantum Chemistry – Eyring, Walter and Kimball. John Wiley and Sons, Inc.
3. Quantum Chemistry –I.N. Levine. Pearson Education, New Delhi, (2000).
4. Theoretical Chemistry – S. Glasstone. East West Press, New Delhi, (1973).
5. Quantum Chemistry – R.K. Prasad, New Age International Publishers, (1996).
6. Valence Theory – Tedder, Murel and Kettle.
7. Surface chemistry: Theory and applications, J. J. Bikertman, Academic press, (1972).
8. Chemical Kinetics, K. J. Laidler 3rd Edn., Harper International Edn., (1087).
9. Test Bok of Physical Chemistry, S. Glasston, McMillan India Ltd., 2nd Edn. (1986).
10. Physics at Surfaces, A. Zangwill, Combridge University Press (1988).
11. Surface Crystallography, L. J. Clarke, Wiley-Interscience (1985).
12. Biosensors: Fundamentals and Applications, Bansi Dhar Malhotra and Chandra Mouli Pandey, Smither Group Co., 2017, UK.
13. Biosensors: Techniques and Instrumentations in Analytical Chemistry, Frieder Scheller and Florian Schubert, Vol. 11, Elsevier Sci. Publishers, 1992.
14. Chemical Sensors and Biosensors, Brian R. Eggins, John Wiley & Sons Ltd, UK, 2004.

JSS COLLEGE OF ARTS, COMMERCE & SCIENCE

(AUTONOMOUS)

OOTY ROAD, MYSORE-570 025

Postgraduate Department of Commerce

Syllabus

2021 – 22

First Semester M.Com

Sl. No.	Course Code	Title of the course	Hard core/ Soft core/	Number of Credits			
				L	T	P	TOTAL
HC01	MCA010	Accounting Theory	HC	3	1	0	4
HC02	MCA080	Corporate Governance and Business ethics	HC	3	1	0	4
HC03	MCA090	Advanced Financial Management	HC	3	1	0	4
HC04	MCA100	Strategic Marketing	HC	3	1	0	4
SC01	MCA210	Business Policy and Environment	SC	3	1	0	4
SC02	MCA220	Statistics for Business Decisions	SC	3	1	0	4

Note: students can register for any one of the above soft cores.

Second semester M.Com

Sl. No.	Course Code	Title of the course	Hard core/ Soft core	Number of Credits			
				L	T	P	TOTAL
HC05	MCB030	Organizational Behavior	HC	3	1	0	4
HC06	MCB050	Entrepreneurial Development	HC	3	1	0	4
HC07	MCB010	Capital Market Instruments	HC	3	1	0	4
SC05	MCB240	Human Resource Management	SC	3	1	0	4
SC06	MCB270	Management of Financial Services	SC	3	1	0	4
SC07	MCB250	Banking Technology	SC	3	1	0	4

Note: Students can register for any two of the above soft cores.

M.COM- SYLLABUS

First Semester

HARD CORE SUBJECTS

HC01: MCA010 ACCOUNTING THEORY

1. **Course Description:** The course provides the coverage of the meaning of accounting theory, its types, approaches to formulate accounting theory; the IASB's conceptual framework; recognition, measurement and disclosure of elements of financial statements.

2. **Course Outcome:**
   - CO1 Acquaint a set of logical principles for evaluation and development of sound accounting practices.
   - CO2 knowledge on conceptual framework of accounting theory
   - CO3 Critical thinking skills to analyze and interpret accounting transactions.
   - CO4 Understand the recognition, measurement and disclosure principles of elements of financial statements.

3. **Pedagogy:** Course activities consist of lectures, case study analysis, group discussions, seminar presentation, assignment writing and tests. Reading and analysis of annual reports of companies will be the integral part of instruction.

4. **Course Contents:**

Module 1: The Meaning of Accounting Theory: The meaning of accounting theory; relationship with accounting research and practice. Types of accounting theories- syntactical, semantical and behavioral theories. Approaches to formulation of Accounting Theory. Ownership theories - proprietary, entity and fund theories.

Module 2: The Conceptual Framework of Accounting: The IASB Framework for the Preparation and Presentation of Financial Statements-preface, purpose and scope; Users and their information needs; Objectives of financial statements; Underlying concepts and assumptions; Qualitative characteristics of financial statements; Constraints on relevant and reliable information; True and fair view; the elements of financial statements; Structure and format of financial statements. The accounting cycle.

Module 3: Recognition, Measurement and Disclosure of Elements of Income Statement: The concept of revenue and expense; their recognition principles and processes, measurement methods and disclosure issues. Recognition, measurement and disclosure of gains and losses from extraordinary items, unusual items, discontinued operations, effects of changes in accounting principles, and prior period items. Problems. Case studies on annual reports of companies.

Module 4: Recognition, Measurement and Disclosure of Elements of Balance Sheet: Definition of asset, liability and owners' equity; their types and characteristics. Recognition, measurement and disclosure of long-term and short-terms assets and liabilities, owners' equity and retained earnings. Problems. Case studies of annual reports of companies.

References:

Anthony R.N., D.F. Hawkins and K.A. Merchant, *Accounting: Text and Cases* , McGraw Hill, 1999

Richard G. Schroeder, Myrtle W. Clark and Jack M. Cathey, *Financial Accounting Theory and Analysis: Text Readings and Cases*, John Wiley and Sons, 2005.
Ahmed Riahi Belkaoui, *Accounting Theory*, Quorm Books, 2000.
Jawahar Lal, *Accounting Theory and Practice*, Himalaya Publishing House, 2008.
L.S. Porwal, *Accounting Theory*, TMH, 2000.
Thomas R.Dyckman, Charles J Davis, Roland E.Dukes, *Intermidate Accounting,* Irwin McGraw-Hill.

HC02:MCA080 CORPORATE GOVERNANCE AND BUSINESS ETHICS

Course Outcome:

CO1	Understand the concept of corporate governance
CO2	knowledge about corporate ethics and cultural influences
CO3	Acquire knowledge of corporate social responsibility and accountability
CO4	Analyze the role of E-governance in present scenario.

Pedagogy:

The subject matter will be presented through lecture, class discussion, student presentation, guest lectures and laboratory experiences.

Module 1: Business ethics: Ethics; Doctrine of Trusteeship: Unethical practices; Good ethics and Good Business. Corporate Ethics: Concept and Importance – Benefits of corporate Ethics- Corporate Philosophy and Culture – Managing Ethics and Legal Compliance – Case Analysis.

Module 2: Social Responsibility of Business; Doctrine of Social Responsibilities of Business, Dimensions of Social Responsibility, and Assumptions of S.R. Corporate Social Responsibility: Corporate Crimes – Company and Society Relations – corporate Social Challenges – Corporate Accountability – Business and Ecology –Case Analysis.

Module 3: Concept of Corporate Governance: It's Importance –Agency Theory – Governance model - Benefits of Good Corporate Governance – Present Scenario – Case Studies.

Module 4: Corporate Governance In India: Reforming BOD –Birla Committee – Naresh Chandra Committee – Narayana Murthy Committee – Audit Committee – Corporate Governance Code – The Future Scenario , E-Governance Importance, Requirements and Challenges in Present Scenario – Case Studies.

References:

Business ethics by L.P. Hartman, (Tata Mc Graw Hill)
Business ethics by W.H.Shaw, (Thomson)
Corporate management and Accountability by L.C. Gupta (Mc Millan Institute for FM and Research, Chennai-1974)
Strategic Management by Hill, Ireland and Horkisson (Thomson)
Business and society by Keith Davis (Mc Graw Hill)
Corporate Governance – Fernando.
Business ethics and corporate Governance – Bansal Sandeep, Bansal Sanjiv, Bansal Rama – Kalyani Publishers.

HC03:MCA090 ADVANCED FINANCIAL MANAGEMENT

1. Course Description:

Financial management is a functional area in general management. This subject is focusing on introduction, scope and importance of financial management, investment decisions, capital structure decisions, dividend decisions and working capital management.

2. Course Outcome:

CO1 Understand financial management concepts and its important functions.
CO2 Learn the process of evaluation of projects
CO3 Understand capital structure theories
CO4 Identify the dynamics of financial markets

3. Pedagogy:

Students must work out assigned individual topics, present seminars and participate in case studies or group discussions.

Course Contents:

Module 1: Introduction : Meaning, Scope, and functions of Financial Management. Corporate Objectives-Profit Maximization and Wealth Maximization, their social implications.

Module 2: Capital Budgeting Decision – Importance – Challenges – NCF estimation DCF Techniques- NPV vs IRR – Multiple IRR Problem- Modified IRR (MIRR) – Capital Rationing.

Module 3: Risk Analysis in Capital Budgeting- Approaches to risk absorption- Expected Net Present Value (ENPV) - Payback method - Risk-Adjusted Discount rate - Use of Normal Distributions - Sensitivity analysis - Measurement of Project risk- Risk Analysis of Project Portfolios.

Module 4: Capital Structures Decision – Traditional View – MM's theory- Factors impacting leverage decision. Cost of capital – Cost of equity – Cost of preferred capital- Cost of debt- Cost of retained earnings – WACC- Marginal cost of capital

References:

Pandey, I.M. financial Management, Vikas Publishing House, New Delhi.
Khan M.Y. and Jain P.K. Financial Management, Tata McGraw Hill, New Delhi.
Kishore, R., Financial Management, Taxmans Publishing House, New Delhi.
Chandra, Prasanna; Financial Management TMH, New Delhi.
Horn, Van; Financial management and Policy, Prentice Hall of India.
Brigaham & Houston, Fundamentals of Financial Management, Thomson Learning, Bombay.
Richard Brealey and Stewart Myers, Principles of Corporate Finance, Tata McGraw Hill, 2000.
V K Bhalla, Financial Management and Policy: Text and Cases, Annual Publishers, 2002.

HC04: MCA100 STRATEGIC MARKETING

1. Course Outcome:

- CO1 Understand the marketing strategy formulation
- CO2 Learn the steps in implementation of marketing strategies.
- CO3 Analyze different marketing strategy
- CO4 Learn about formulation and evaluation of marketing strategy

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2. Pedagogy: Teaching method comprises of lecture sessions and tutorials. Lecture sessions focus on providing conceptual understanding and analytical setting for select aspects of the course content.

3. Course Contents:

Module 1: Marketing Management –Core Concepts, scope and importance of marketing management evolution of modern marketing concepts; objectives of marketing; marketing mix; Marketing Strategy Formulations – Key Drivers Of Marketing Strategies - Strategies For Consumer Marketing — Services Marketing – Competitor Analysis - Analysis of Consumer Markets – Strategic marketing planning.

Module 2: Marketing Mix Decisions -Product Planning And Development – Product Life Cycle – New Product Development And Management – Market Segmentation – Target m And Positioning of products – Channel Management – Advertising And Sales Promotions – Pricing Objectives, Policies And pricing strategies.

Module 3: Buyer Behaviour - Buyer Behavior – buying Influencing Factors – Buyer Behaviour Models – Online Buyer Behaviour - Building And Measuring Customer Satisfaction – Customer Relationships Management – study of banking and automobile industries -Customer Acquisition, Retaining, Defection.

Module 4: Marketing Research & Trends In Marketing-Marketing Information System – Research Process – Concepts and Applications: Product – Retail Research – Customer Driven Organizations - Ethics in marketing –Online marketing trends.

References:

1. Marketing Management: Philip Kortler and Kevin Lane Keller, PHI 14th Edition, 2012

2. Marketing management-Text and Cases: KS Chandrasekar, Tata McGrawHill-Vijaynicole, First edition, 2010.

3. Marketing: Paul Baines, Chris Fill and Kelly Page, Oxford University Press, 2nd Edition, 2011.

4. Marketing – An Innovative approach to learning and teaching- A south Asian perspective: Lamb, hair, Sharma, Mc Daniel, Cengage Learning — 2012.

Second Semester

HC05: MCB030 ORGANISATIONAL BEHAVIOUR

1. Course Outcome:

- CO1 Understand individual behaviour in the organization
- CO2 Acquire the knowledge about foundation of individual behaviour
- CO3 Learn and apply skills in motivation
- CO4 Evaluate individual behaviour in group and resolve the conflicts

2. Pedagogy:

Teaching method comprises of lecture sessions and tutorials. Lecture sessions focus on providing conceptual understanding and analytical setting for select aspects of the course content.

3. Course Contents

Module1: Introduction: Meaning-Definitions and scope of organizational behavior-people-Organizational structure-technology and environment-OB as a Behavioral science-Contributing Discipline to OB-Psychology-Sociology-social psychology-Anthropology-Political science-OB and Management-Comparative roles in organization-Case studies.

Module 2: Foundations of Individual Behaviour: Biological Characteristics-Age-Sex-Marital Status-Number of Dependents-Tenure-Ability-Intellectual Abilities- Physical Abilities-The Ability-Job fit personality-personality determinants-Personality Traits-Major Personality Attributes influencing OB-Matching personality and Jobs-Values, attitudes, and Job satisfaction: Importance of Values-Sources of Value system-Sources and types of Attitudes- learning –Theories of learning shaping values -Case Studies.

Module 3: Motivation: The concept of Motivation-Early Theories of Motivation-Hierarchy of Needs theory-theory X and Theory Y-Hygiene theory-contemporary theories of motivation-ERG Theory-three needs theory-cognitive evaluation theory and others –case studies.

Module 4: Foundation of group behaviour: Defining and classifying groups-group process-group tasks-cohesive groups-group dynamics-leadership-nature and importance-functions-styles-communications-nature and types-effective communication-Roles of Formal and informal communication-Conflict management-The process of conflict-types of conflict-functional and dysfunctional conflict-resolution of conflict-case studies.

References:

Organisational Behaviour: Concept, Theory and Practice-Nirmal Singh
Organisational Behaviour - Fred Luthans
Organisation Theory and Behaviour - V S P Rao and PS Narayana
Organisational Behaviour - Niraj Kumar
Organisational Behaviour – K. Aswathappa
Management of organisational change –Harigopal

HC 06:MCB050 ENTREPRENEURIAL DEVELOPMENT

Course Outcome:

CO1	Analyze the foundations and different dimensions of Entrepreneurial Development
CO2	Acquaint the skills of an young entrepreneurs
CO3	Analyze the techniques of project planning, implementation and execution.
CO4	Identify the institutional support to entrepreneurs.

Pedagogy: A combination of Lectures, Case Analysis, Group Discussion, Seminars, Assignments, etc.

Module – 1: Entrepreneurship: Need, Factors affecting Entrepreneurial Development, Entrepreneurial Motivation, Conceptual Model of Entrepreneurship, Entrepreneur Vs Intrapreneur, and Classification of Entrepreneurs. Micro, Small and Medium Enterprises (MSMEs): Meaning and Definitions of MSMEs, Features, Scope, Objectives, Problems and Government Schemes; and MSMEs Act, 2006.

Module – 2: Entrepreneurial Development Programs and Small Business: Role of Government in Organizing such Programs, Women and Rural Entrepreneurs. Small Business: Concept and Definition, Role of Small Business in Modern Indian Economy, Steps for starting a Small Industry, Registration as SSI, Role of SIDBI, Advantages and Problems of SSIs, Institutional Support Mechanism in India, EDI, Incubation Centers, Incentives and Facilities, and Government Policies for SSIs.

Module – 3: Project: Definition, Characteristics, Types, Steps in identification of Projects, Project Life Cycle. Project Management – Meaning and Importance, Role of Project Manager. Project Appraisal - Technical Appraisal, Environment Appraisal, Market Appraisal and Managerial Appraisal. Project Identification - Environment for Business Opportunities, Idea Generation, Short Listing and Selection of Product/Service, Stages in Venture Appraisal.

Module – 4: Project Planning: Identifying Strategic Project Variables; Project Financing: Project Cost Estimation and Working Capital Requirement, Sources of Fund, Preparation of Projected Income Statement, etc; Implementation of Projects - Graphic representation of Project Activities, Project Scheduling, MIS in Project, Problems of Project Implementation.

Reference

1. Singh Narendra, Project Management and Control, Himalaya Publishing House.
2. Prasanna Chandra, Projects: Planning, Analysis, Selection, Implementation and Review, Tata McGraw Hill.
3. P. Gopala Krishnan and V. E Rama Moorthy, Project Management, MacMillan India.
4. Chandra Prasanna, Project Preparation, Appraisal and Implementation, Tata McGraw Hill.
5. A. N Desai, Entrepreneurship Management, Ashish Publishing House.
6. Vasanth Desai, The Dynamics of Entrepreneurial Development and Management, Himalaya Publishing House.
7. Nicholas, Project Management for Business and Technology: Principles and Practice, Prentice Hall of India.
8. Hall B. L, Pickle and Yance, Small Business Management, John Wiley & Sons, USA.
9. Kenneth R. Van Vloorthis, Entrepreneurship and Small Business Management, Allyn and Bacon. Kuvempu University, Master of Commerce (Regular), 2017-18 51
10. C. M. Bammback and J. R. Manscusu, Entrepreneurship and Venture Management, Prentice Hall of India.
11. Yound, Trevour L, Planning and Implementing Project, Sterling Publishing Ltd.
12. C. A Dailey, Entrepreneurship Management, McGraw Hill.

HC07: MCB010 CAPITAL MARKET INSTRUMENTS

1. Course Description:

Capital markets in recent times are flooded with new and innovative instruments enhancing vibrancy and volume of capital markets. Every advanced programme in commerce should consist of a course in analysis and evaluation of various instruments traded in capital markets today.

2. Course Outcome:

CO1	Understand the role of capital markets
CO2	Critically evaluate the various capital market instruments like Stock, bonds etc
CO3	Identify the dynamics of global capital markets
CO4	Understand the concept and use of Derivatives in risk management.

3. Pedagogy:

Teaching method comprises of lecture sessions and tutorials. Lecture sessions focus on providing conceptual understanding and analytical setting for select aspects of the course content.

4. Course Contents:

Module 1: Origin, Nature and Role of Capital Markets -Globalization of Capital markets- Capital Markets in India - Stock exchanges.

Module 2: Stocks, Bonds, Debentures – Types of Debentures, Private Placement, Guidelines for IPO – ADRs - GDRs – ETFs –Units of Mutual funds

Module 3: Derivatives- Basic features – Role of Derivatives markets - Forwards and Futures - Commodity Futures – stock Futures and Index futures.

Module 4: Options - Stock options and Index options-Swaps – Currency Swaps and Interest Rate Swaps.

References:

Financial institutions and markets- by Bhole (TMH).
Financial markets- by M.Y.Khan (Vivek).
Financial Derivatives – Dr.G.Kotreshwar

SOFT CORE SUBJECTS

First Semester

SC01: MCA210 BUSINESS POLICY AND ENVIRONMENT

1. Course Outcome:

CO1	Insight on policy formation
CO2	Understand the environmental factors that influence business
CO3	Knowledge and significance of corporate social responsibility
CO4	Identify the Principles of Business ethics

2. Pedagogy:

Teaching method comprises of lecture sessions and tutorials. Lecture sessions focus on providing conceptual understanding and analytical setting for select aspects of the course content.

3. Course Contents:

Module 1: Introduction: Business Policy: Importance of business policy-essentials of business policy-classification of business policy- Vision, Mission, Objectives –Types of Policies: Production policy-personnel policy- Financial policy-Marketing Policy-case studies.

Module 2: Business in a Social System, Business and Economic system –Business Objectives-External Business Environment.

Module 3: Business Environment: Internal Environment of Business-External Environment-Economic-Political-Socio-Cultural-Technological Environment –case studies

Module 4: Business Ethics: Principles of Business Ethics; Doctrine of trusteeship; unethical practices; good ethics and good business. Social responsibility of business; Doctrine of social responsibility: Rationale of social responsibility; control of monopoly and restrictive and unfair trade practices.

References:

A concept of corporate planning-, Russel Ackoff, Newyork wiley

Business policy and strategic management- Tokyo, McGraw hill

Strategic Management-Text and Cases- V.S.P. Rao and V. Harikrishna

Strategic Management-Azar Kazmi

Strategic Management-Francis Cherunillam

Strategic Management-Subba Rao.

SC02: MCA220 STATISTICS FOR BUSINESS DECISIONS

1. Course Description:

The course comprises of probability theories, sampling techniques, time series analysis and multivariate analysis.

2. Course Outcome:

CO1	Knowledge about application of probability theory and sampling in different areas of commerce
CO2	Analyze the various methods of theoretical probability distribution
CO3	Application of different tools in taking business decisions
CO4	Learn the advanced application oriented tests – F Distribution and Anova

3. Pedagogy:

Class room teaching of basic statistical models shall be followed by solving problems involving business applications. Assigned problems are to be worked on an individual basis, followed by group discussion of case problems.

4. Course Contents:

Module 1: Probability: Meaning, terminology, types and rules. Random variables and use of expected value in decision making. Binomial, Poisson and Normal probability distributions- their characteristics and applications in business decisions.

Module 2: Sampling: Meaning of sample and population. Probability and non-probability methods of sampling. Use of random digits to choose random samples. Sampling from normal and non-normal populations. The Central limit theorem. Use of sampling in business decisions

Module 3: Time Series Analysis : Variations in time series. Cyclical, seasonal and irregular variations. Trend analysis. Application of time series analysis in forecasting.

Module 4: Multivariate Analysis: Multiple regression and correlation analysis. Analysis of Variance. Application of multivariate analysis in business decisions. Using Statistical Package for Social Sciences (SPSS) to solve problems.

References:

Wonnacott and Wonnacott: "Statistics for Business and Economics" Wiley Publications
Wonnacott and Wonnacott: "Econometrics" Wiley Publications
Sanchetti and Kapoor: "Statistics"
Morris Hamber: "Statistical Analysis for Decision Making"
Richard Livin and David Robin: "Statistics for Management"

SC03:MCB270 DISASTER MANAGEMENT

1. **Course Description:** The course essentially covers all aspects of disaster management.
2. **Course Outcome:**

   CO1: Understand the concept of disaster management

   CO2: Learn the management of natural and man-made disaster.

   CO3: Knowledge of National policies on Disaster Management.

3. **Pedagogy**: Method of instruction consists of lectures, case study design and analysis, group discussions, seminar presentations, writing assignments and tests.

4. **Course content:**

Module 1: Basics of Disaster: Definition of hazard and disaster; typology of disaster; natural and human; made disasters. Geological disaster; earth quakes and seismology, volcanic eruptions, tsunami and landslides. Hydrological disasters- floods, droughts and famines, cyclones and hurricanes.

Module 2: Human made disaster: Human instigated disaster; communal forces and violence, caste conflicts, ethnic conflicts, refugees. Industrial and technological accidents, system failure, explosion and chemical leakers/spillage, biological weapons.

Module 3: National policy on disaster management, contingency action plans, financial assistance, from center to states under calamity relief fund. Crisis management groups; their formations and functions

Module 4: Management of disaster: Risk assessment and disaster response, quantification techniques, NGO management, SWOT Analysis based on design and formulation strategies, insurance and risk management, role of financial institutions in mitigation effort.

References:

Encyclopedia of disaster management By Goel, S. L. Deep & Deep, Publication Pvt, Ltd.
Disaster management by G. K. Ghosh, A. P.H Publishing corporation.
Disaster management by R. B. Singh, Rawat Publications
Disaster management : Through the new millennium by Ayaz Ahmed, Anmol Publications.
Emergency medical services and disaster management: A Holistic approach by P.K.Dave, Gaytee Brothers medical Publishers(P) ltd.
Disaster management by D. Narayan, A.P.H. Publishing Corporations.
Model Encyclopedia of Disaster and Hazard management by B.C. Bose, Rajath Publications.
Disaster management by Nikuj kumar, Alpha Publications.
Disaster management: recent approaches by Aravind Kumar. Anmol Publications.

Second Semester

SC05: MCB240 HUMAN RESOURCE MANAGEMENT

1. Course Outcome:

CO1	Knowledge about human resources, their significance and management in organizations
CO2	Analyze human resource planning
CO3	Learn the steps in HRD
CO4	Understand reward system and appraisal of individual

2. Pedagogy:

Teaching method comprises of lecture sessions and tutorials. Lecture sessions focus on providing conceptual understanding and analytical setting for select aspects of the course content.

3. Course Contents:

Module 1: Environmental context: New economic policy and changing business-technological –socio-economic and political and legal environment, structural reforms and their implications for HRM in India-Response of the management-worker and unions to structural reforms and their implications for HRM in India-Response of the management –Worker and unions to structural adjustment. Concepts of human resource management-Meaning-Objectives-Scope and functions-Perspective of HRM: linking corporate strategies and policies with HRM Organization of HRM department.

Module 2: Human Resources planning and Procurement; Job analysis and evaluation-job description-job specification -job rotation and job enrichment. Human resource planning- importance-objectives and problems. Recruitment-meaning-recruitment policy, sources –factors affecting selection decision-selection procedure. Human resource information system.

Module 3: Human resource development: Meaning-concepts of HRD-objectives of training-organization of training programmers-methods-advantages and limitations of training. Evaluation of training program HRD for total quality management. Transfer policy Promotion policy-Demotion and Discipline-consequences of indiscipline –disciplinary procedure.

Module 4: Compensation/Rewards system: Significance of reward system in business organisation. Compensation system in practice-systems of promoting -factors determining employee compensation and rewards-dearness allowance, employee benefits-bonus-laws on wages, bonus and social security-managerial compensation. Performance Appraisal: concepts, objectives philosophy and process of performance appraisal system- counseling.-career planning and management.

References:

1. Human Resource Management: Strategies and Action -Armstrong
2. Human Resource Management -Dr.Ashwathappa
3. Personnel and Human Resource Management -D.A. Deonz and F.P. Robins
4. Personnel Management - Edwin Phillip
5. Human Resources Management—L.M. Prasad

SC06:MCB270 MANAGEMENT OF FINANCIAL SERVICES

1. Course Description:

This course is all about Financial Services industry analysis, trends, globalization and government policy. It also includes an analysis of future of Financial Services, particularly in respect of investment banking, micro-finance/insurance and angel investing.

2. Course Outcome:

CO1	Understand and appreciate the role of financial services industry
CO2	Grasp the trends in financial services industry particularly the impact of globalization of Financial Services
CO3	Analyze the factoring services and securitization system.
CO4	Gain insight into the future of Financial Services industry

3. Pedagogy:

Students must work out assigned individual topics, present seminars and participate in case studies or group discussions.

4. Course Contents:

Module 1: Concept and Scope of Financial Services – Marketing of Financial Services Problems and Prospects of Financial Services Industry in India.

Module 2: Globalization of Financial Services – GATS – Functions and the Role of GATS Evaluation of Government's policy towards globalization.

Module 3: An Overview of Trends in Financial Services in India – Lease Financing; Types, History and Development of Lease Financing, Structure of Leasing Industries, Factoring and International Factoring, Securitization- meaning, features, process, IPO Management – Venture Capital; Features, Methods of Venture Financing, Initiatives – Credit Rating; functions –Credit Rating Agencies. Portfolio Management Services.

Module 4: Future of Financial Services Industry – Micro Finance/Insurance – Angel investing – Investment Banking.

References:

1. Financial Markets and Institutions – Bhole L. M. (Tata McGraw Hill)
2. Indian Financial System – Theory and Practice – Khan M.V (Vikas Publishing)
3. Financial Management and Control – Chakraborty S.K (Mc Milan)
4. New Issues Markets - Khan M.Y (Allied Publishers)
5. Emerging Scenario of Financial Services – Gordon & Natarajan (Himalaya Publishing House)
6. Financial Services in India - M.A. Kohok (Himalaya Publishing House)
7. Management of Financial Services – Avadhani (Himalaya Publishing House

SC07:MCB250 BANKING TECHNOLOGY

1. **Course description:** The course deals with study of technology adaption in banking, besides providing scope of practical side of banking
2. **Course Outcome:**

CO1	Understand the recent developments in banking technology
CO2	Assess the impact of technology on banks
CO3	Identify the available payment channels and their delivery system.
CO4	Verify the global developments in banking technology.

3. **Pedagogy:** LTP model, field survey, summary and group discussions.

4. **Course Contents:**

Module 1: Branch Operation and Core Banking - Introduction and Evolution of Bank Management – Technological Impact in Banking Operations – Total Branch Computerization – Concept of Opportunities – Centralized Banking – Concept, Opportunities, Challenges & Implementation . – Case study: Analysis of Recent Core Banking Software.

Module 2: Delivery Channels - Overview of delivery channels – E – Lounge establishment - Phone Banking – Call centers – Internet Banking – Mobile Banking – Payment Gateways – Card technologies – MICR electronic clearing

Module 3: Interbank Payment System - Interface with Payment system Network – Structured Financial Messaging system – Electronic Fund transfer – RTGSS – Negotiated Dealing Systems & Securities Settlement Systems – Electronic Money – E Cheques

Module 4: Global developments in banking technology - Information technology in finance and service delivery. Impact of technology on banks – protecting the confidentiality information system audit. Audit measures in computerized environment information system security and disaster management.

References:

1. Financial Services Information Systems - Jessica Keyes Auerbach publication; 2nd edition (March 24, 2000)(Text Book)
2. Kaptan S S & Choubey N S., "E-Indian Banking in Electronic Era", Sarup & Sons, New Delhi, 2003
3. Vasudeva, "E – Banking", Common Wealth Publishers, New Delhi, 2005
4. Turban Rainer Potter, Information Technology, John Wiely & Sons Inc
5. Banking Technology - Indian Institute of Bankers Publication

JSS COLLEGE OF ARTS, COMMERCE & SCIENCE

(AUTONOMOUS)

OOTY ROAD, MYSURU-570 025

(Autonomous under University of Mysore: Re-accredited by NAAC with 'A' Grade)

Choice Based Credit System and CAGP

MASTERS DEGREE

Syllabus

2020-22

Postgraduate Department of Computer Science

JSS College of Arts, Commerce and Science

Ooty Road, Mysore-25

2020-2022

PROGRAMME: MASTER OF SCIENCE IN COMPUTER SCIENCE

2 Years /4 Semesters (under CBCS-CAGP)

ADMISSIONS:

i) 50% seats of the total intake for M.Sc., Computer Science Programme of the College will be filled-up by University of Mysore through Centralized Admission Cell as per University regulations.

ii) Remaining 50% seats will be filled-up by the College under College Quota.

ADMISSION REQUIREMENT

Eligibility - All students who have 45% (40% for SC/ST) in their B.Sc degree (from Recognised University/ Open University) with Mathematics as one subject and any one-two among Electronics, Instrumentation, Computer Science or Computer Maintenance and Physics as other subject. OR Student with B.Sc (IT) are permitted provided they have not studied Mathematics in their 2 years PUC. OR Diploma (in Electronics, Computer Science and Information Technology) holders with B.Sc (IT) are permitted if they have SSLC level Mathematics. OR BCA degree from recognized University OR equivalent to this from any other recognized University in India or abroad is also permitted.

PROGRAMME OUTCOMES:

After Completing the M.Sc Program Students will be able to:

PO1. Identify, formulate, and solve computer science problems

PO2. Design, implement, test, and evaluate a computer system, component, or algorithm to meet desired needs

PO3. Receive the broad education necessary to understand the impact of computer science solutions in a global and societal context

PO4. Communicate effectively

PO5. Success in research or industry related to computer science

PO6. Have solid knowledge in computer science and engineering, including programming and languages, algorithms, theory, databases, etc.

PO7. Integrate well into and contribute to the local society and the global community related to computer science

PO8. Practice high standard of professional ethics

PO9. Draw on and integrate knowledge from many related areas

PROGRAMME SPECIFIC OUTCOMES:

PSO1. Programmers or the Software Engineers with the sound knowledge of practical and theoretical concepts for developing software.

PSO2. Serve as the Computer Engineers with enhanced knowledge of computers And its building blocks. Work as the Hardware Designers/Engineers with the knowledge of Networking Concepts.

PSO3. Work as the System Engineers and System integrators Serve as the System Administrators with thorough knowledge of DBMS.

PSO4. Work as the Support Engineers and the Technical Writers

PSO5. Work as IT Sales and Marketing person.

PSO6. Serve as the IT Officers in Banks and cooperative societies.

PSO7. Computer Scientist in research and R & D laboratories.

PSO8. Faculty for Graduate and Under graduate Colleges**.**

MSc. in Computer Science – 2018

I Semester

Course Code	Course	L:T:P	Credit Value
CSC101	HC1 (Data Structures and Algorithms)	3:0:1	4
CSC102	HC2 (System Software)	2:1:1	4
CSC103	HC3 (Computer Networks)	2:1:1	4
CSC104	SC1		4
CSC105	SC2		4
	TOTAL		**20**

II Semester

Course Code	Course	L:T:P	Credit Value
CSC201	HC4 (Analysis and Design of Algorithms)	2:1:1	4
CSC202	HC5 (Operating System and Unix)	2:0:2	4
CSC203	HC6 (Computer Graphics)	3:0:1	4
CSC204	SC3		4
CSC205	SC4		4
	TOTAL		**20**

III Semester

Course Code	Course	L:T:P	Credit Value
CSC301	HC7 (Software Engineering)	3:1:0	4
CSC302	HC8 (Theory of Languages)	3:1:0	4
CSC303	HC9 (Database Management System)	2:1:1	4
CSC304	SC5 / Term Work		4
CSC305	SC6 (Open Elective ****)		4
	TOTAL		**20**

IV Semester

Course Code	Course	L:T:P	Credit Value
CSC401	HC10 (Major Project)	0:1:7	8
CSC402	SC7		4
CSC403	SC8		4
	TOTAL		**16**

****** Open Elective Course: III Semester**

Course Code	Course	L:T:P	Credit Value
CSC305	OE- Computer Fundamentals / Programming with C	2:0:2	4

HARD CORE:

Sl. No.	Course	L:T:P	Credit Value
1	Computer Networks	2:1:1	4
2	Computer Graphics	3:0:1	4
3	Data Structures and Algorithms	3:0:1	4
4	Analysis and Design of Algorithms	2:1:1	4
5	DBMS	2:1:1	4
6	Software Engineering	3:1:0	4
7	Theory of Languages	3:0:1	4
8	Operating System and Unix	2:0:2	4
9	System Software	3:1:0	4

SOFT CORE:

Sl. No.	Course	L:T:P	Credit Value
1	Principles of Programming Language and C	2:1:1	4
2	Internet Technology	2:0:2	4
3	Java Programming	2:0:2	4
4	Multimedia	3:1:0	4
5	Microcontroller	3:1:0	4
6	Discrete Mathematics	3:1:0	4
7	Simulation and Modeling	3:1:0	4
8	Operations Research	3:1:0	4
9	Mobile Communication	3:1:0	4
10	C++	2:0:2	4
11	Pattern Recognition	3:0:1	4
12	Image Processing	2:1:1	4
13	Software Testing	3:0:1	4
14	Computational Techniques	3:0:1	4
15	Graph Theory	3:1:0	4
16	OOAD	2:1:1	4

17	Probability and Statistics	3:1:0	4
18	Data Mining	2:1:1	4
19	Artificial Intelligence	3:1:0	4
20	.NET Technologies	2:0:2	4
21	Object Oriented Modeling and Design with UML	2:1:1	4
22	Android Application Development	2:0:2	4
23	Advanced Database Management Systems	2:1:1	4
24	Compiler Design	3:0:1	4

SCHEME OF EXAMINATION AND ASSESMENT:

In view of the CBCS syllabus, Each Course is Assess with Components . Component 1 (C1), Component 2 (C2), and Component 3 (C3),

The following is the scheme which will be followed for the assessment of marks for both theory (HC/ SC/ OE) as well as practicals (HC/ SC) irrespective of the Credits associated with each Course. Thirty percent of the marks will be assessed for the internals (C1 and C2) and remaining seventy percent will be for the semester end examinations (C3). Each Course carries 100 marks and hence thirty marks for internal assessment and remaining seventy marks will be for Semester End Examinations. Out of thirty marks for internals, fifteen marks will be allotted to each C1 and C2 components.

Each theory Course (HC/ SC/ OE) consists of three components namely C1, C2 and C3. C1 and C2 are designated as Internal Assessment (IA) and C3 as Semester End Examination. Each Course (HC/ SC/ OE) carries 100 Marks and hence the allotment of marks to C1, C2 and C3 Components will be fifteen, fifteen and seventy marks respectively. i.e.,

C1 Component : 15 Marks C2 Component : 15 Marks	Internal Assessment Marks
C3 Component : 70 Marks	Semester End Examination
Total : 100 Marks	

The above will be followed in common for all the theory (HC/ SC/ OE) Courses in all the four semesters.

DATA STRUCTURES & ALGORITHMS **3:0:1**

Course Code:CSA100

Course Outcomes: At the end of the course students will be able to:

CO1. Select appropriate data structures as applied to specified problem definition.

CO2. Implement operations like searching, insertion, and deletion, traversing mechanism etc. on various data structures.

CO3. Implement Linear and Non-Linear data structures.

CO4. Implement appropriate sorting/searching technique for given problem.

CO5. Design advance data structure using Non Linear data structure.

UNIT I: Introduction

Introduction to Stages in Problem Solving, Difference between Data Type, Data Structure and Storage Structure, Formal Definition of Data Structure, Classification of Data Structure
Analysis of Algorithms: Algorithm, Time Complexity and Space Complexity, O-Notation, Omega Notation and Theta Notation.
Primitive Data Structure: Integer, Real, Character and Boolean and Its Storage Representation

UNIT II: Non-Primitive Data Structures

Arrays: Introduction to Array Data Structure and Its Representation, Sparse Matrix Representation. Introduction to Structures
Stacks: Introduction, Implementation Using Arrays, Applications - Tower Of Hanoi, Expression Evaluation, Conversion of Expressions

UNIT III: Stacks and Queues

Queue: Introduction, Types – Ordinary, Circular, Doubly Ended, Priority, Implementation Using Arrays

Linked List: Introduction, Types, Operations, Implementation of Stacks and Queues Using Linked List

UNIT IV: Non-Linear Data Structures

Graphs: Introduction, Basic Terminologies, Graph Representation – Adjacency and Incidence Matrix Representation

Trees: Introduction, Binary Tree Representation – Array and Linked List Representations, Traversals – Preorder, In-order, Post order, Binary Search Tree, Introduction to B-Trees

Hash Tables: Direct Address Tables, Hash Tables, Hash Functions, Open and Closed Addressing

References:

1. Data Structures and Algorithms, 2nd Edition, 2006 , Andrew Tanenbaum
2. "An Introduction to Data Structures, with Applications" McGraw Hill, Kongakusha 1976, Trembley and Sorenson
3. "Data Structures" SBCS Publication, 1980, Horowitz and Sahni
4. Data Structures using c, A K Sharma
5. Data Structures and program design in C, Kruse Robert L
6. Data Structures and analysis in C, Mark Allen Weiss
7. Data Structures and Algorithms, Alfred V AHO and Jeffrey D Ullman

SYSTEM SOFTWARE **2:1:1**

Course Code:CSA110

Course Outcomes:

At the end of the course students will be able to:

CO1. Understand fundamentals of language processing and grammar

CO2. Apply knowledge of compilation and code optimization steps to mimic a simple compiler

CO3. Demonstrate the working of various system software like assembler, loader, linker, editor and device driver

UNIT 1

Background: Machine Structure, Evolution of the components of a programming system, evolution of operating system, operating system user view point functions, facilities

General Machine Structure, General Approach to a new machine, Machine Structure – 360 and 370, Assembly Language

UNIT 2

Assemblers: General design procedure, design of an assembler.

Macro language and macro processor, macro instructions, features of macro, implementation

UNIT 3

Loaders, different types of loaders, loader schemes, design of an absolute loader, design of direct linking loader.

Compilers: Structure and phases

UNIT 4

Lex and yacc: The Simplest lex Program, Recognizing Words with Lex, Parser-Lexer Communication, Regular Expressions, Grammars, Shift/Reduce Parsing, Structure of lex and yacc Programs, Programs in lex and yacc

References:

1. Systems Programming by Donovan
2. Principles of Compiler design by Ullman
3. System programming by Dhamdhare
4. Lex and yacc by John R Levine, Tony Mason and Doug Brown
5. System Software- Prof. Liland L Beck.

6. System Software- Prof. John R Levine

COMPUTER NETWORKS **2:1:1**

Course code:CSA120

Course Outcomes:

At the end of the course students will be able to:

CO1. Master the terminology and concepts of the OSI reference model and the TCP-IP reference model.

CO2. Study the basic taxonomy and terminology of the computer networking and enumerate the layers of OSI model and TCP/IP model.

CO3. Master the concepts of protocols, network interfaces, and design/performance issues in local area networks and wide area networks

CO4. Acquire knowledge of Application layer and Presentation layer paradigms and protocols.

CO5. Study Session layer design issues, Transport layer services, and protocols.

CO6. Gain core knowledge of Network layer routing protocols and IP addressing.

CO7. Study data link layer concepts, design issues, and protocols.

CO8. Read the fundamentals and basics of Physical layer, and will apply them in real time applications.

CO9. Familiar with wireless networking concepts

CO10. Familiar with contemporary issues in networking technologies
CO11. Familiar with network tools and network programming

UNIT 1

USES OF COMPUTER NETWORK: Business Applications, Home Applications, Mobile Users, Social Issues

NETWORK HARDWARE: Local Area Networks, Metropolitan Area Networks, Wide Area Networks, Wireless Networks, Home Networks, Internetworks

NETWORK SOFTWARE: Protocol Hierarchies, Design Issues for the Layers, Connection-Oriented and Connectionless Service, Service Primitives, the Relationship of Services to Protocols

REFERENCE MODELS: The OSI Reference Model, The TCP/IP Reference Model, A comparison of OSI and TCP/IP Reference Model

UNIT 2

THE PHYSICAL LAYER

THE THEORETICAL BASIS FOR DATA COMMUNICATION: Fourier Analysis, Bandwidth-Limited Signals, The Maximum Data Rate of a Channel

GUIDED TRANSMISSION MEDIA: Magnetic Media, Twisted Pairs, Coaxial Cable, Fiber Optics

WIRELESS TRANSMISSION: The Electromagnetic Spectrum, Radio Transmission, Microwave Transmission, Infrared and Millimeter Waves, Light wave Transmission

COMMUNICATION SATELLITES: Geostationary Satellites, Medium-Earth Orbit Satellites, Low-Earth Orbit Satellites, Satellites versus Fiber

THE DATA LINK LAYER

DATA LINK LAYER DESIGN ISSUES: Services Provided to the Network Layer, Framing, Error Control, Flow Control

ERROR DETECTION AND CORRECTION: Error-Correcting Codes, Error-Detecting Codes

ELEMENTARY DATA LINK PROTOCOLS: A Utopian Simplex Protocol, A Simplex Stop-and-Wait Protocol

SLIDING WINDOW PROTOCOLS: A One-Bit Sliding Window Protocol, A Protocol Using Go-Back-N

UNIT 3

THE MEDIUM ACCESS CONTROL SUBLAYER

THE CHANNEL ALLOCATION PROBLEM: Static Channel Allocation, Dynamic Channel Allocation

MULTIPLE ACCESS PROTOCOLS: ALOHA, Carrier Sense Multiple Access Protocols, Collision-Free Protocols, Limited-Contention Protocols

ETHERNET: Ethernet Cabling, Manchester Encoding, The Ethernet MAC sub layer protocol, the binary exponential back off algorithm, Ethernet Performance, Switched Ethernet, IEEE 802.2: Logical Link Control

THE NETWORK LAYER

NETWORK LAYER DESIGN ISSUES: Store-and-Forward Packet Switching, Services Provided to the Transport Layer, Implementation of Connectionless Service, Implementation of Connection-Oriented Service, Comparison of Virtual-Circuit and Datagram Networks

ROUTING ALGORITHMS: The Optimality Principle, Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing
CONGESTION CONTROL ALGORITHMS: Approaches to Congestion Control, Traffic-Aware Routing, Admission Control, Traffic Throttling, Traffic Shaping
INTERNETWORKING: How Networks Differ, How Networks Can Be Connected, Tunneling, Internetwork Routing, Fragmentation
THE NETWORK LAYER IN THE INTERNET: The IP Protocol, IP Addresses, IPv6

UNIT 4

THE TRANSPORT LAYER
THE TRANSPORT SERVICE: Services Provided to the Upper Layers, Transport Service Primitives
ELEMENTS OF TRANSPORT PROTOCOLS: Addressing, Connection Establishment, Connection Release, Error Control and Flow Control, Multiplexing, Crash Recovery
THE INTERNET TRANSPORT PROTOCOLS: UDP: Introduction to UDP, Remote Procedure Call, Real-Time Transport Protocols
THE INTERNET TRANSPORT PROTOCOLS: TCP: Introduction to TCP, The TCP Service Model, The TCP Protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release, TCP Connection Management Modeling, TCP Sliding Window, TCP Timer Management
THE APPLICATION LAYER
DNS—THE DOMAIN NAME SYSTEM: The DNS Name Space, Resource Records, Name Servers
ELECTRONIC MAIL: Architecture and Services, The User Agent, Message Formats, Message Transfer, Final Delivery
NETWORK SECURITY:
CRYPTOGRAPHY: Introduction to Cryptography, Substitution Ciphers, Transposition Ciphers, Two Fundamental Cryptographic Principles
SYMMETRIC-KEY ALGORITHMS: DES—The Data Encryption Standard, Cipher Modes
PUBLIC-KEY ALGORITHMS: RSA, Other Public-Key Algorithms
DIGITAL SIGNATURES: Symmetric-Key Signatures, Public-Key Signatures

MANAGEMENT OF PUBLIC KEYS: Certificates

Reference Books:

1. Computer Networks, 5th Edition, Prentice Hall, 2006, Andrew S. Tanenbaum & David J. Wetherall
2. Data & Computer Communications, 6th Edition, Pearson Education, 2002, William Stallings
3. Computer Networks: 3rd Edition, Elserier, 2003, Larry L. Peterson & Bruce S. Davie
4. Data Communication & Networking, 4th Edition, Mc Graw Hill, 2006, Behrouza Forouzan
5. Computer & Networks with Internet Applications, 4th Edition, Pearson Education, 2004, Douglas E. Comer

ANALYSIS AND DESIGN OF ALGORITHMS **2:1:1**

Course Code:CSB060

Course Outcomes:

At the end of the course students will be able to:

CO1. Analyze different scenarios for running time of algorithms using asymptotic notations and Design using Recursion.
CO2. Apply divide and conquer strategy for design of various algorithms.
CO3. Develop algorithms for well known problems using greedy methods.
CO4. Describe and apply dynamic-programming approach for designing graph and matrix based algorithms.
CO5. Understand the concept of backtracking for traversal and search algorithms.
CO6. Apply the knowledge earned to determine the efficiency of algorithms considering time and space tradeoffs.

UNIT 1

INTRODUCTION**:** Algorithm specification, pseudo code conventions

PERFORMANCE ANALYSIS: Space Complexity, Time Complexity, Asymptotic Notation,

Mathematical Analysis: Recursive and Non recursive algorithms

BRUTE FORCE – Bubble Sort, Selection Sort, Sequential Search, String Matching

UNIT 2

DIVIDE- AND – CONQUER: General Method, Binary Search, Finding the Maximum and Minimum, Merge Sort, Quick Sort, Strassen's Matrix Multiplication

THE GREEDY METHOD: The General Method, Knapsack Problem, Tree Vertex Splitting, Job Sequencing with Deadlines, Minimum-Cost Spanning Trees - Prim's Algorithm, Kruskal's Algorithm, Optimal Storage on Tapes, Optimal Merge Patterns, Single-Source Shortest Paths.

UNIT 3

DYNAMIC PROGRAMMING: The General Method, Binomial Coefficient, Multistage Graphs, All Pairs Shortest Paths Single-Source Shortest Paths: General Weights, String Editing, 0/1 Knapsack, the Traveling Salesperson Problem

BACKTRACKING: The General Method, the 8-Queens Problem, Sum of Subsets, Graph Coloring, Hamiltonian Cycles

UNIT 4

Elementary Graph Problems: Depth First Search, Breadth First Search, Topological Sort

NP-Hard and NP-Complete Problems: Basic Concepts, Nondeterministic Algorithms, The Classes NP-Hard And NP-Complete

NP-Hard Graph Problems: Clique Decision Problem (CDP), Node Cover Decision Problem, Chromatic Number Decision Problem (CNDP), Traveling Salesperson Decision Problem (TSP), AND/OR Graph Decision Problem (AOG)

References:

1. Analysis and Design of Algorithms: Horowitz Sahani
2. Analysis and Design of algorithms: Trembly
3. Introduction to Algorithms: Thomas H. Cormen
4. Analysis and Design of Algorithm: Padma Reddy
4. Introduction to the design and analysis of algorithm: Anany Levitin.
5. Design and analysis of algorithm: S Shridhar.

OPERATING SYSTEM and UNIX **2:0:2**

Course Code:CSB070

Course Outcomes:

At the end of the course student will be able to:

CO1. Understand device drivers
CO2. Write applications with improved performance and stability
CO3. Write set of small commands and utilities that do specific tasks well
CO4. Run multiple programs each at the same time without interfering with each other or crashing the system.
CO5. Implement Commands of UNIX.
CO6. Implement various file processing commands and shell Programming.

UNIT 1

Introduction to Operating System, Operating System Structures

Process Management: Processes, CPU Scheduling

UNIT 2

Deadlocks, Storage Management: Memory management, Virtual Memory, File-System Interface

UNIT 3

Introduction: Why UNIX? The Unix Environment, UNIX Structure, accessing UNIX, UNIX commands

File Systems: File Names, File Types, Regular Files, Directories, File System Implementation, Operations unique to directories, Operations unique to regular files, Operations common to both.

Vi editor, local commands, range commands in vi, global commands in vi, rearrange text in vi, ex editor.

UNIT 4

Introduction to shells: Unix Session, Standard Streams, Redirection, pipes, tee command, command execution, command line editing, quotes, command substitution, job control, aliases, variables, predefined variables, options, shell/environment customization.

Security and file permission: User and groups, Security levels, changing permissions, User masks, Changing ownership and group, Regular expressions: Atoms, Operators, grep: operation, grep family, Searching for file content, sed and awk.

C Shell Programming: Basic script concepts, Expressions, Decision making selections,, Built in commands, Scripting techniques, Shell environment & Script, Script examples

References:

1. Unix and Shell Programming, Behrouz A Forouzan and Richard F.Gilberg, 2nd Edition, 2003, Thomson.
2. System Programming and Operating Systems, Dhamdhare. D.M., 4th Edition, TataMcGraw Hill, 2006
3. A Practical Guide to Linux, Mark G. Sobell, 1st Edition, 2002, Pearson Education (Chapters:1 to 5, 8, 10, 11, 15)
4. UNIX: The Complete Reference, Kenneth Rosen and others, 2nd Edition, 2002,Obsborne/McGraw Hill
5. Design of the UNIX Operating System, Maurice J Bach.
6. Operating System: A Modern Perspective , Gary J Nutt.

COMPUTER GRAPHICS **3:0:1**

Course code:CSB080

Course Outcomes:

At the end of the course students will be able to:

CO1. Utilize the components of a graphics system and become familiar with building approach of graphics system components and algorithms related with them.

CO 2. Learn the basic principles of 3- dimensional computer graphics.

CO3. Provide an understanding of how to scan convert the basic geometrical primitives, how to transform the shapes to fit them as per the picture definition.

CO4. Provide an understanding of mapping from a world coordinates to device coordinates, clipping, and projections.

CO 5. Implement the applications of computer graphics concepts in the development of computer games, information visualization, and business applications.

CO6. Comprehend and analyze the fundamentals of animation, virtual reality, underlying technologies, principles

UNIT 1

Introduction, Video Display Devices, Refresh Cathode-Ray Tubes, Raster-Scan Display, Random-Scan Displays, Color CRT Monitors, Flat-Panel Displays, Raster Scan Systems, Input devices.

Output primitives: Points & Lines, Line Drawing Algorithms, Loading the Frame Buffer, Circle Generating Algorithms, Pixel Addressing and Object Geometry

UNIT 2

Two dimensional transformations Basic & other transformations, Matrix representations, Homogeneous coordinates Composite transformations, General-pivot-point transformations.

Three Dimensional Transformations: Introduction to 3D Translation, Rotation & Scaling, Other Transformations, Modeling and Co-ordinate Transformations.

UNIT 3

Three Dimensional Viewing :Viewing Pipeling, window to viewport transformations, Projections, Types of projections.

Graphical User Interface & Interactive Input Methods : The User Dialogue, Windows & Icons, feedback, Input of Graphical Data, Interactive Picture Construction Techniques, Basic Positioning Methods, Constraints, Grids, Gravity Field, Rubber-Band Methods, Dragging, Painting & Drawing

UNIT 4

Curves & Surfaces: Properties, Bezier curves properties, Design techniques, Bezier surfaces, Displaying curves & surfaces

Hidden line removal algorithms

Introduction to fractals, Serpinsky's triangle, Construction, Koch curves.

Windowing & Clipping: Clipping operations, Line clipping algorithms, point clipping, text clipping, polygon clipping algorithms, Exterior clipping

Reference:

1. "Computer Graphics", Pearson Education, Donald D. Hern and M. Pauline Baker
2. " Principles of Interactive Computer Graphics" McGraw Hill 1989, W. M. Newman and Robert Sproull
3. "Computer Graphics a Programming Approach" McGraw Hill 1987, Steven Harrington
4. " Schaums outline of theory and problems of Computer Graphics" 2nd printing 1987, 1986 Edition, Roy A Plastock and Gardon Kelley
5. " Procedural Elements of Computer Graphics" McGraw Hill 2nd edition 1990, David F Frogers and J Alan Adams
6. Computer Graphics, James.D.Foley, A Vandam etal

SOFTWARE ENGINEERING **3:1:0**

Course Code:CSC040

Course Outcomes:

At the end of the course students will be able to:

CO1. Understand the nature of software development and software life cycle process models, agile software development, SCRUM and other agile practices.

CO2 Learn methods of capturing, specifying, visualizing and analyzing software requirements.

CO3. Understand concepts and principles of software design and user-centric approach and principles of effective user interfaces.

CO 4. Basics of testing and understanding concept of software quality assurance and software configuration management process.

CO 5. Understand need of project management and project management life cycle.

CO 6. Understand project scheduling concept and risk management associated to various types of projects.

UNIT 1

INTRODUCTION TO SOFTWARE ENGINEERING: Software and Software Engineering, phases in Software Development, Software Development Process models, Agile modeling, Introduction to metrics.

UNIT 2

SOFTWARE REQUIREMENT SPECIFICATION: Role of SRS, Problem Analysis, Requirement specification, validation, metrics, Monitoring and control

PLANNING A SOFTWARE PROJECT: Cost Estimation, Project Scheduling, Staffing personal planning, Team Structure, Software Configuration Management, Quality Assurance Plans, Project Monitoring plans, Risk Management.

UNIT 3

SYSTEM DESIGN: Design Objectives, design principles, Module level Concepts, Design methodology – object oriented approach Design Specification, Verification, Metrics, monitoring and control.

DETAILED DESIGN: Module Specification, Detailed design and process design Language, Verification

UNIT 4

CODING: Programming practice, Verification, Metrics

TESTING: Testing Fundamentals, Fundamental testing, Structural Testing. Testing process Clean Room approach

References:

1. "An Integrated approach to the Software Engineering" 2ed. Narosa Publishing House, New Delhi, 2002, Pankaj Jalote
2. Software Engineering Principles & Practice - 3rd Edition, Tata Mc Graw Hill Companies – 2006, Waman S Jawadekar
3. Software Engineering A Practitioner's Approach - 6th Edition
   McGraw Hill – 2005, Roger S Pressman
4. Software Engineering - 7th Edition : Pearson Education Ltd- 2006, Sommerville

THEORY OF LANGUAGES **3:1:0**

Course Code:CSC050

Course Outcomes:

At the end of the course students will be able to:

CO1. Design different types of Finite Automata and Machines as Acceptor, Verifier and Translator.

CO2. Understand, design, analyze and interpret Context Free languages, Expression and Grammars.

CO3. Design different types of Push down Automata as Simple Parser.

CO4. Design different types of Turing Machines as Acceptor, Verifier, Translator and Basic computing machine.

UNIT - 1

INTRODUCTION TO FINITE AUTOMATA**:** Introduction to Finite Automata; The central concepts of Automata theory; Deterministic finite automata; Nondeterministic finite automata.

FINITE AUTOMATA, REGULAR EXPRESSIONS: An application of finite automata; Finite automata with Epsilon-transitions; Regular expressions; Finite Automata and Regular Expressions

UNIT - 2

REGULAR LANGUAGES, PROPERTIES OF REGULAR LANGUAGES: Regular languages; Proving languages not to be regular languages; Closure properties of regular languages; Equivalence and minimization of automata.

CONTEXT-FREE GRAMMARS AND LANGUAGES: Context –free grammars; Parse trees; Ambiguity in grammars and Languages.

UNIT – 3

PUSHDOWN AUTOMATA: Definition of the Pushdown automata; the languages of a PDA; Equivalence of PDA's and CFG's; Deterministic Pushdown Automata.

PROPERTIES OF CONTEXT-FREE LANGUAGES: Normal forms for CFGs; The pumping lemma for CFGs; Closure properties of CFL

UNIT - 4

TURING MACHINE: The turing machine; Extensions to the basic Turing Machines; UNDECIDABILITY: A Language that is not recursively enumerable; An Undecidable problem that is RE; Post's Correspondence problem

REFERENCES:

1. Introduction to Automata Theory, Languages and Computation – John E.. Hopcroft, Rajeev Motwani, Jeffrey D.Ullman:, 3rd Edition, Pearson education, 2007.
2. Fundamentals of the Theory of Computation: Principles and Practice – Raymond Greenlaw, H.James Hoove, Morgan Kaufmann, 1998.
3. Introduction to Languages and Automata Theory – John C Martin, 3rd Edition, Tata McGraw-Hill, 2007.

DATABASE MANAGEMENT SYSTEM **2:1:1**

Course Code:CSC060

Course Outcomes:

At the end of the course students will be able to:

CO1. Explain the features of database management systems and Relational database.
CO2. Design conceptual models of a database using ER modelling for real life applications and also construct queries in Relational Algebra.
CO3. Create and populate a RDBMS for a real life application, with constraints and keys, using SQL.
CO4. Retrieve any type of information from a data base by formulating complex queries in SQL.
CO5. Analyze the existing design of a database schema and apply concepts of normalization to design an optimal database.
CO6. Build indexing mechanisms for efficient retrieval of information from a database

UNIT 1

Introduction and conceptual modeling databases and Database users, Data modeling using the entity relationship (ER) model, the enhanced entity – relationship (EER) model.

UNIT 2

Relational model: Concepts constraints, Languages, Design and programming.

The relational data model and relational database constraints, Relational algebra and relational calculus, Introduction to SQL Programming technique

UNIT 3

Database design theory and methodology functional dependencies and Normalization for relational database, Relational database design algorithms and further dependencies, practical database design methodology and use of UML diagrams.

UNIT 4

Introduction to transaction processing concepts and theory recovery

REFERENCES

1. Fundamentals of database system – 5th Edition – Ramez elmasri, Navathe – Person edition

2 .An introduction to database system – 8th Edition – C. J. Date, Kannan – Person Education

3.Database system concepts – 5th Edition – Korth, Sudarshan – McGraw Bill Edition

4. Database Management System- Raghuramakrishnan.

5. An Introduction to Database System- Bipin Desai

6. Principles of Database System- J D Ullman

Softcore:

PRINCIPLES OF PROGRAMMING LANGUAGES AND 'C' 2:1:1

Course Code:CSA020

Course Outcomes:

At the end of the course students will be able to:

CO1. Analyzing semantic issues associated with function implementations, including variable binding, scoping rules, parameter passing, and exception handling.

CO2. Implementation techniques for interpreted functional languages.

CO3. Using object-oriented languages.

CO4. Familiar with design issues of object-oriented and functional languages.

CO5. Familiar with language abstraction constructs of classes, interfaces, packages, and procedures.

CO6. Familiar with implementation of object-oriented languages.

CO7. Familiar with using functional languages

.

UNIT 1: Preliminaries

Reasons for studying concepts of programming languages, Programming domains, Language evaluation criteria, Implementation methods Names, Bindings, Type Checking, and Scopes Introduction, Names, Variables, The concept of Binding, Type Checking, String Checking, Type Compatibility, Scope, Scope and Lifetime, Referencing Environments, Named Constants, Variable Initialization.

UNIT 2: Data Types

Introduction, Primitive Data types, Character String Types, User-Defined Ordinal Types, Array Types and Associative Arrays, Record Types, Union Types, Set Types, Pointes Types.
Expression, Assignment Statements and Statement Level Control Structures
Introduction, Arithmetic Expressions, Overloaded Operators, Type Conversions, Relational And Boolean Expressions, Short-Circuit Evaluation, Assignment Statements, Mixed-Mode assignment.

UNIT 3

Compound Statements, Selection Statements, Iterative Statements, Unconditional Branching, Guarded Commands, Conclusion.

Subprograms: Introduction, fundamentals, design issues, local referencing environments, parameter passing methods, overloaded programs, generic subprograms, coroutines, user defined overloaded operators

UNIT 4

C LANGUAGE: C Fundamentals, Operation data input and output, Control statements, Function Storage classes, Arrays, Pointers, structures and unions, Enumeration, Command line parameters, Macros, 'C' processor.

Reference:

1. Concepts of Programming Languages, Eight Edition, Pearson, Robert W. Sebesta
2. Foundation for Programming Languages, John C Mitchell
3. Principles of Programming Language, Chopra Rajiv
4. Principles of Programming Language, Dowek
5. Types and Programming Languages, Benjamin C Pierce
6. Programming Languages: Principle and Practices ,3rd Edition, Kenneth C Louden

INTERNET TECHNOLOGY **2:0:2**

Course Code:CSD220

Course Outcomes:

At the end of the course students will be able to:

CO1. Develop analytical ability in network technology.

CO2. Create quality websites
CO3. Work individually as a web designer and set up their own business
CO4. Get the job opportunities in most companies for professional web designers and build websites more visually elegant and interactive
CO5. Implement interactive web page(s) using HTML, CSS and JavaScript.
CO6. Design a responsive web site using HTML5 and CSS3.

UNIT 1

Fundamentals: introduction to the Internet, WWW, Web Browsers, Web Servers, URL, Multipurpose Internet Mail Extensions (MIME), HTTP, Security,

Introduction to HTML: Origins and Evolution, Basic Syntax, Document Structure, Basic tags, Images, Links, Lists, Tables, Forms, Frames.

UNIT 2

Introduction to XML: Syntax of XML, XML Document Structure, Document Type Definition.

Introduction to XHTML: Origins and Evolution, Basic Syntax, Document Structure, Basic tags, Images, Links, Lists, Tables, Forms, Frames, Syntactic difference between HTML and XHTML.

Cascading Style Sheets (CSS): Introduction, levels of style sheets, Selector Forms, Property value forms, Font properties, Color, Alignment of Text, Box model, Background Images, and tags.

UNIT 3

The basics of JavaScript: Overview, Object Orientation and JavaScript, General syntactic characteristics, Primitives, Operations and Expressions, Screen Output and Keyboard Input, Control Statements, Objects, Arrays, Functions, Constructors, Errors.

JavaScript and XHTML Documents: Element access, Events and Event Handling, Handling Events from Body elements, Handling Events from Button elements, Handling Events from Text Box and password elements.

Dynamic Documents with JavaScript: Introduction, Positioning Elements, Moving Elements, Element Visibility, Changing Colors and Fonts, Dynamic Content, Stacking Elements, Locating Mouse Cursor, Reacting to Mouse Click, Slow Movement of Elements, Dragging and Dropping Elements.

UNIT 4

Introduction to PHP: Origins and Uses, Overview, General Syntactic Characteristics, Primitive, Operations and Expressions, Output, Control Statements, Arrays, Functions, Form Handling, Cookies.

REFERENCES:

1. Programming the World Wide Web – by Robert W. Sabesta 4th Edition Pearson Publications
2. HTML and XHTML the Complete Reference.
3. How to program the World Wide Web – by Deitel and Deitel
4. Mastering in HTML – by Ray and Ray.
5. Web programming and Internet Technologies: An E Commerce approach- By Porter ` Seobey and Pawan Lingras.
6. Internet Technology and Information services by Joseph Miller

JAVA Programming **2:0:2**

Course Code:CSA270

Course Outcomes:

At the end of the course students will be able to:

C01. Understand concept of Object Oriented Programming & Java Programming Constructs.

C02. Understand basic concepts of Java such as operators, classes, objects, inheritance, packages ,Enumeration and various keywords.

C03. Understand the concept of exception handling and Input/Output operations.

C04. Design the applications of Java & Java applet.

C05. Analyze & Design the concept of Event Handling and Abstract Window Toolkit.

UNIT 1

History and evolution of Java, An overview of Java, Data types, variables and arrays, Operators, Control statements- Introducing classes ,A closer look at methods and classes, Inheritance, Packages and interfaces.

UNIT 2

Exception handling, Multithreaded Programming, Enumeration, Autotoxins, I/O, Applets

UNIT 3

Networking, Event handling, Swings.

UNIT 4

String handling, Collection framework, Introduction to J2EE, Java servlet, Java server pages (JSP) and HTML, JDBC objects.

REFERENCES:

1. The complete reference Java – 7th Edition – Herbert Schildt – Tata Mcgraw hill Edition.

2. The complete reference J2EE – Jem Keogh – Tata Mcgraw hill Edition.

3. Object Oriented Programming with Java- M T Somashekara, D S Guru and K S Manjunatha.

4. The Complete Reference 7th Edition Herbert Schiidt

5. Introduction to Java Programming – E Balaguruswamy

6. Head First Java – 2nd Edition

7. Core Java- Horst Mann, C S –8th Edition-Cornell.

8. Core Servelet and Java Server pages- Hall, M-Brown L

MULTIMEDIA **3:1:0**

Course Code:CSD210

Course Outcomes:

At the end of the course students will be able to:

CO1. Understand various file formats for audio, video and text media.

CO2. Develop various Multimedia Systems applicable in real time.

CO3. Design interactive multimedia software.

CO4. Apply various networking protocols for multimedia applications.

CO5. Develop understanding of technical aspect of Multimedia Systems

UNIT 1

Introduction to Multimedia (MM) Communication, Scope, Range, Feasibility and Challenges of MM Communication Key aspects of MM: Compression, Coding, Transmission and Replay.

UNIT 2

Types of Compression: Quantization, Coding as PCM, DPCM, ADPCM. Simple Encoder and Decoders based on PCM Samples. Introduction to Transform domain Compression. Introduction to Audio part of MPEG, Psychoacoustics

UNIT 3

Compression in Spatial Domain Algorithms for Data Compression in Transform Domain: DCT. Variable Length Coding, Huffman code. Variable Length Coding: Arithmetic Coding. Introduction to JPEG 2000 Standard, Encoders-Decoders based on this. Audio Compression and MPEG Audio

UNIT 4

Fundamental concepts of Video. MPEG Architecture Details: Audio-Video- Systems. Video Coding standard related to H.263 and H. 264. MPEG- 1, 2 Video. MPEG- 4 : Video. Streaming and Transport Issues: Multiplexing, Synchronization and File formats. Errors in MPEG and Error handling, Concealment. Buffer structures and Buffer Management

Introduction to MPEG-7 and MPEG-21., HDTV. Content based Image Retrievals and Digital Libraries.

References:

1. Fundamentals of Multimedia, 2nd Ed, Pearson, 2005, Ze-Nian Li and Mark Drew
2. Multimedia Communications., Pearson, 2005, Fred Halsall
3. Introduction to Data Compression, 3rd Ed, Morgan Kaufman (India Ed), 2005, Khalid Sayood
4. The DATA compression; The Complete Reference, 3rd Ed, Springer (India Ed), 2006, David Solomon
5. Multimedia foundations: A Core Concepts of for Digital Design, Vic Cost Ello
6. Multimedia: Making it work, 9th edition, Tay Vaughan

MICROCONTROLLERS **3:1:0**

Course Code:CSC210

Course Outcomes:

At the end of the course students will be able to:

CO1. Describe the architecture of 8051 microcontroller and write embedded program for 8051 microcontroller.

CO2. Design the interfacing for 8051 microcontroller.

CO3. Understand the concepts of ARM architecture.

CO4. Demonstrate the open source RTOS and solve the design issues for the same.

CO5. Select elements for an embedded systems tool.

CO6. Understand the concept and architecture of embedded systems

UNIT 1

Introduction, Numbering system and binary arithmetic,

UNIT 2

The 8051 Architecture, Basic assembly language programming concepts, Moving data,

UNIT 3

Logical operations, Arithmetic operations Jump and call instructions

UNIT 4

An 8051 Microcontroller design, Applications

References

1. "The 8051 Microcontroller", 3rd Edition, Thomson India edition, 2007, Kenneth Ayala
2. "Programming and customizing the 8051 microcontroller", Tata McGraw-Hill edition, 2006, Myke prick
3. "The 8051 Microcontroller and embedded systems", Pearson India, 2006, Muhammad Ali Mazidi & Janice Gillispie Mazidi,
4. Microcontroller and Embedded System, Mazidi, M A- Mazidi
5. Microcontroller: Architecture, Programming and application, Ayala, Kenneth

DISCRETE MATHEMATICS **3:1:0**

Course Code:CSA260

Course Outcomes:

At the end of the course students will be able to:

CO1. Construct simple mathematical proofs and possess the ability to verify them.
CO2. Have substantial experience to comprehend formal logical arguments .
CO3. skillfull in expressing mathematical properties formally via the formal language of propositional logic and predicate logic.
CO4. Specify and manipulate basic mathematical objects such as sets, functions, and relations and will also be able to verify simple mathematical properties that these objects possess.
CO5. Apply basic counting techniques to solve combinatorial problems .
CO6. Use various techniques of mathematical induction (weak, strong and structural induction) to prove simple mathematical properties of a variety of discrete structures

UNIT 1

Set Theory: Sets and Subsets. Operations on sets, Countable and uncountable sets, The addition principal, the concept of probability.

Mathematical Logic: Propositions, Logical Connectives, Tautologies; Contradictions, Logical equivalence, Application to switching networks, Duality, Commentates NAND and NOR, Converse, Inverse and Contrapositive, Rules of inference.

UNIT 2

Open statements; Quantifiers, Logical Implication involving Quantifiers, Statements with more than one variable, Methods of proof and disproof, Mathematical Induction.

UNIT 3

Relations and Ordering: Cartesian products of sets, Relations, Paths in relations and digraphs, Operations on relations, Composition of relations, Properties of relations, Equivalence relations, Partial orders, Total Orders, External elements in posets, Lattices.

Functions: Functions, Types of functions, Composition of function, Invertible functions, Permutation Function.

UNIT 4

Fundamental principles of counting: Principles of inclusion and exclusion: The rule of sum and product, Permutations, combinations: The binomial theorem, combinations with repetition,

Ramsey number, the Catalan numbers, sterling number and bell numbers, Generalizations of principles, the pigeonhole principle, Derangements-Nothing is in its Right place, Rook polynomials, Arrangements with Forbidden positions.

References:

1. Discrete Mathematics by Dr. Chandrashekar S .
2. Discrete and combinational Mathematics by Ralph P. Grimaldi, 5th edition, Addison Wesley, 2004
3. Discrete mathematical structures by Kolman, Robert C Busby and Sharon., 6th Edition, Prentice Hall, 2008
4. Discrete Mathematics and Application by Kenneth H Rosen.
5. Discrete Mathematics by Norman L Biggs.

SIMULATION & MODELLING **3:1:0**

Course Code:CS/A/B/C/D300

Course Outcomes:

At the end of the course students will be able to:

CO1. Understand the definition of simulation and how to develop and analyze a simulation model

CO2. Understand the fundamental logic, structure, components and management of simulation modeling

CO3. Demonstrate knowledge of how to use Arena

CO4. Build a simulation model with basic operations and inputs

CO5. Build a simulation model with detailed operations

CO6. Perform statistical analysis of output from terminating simulation

UNIT 1

Introduction, Simulation of prepursuit problem, A system & its model, Simulation of an inventory problem, The basic nature of simulation

Simulation of continuous systems: A chemical reactor, Numerical integration vs continuous system simulation, Selection of an integration formula, Runge Kutta integration formulas, simulation of a servo system, Simulation of a water reservoir system, Analog vs digital simulation

UNIT 2

Discrete system simulation

Fixed time-step vs event to event model, On simulating randomness, Generation of random numbers, Generation of non uniformly distributed random numbers, Monte Carlo computation vs stochastic simulation

UNIT 3

Simulation of queuing systems

Rudiments of queuing theory, simulation of single server queue, Simulation of two server queue, Simulation more general queues.

Simulation of PERT network

UNIT 4

Network model of a project, Analysis of an activity network, Critical path computation, Uncertainties in activity duration, Simulation of an activity network, Computer program for simulation, Resource allocation and cost considerations, Inventory control & forecasting Elements of inventory theory, More complex inventory models, simulation examples, Generation of Poisson & erlang variates, Forecasting & regression analysis

Design and Evaluation of Simulation Experiments

Length of simulation runs, Variance reduction techniques, Experimental layout, validation

References:

1. System Simulation with Digital Computer Narsingh Deo
2. System Simulation and Modeling - Sengutta
3. Computer Methods for solving Dynamic Seperation problems- C D Holland and A I Liapis.
4. Fundamentals of Modeling separation Process- C D Holand.
5. Process Modeling-M M Denn

OPERATIONS RESEARCH **3:1:0**

Course Code: CS A/B/C/D 310

Course Outcomes:

At the end of the course students will be able to:

CO1: Formulate and solve mathematical model (linear programming problem) for a physical situations like production, distribution of goods and economics.

CO2: Apply the concept of simplex method and its extensions to dual simplex algorithm.

CO3: Solve the problem of transporting the products from origins to destinations with least transportation cost.

CO4: Convert and solve the practical situations into non-linear programming problem.

CO5: Identify the resources required for a project and generate a plan and work schedule

UNIT 1

Introduction: formulation of LP problems, graphical solution of LP problems, General formulation of L P problems, Slack & Surplus variables, Standard form, Matrix form, Simplex method, Revised Simplex method, Dual simplex

UNIT 2

Assignment model, Transportation model, Game theory

Probability: Introduction, Basic terms of probability, The Addition law of probability, discrete & continuous, variables, random variables, probability distribution of random variables, Mean variance& standard deviation, Mathematical expectation of a random variable.

UNIT 3

Queuing theory

Introduction, queuing system, distribution, Kendall's Notation, Classification, model I (m/m/1).

UNIT 4

Project management by PERT CPM

Introduction, history, Applications, Basic steps, Network diagram representation, rules of drawing network diagram, labeling Fulkerson's I-J rule, Time estimates & Critical path, PERT, Resource allocation, Uses of PERT/CPM.

References:

1. Operations Research - S D Sharma
2. Operations Research - R K Gupta & D S Hira
3. Introduction to Operation research – Frederick S Hillier ,Gerald J and Liberman.
4. Operation research: An Introduction by Hamdy A Taha.
5. Operation research: Application and algorithm by Wayne L Winston.

MOBILE COMMUNICATION **3:1:0**

Course Code:CS A/B/C/D 320

Course Outcomes:

At the end of the course students will be able to:

CO1. Design a mobile cellular network

CO2. Optimize a radio channel system

CO3. Select the apt diversity scheme for a given wireless system to improve the performance.

CO4. Perform efficient spectral allocation using multiple access techniques such as CDMA, and OFDM.

CO5. Select the correct MAC protocol and routing algorithm for mobile ad-hoc networks.

CO6. Optimize the mobile ad-hoc network, MAC protocols and routing algorithms as per application.

UNIT 1

Introduction, Applications, History of wireless communication, reference model,
Wireless transmission, Frequencies for radio transmission, signals, Antennas, Signal propagation Multiplexing, Modulation, Spread spectrum

UNIT 2

Cellular Systems, Medium Access control, Motivation for a specialized MAC, SDMA, FDMA, TDMA, CDMA, Comparison.

UNIT 3

Telecommunications Systems, GSM, DECT, TETRA, UMS & IMT 2000
Satellite Systems, history, Applications, Basics, Classical TCP improvements, TCP over 2.5/3G wireless networks, performance enhancing proxies

UNIT 4

Support for mobility, File Systems World Wide Web, Wireless Application protocol

References:

1. Cellular and Mobile Communication- Krishna.
2. Cellular Mobile Communication – V S Bhagat
3. Cellular and Mobile Communication- V Jeyasri Arokiamary.
4. Wireless Communication and Networks – William Stallings.

5. Cellular Communication; A Comprehensive and practical guide- Nishith Tripathi and Jeffreyhreed.

C++ 2:0:2

Course Code:CSA250

Course Outcomes:

At the end of the course students will be able to:

CO1 . Understand the features of C++

CO2. Understand the relative merits of C++ as an object oriented programming language

CO3. Understand how to produce object-oriented software using C++

CO4. Understand how to apply the major object-oriented concepts to implement object oriented programs in C++, encapsulation, inheritance and polymorphism

CO5 Understand advanced features of C++ specifically stream I/O, templates and operator overloading

Unit I

Quick overview of C : Expressions - Statements - Arrays and Null-Terminated Strings – Pointers - Functions – Structures, Unions, Enumerations and User-Defned Types – C Style Console I/O – File I/O -.

Unit II

An Overview of C++ - Classes and Objects – Arrays, Pointers, References, and the Dynamic Allocation Operators

Unit III

Function Overriding, Copy Constructors and Default Arguments – Operator Overloading - Inheritance – Virtual Functions and Polymorphism

Unit IV

Templates – Exception Handling - The C++ I/O System Basics

References :

1. The Complete Reference C++, 4th Edition, Tata-McGraw-Hill, 2003, Herbert Schildt
2. Object Oriented Programming with C++ , M T Somashekara, D S Guru, H S Nagendraswamy and K S Manjunatha
3. C++ Premier, 5th Edition. Stanley B Lippman
4. C++ Programming language, E Balaguruswamy
5. The C++ programming language, 4th Edition, Bjarne Stroustrup

PATTERN RECOGNITION **3:0:1**

Course Code:CAC230

Course Outcomes:

At the end of the course students will be able to:

C01. Explain and compare a variety of pattern classification, structural pattern recognition, and pattern classifier combination techniques.

C02. Summarize, analyze, and relate research in the pattern recognition area verbally and in writing.

C03. Apply performance evaluation methods for pattern recognition, and critique comparisons of techniques made in the research literature.

C04. Apply pattern recognition techniques to real-world problems such as document analysis and recognition.

C05. Implement simple pattern classifiers, classifier combinations, and structural pattern recognizers.

UNIT 1

Machine perception, pattern recognition systems, Design Cycle, Learning and adaption, models of Pattern recognition

UNIT 2

Bayesian Decision Theory

Introduction, Bayesian, Decision theory- Two category classification, classifiers-Two category case and multi category case, missing and noisy features.

UNIT 3

Nonparametric Techniques

Introduction, Density estimation, Parzen window, KN neighbor estimation, The nearest neighbor rule, Metrics and Nearest Neighbor Classification, Error analysis of nearest decision rule

UNIT 4

Introduction, Heirarchical clustering techniques, partitional clustering techniques Dimensionality reduction techniques Introduction, principle component analysis, Fisher Linear Dicriminant Analysis, Spectral clustering based dimensionality reduction

References:

1. Pattern Classification, 2nd edition, Wiley publications, R. O Duda, P.E. Hart and D G Stork,
2. Pattern Recognition and Image Analysis, Prentice Hall of India, Pvt Ltd, Earl Gose, Richard, Johnsonbaugh, Steve Jost
3. Pattern Recognition and machine Learning, Cristopher M Bishop,
4. Pattern Recognition (Blue Ant) – Willian Gibsom.
5. Pattern Recognition, 4th Edition- Sergios Theodoridis and Konstantios Koutroumbas

IMAGE PROCESSING **2:1:1**

Course Code:CS A/B/C/D 330

Course Outcomes:

At the end of the course students will be able to:

C01. Analyze general terminology of digital image processing.

C02. Examine various types of images, intensity transformations and spatial filtering.

C03. Develop Fourier transform for image processing in frequency domain.

C04. Evaluate the methodologies for image segmentation, restoration etc.

C05. Implement image process and analysis algorithms.

C06. Apply image processing algorithms in practical applications.

UNIT I

Introduction, digital image fundamentals

UNIT II

Image enhancement in the spatial domain, Image enhancement in the frequency domain

UNIT III

Image restoration, color image processing

UNIT IV

Wavelets and multi-resolution processing image compression

References:

1. Digital Image Processing-Rafel C.Gonzalez and Richard E Words.
2. The Image Processing hand Book- John C Cruss.
3. Fundamentals of Digital Image Processing- Anil K Jain.
4. Digital Image Processing –Jayaraman S.
5. Digital Image Processing- Sanjay M Shah Munesh Chandra Trivedi

SOFTWARE TESTING **3:0:1**

Course Code:CSC440

Course Outcomes:

At the end of the course students will be able to:

CO1.Check Various test processes and continuous quality improvement

CO2.Verify Types of errors and fault models

CO3.Check Methods of test generation from requirements

CO4.Check Behavior modeling using UML: Finite state machines (FSM)

CO5.Test generation from FSM models

CO6.Input space modeling using combinatorial designs

UNIT 1

Assessing Testing Capabilities and Competencies, Building a software Testing Environment: Building a software Testing Strategy, Establishing a Software Testing Methodology, Determining your Software Testing Techniques, Selecting and Installing Software Testing Tools.

UNIT 2

The Eleven-Step Testing Process: Eleven-Step Testing Process Overview, Step1: Access Project Management Development Estimate and status, Step2: Develop Test Plan, Step3: Requirement Phase Testing,

UNIT 3

Step4: Design Phase Testing, step 5: Requirement Phase Testing, Step6: Execute Test and Record Results,

UNIT 4

Step7: Acceptance Test Results Step8: Report Test Results, Step9: Testing Software Installing, Step10: Test Software Changes, Step11: Evaluate Test Effectiveness.

.

REFERENCES:

1. Effective Methods for Software Testing, William E. Perry, 2nd Edition 2003, Wiley
2. *Surviving the Top Challenges of Software Testing*, New York: Dorset House, 1997., Rice, Randall and Peery, William E.,
3. A practitioner's Guide to Software Test Design, By Lee Copelane.
4. The Art of Software Testing By Glenford Myers.
5. Testing Object System: Models, Patterns and Tools by Robert V Binder.

GRAPH THEORY **3:1:0**

Course Code:CSB270

Course Outcomes:

At the end of the course students will be able to:

CO1. Explain basic concepts in combinatorial graph theory

CO2. Define how graphs serve as models for many standard problems

CO3. Discuss the concept of graph, tree, Euler graph, cut set and Combinatorics.

CO4. See the applications of graphs in science, business and industry.

UNIT 1

Introduction to Graph theory: Basic terminologies—direst & undirect graphs, walks, paths & circuits, sub-graphs and complements, Graph Isomorphism, vertex degree and regular graphs,

UNIT 2

Konigsberg bridge problem & Euler graphs. Hamilton graphs & traveling salesman problem, planar graphs- definition & examples, Bipartite & Kuratowskis graphs, Euler's formula & detection of planarity, Dual of Planar graphs,

UNIT 3

Graph Coloring: Proper coloring & chromatic number of graphs, Chromatic polynomial, four color problems, Trees: Optimization & Matching: Trees; Definition & Properties, Rooted & binary rooted trees, ordered trees & trees sorting. Weighted trees & prefix codes

UNIT 4

Spanning trees, optimization, Networks, Cutset, Edge & Vertex connectivity of a graph, Max-flow Min-cut thermo and its applications, Matching theory and its applications

References:

1. Graph Theory, V.K Balakrishnan, Schaum Series, McGrawHill, 1997
2. Graph Theory, by Frank Harary, Westview Press, 1994.
3. Introduction to Graph Theory, Douglas B west.
4. Hand Book of Graph Theory, Jonathan L Gross and Jay Yellen.
5. Graph Theory with application to Engineering and Computer science, Narsingh Deo.

OOAD **2:1:1**

Course Code:CSB210

Course Outcomes

At the end of the course students will be able to:

CO1. Analyse, design, document the requirements through use case driven approach.

CO2.Identify, analyse, and model structural and behavioural concepts of the system.

CO3.Develop, and explore the conceptual model into various scenarios and applications.

CO4.Apply the concepts of architectural design for deploying the code for software**UNIT I**

Implementation of Object Oriented concepts using C++

UNIT II

Introduction, Object orientation, OO development, OO themes, OO modeling ,History. Modeling, Abstraction, Models .Class Modeling Object & class, Link & Association concepts, Generalization & Inheritance, sample Class Model, Navigation of class models. Advanced class modeling: advanced object & class concepts, Association end N ary Association, Aggregation, Abstract Classes, Multiple Inheritance, Meta Data, Reification, Constraints, Derived Data.

UNIT III

State modeling: Events, States, Transitions & Conditions, State Diagrams, State Diagram behavior. Advanced state modeling, interaction modeling.

UNIT IV

System design: Overview of System design, Estimating performance, making a Reuse plan, Breaking a System into Subsystems, Identifying concurrency, Allocation of subsystems, Management of Data Storage.

Reference:

1. Object Oriented Analysis and Design – Blaha, Rambaugh.

2. Object Oriented Analysis and Design with the Unified Process- W Satzinger, Robert B Jackson and Stephen D Burd.

3. Object Oriented Analysis and Design with application, 3rd edition- Grady Booch, Robert A Maksimchuk, Michael W Engel

4. Object Oriented Analysis and Design with application- Grady Booch.

PROBABILITY AND STATISTICS **3:1:0**

Course Code: CS A/B/C/D 340

Course Outcomes

At the end of the course students will be able to:

CO1. Apply probability theory to set up tree diagrams
CO2. Apply probability theory via Bayes' Rule
CO3. Describe the properties of discrete and continuous distribution functions
CO4. Use method of moments and moment generating functions
CO5. Assess the consistency, efficiency and unbiasedness of estimators
CO6. Apply method of maximum likelihood estimation
CO7. Apply the Central Limit Theorem
CO8. Use statistical tests in testing hypotheses on data

UNIT 1

Introduction, basic terminology, Interpretation of probability: Axioms of probability, Some elementary theorems, Conditional probability, Mathematical Exception

UNIT 2

Probability Distributions: Introduction, Discrete probability distributions continuous probability distributions, The expected value of a random variable Chebyshev's Theorem

UNIT 3

Sampling distributions, Populations and samples, Sampling distribution, The sampling distribution of the mean, sampling distributions of proportions, sampling distributions of mean, chi squared distribution, F distribution.

UNIT 4

Estimation and inference theory, introduction, point estimation, interval distribution, bayesian estimation, test of hypot, Introduction to ANOVA.

References:

1. Probability and Statistics: Bheeshma Rao
2. Probability and Statistics, 4th edition, Degroot, Schervish.
3. Probability and Statistics for Engineering and Science, 8th edition, Jay L Devore.
4. Probability and Statistics, Michael Akritas.

5. An Introduction to Probability and Statistics,3rd edition, Vijay K Rohatgi and A K MD Ehsanes Saleh.

DATA MINING **2:1:1**

Course Code:CSD230

Course Outcomes:

At the end of the course students will be able to:

CO1. Demonstrate an understanding of the importance of data mining and the principles of business intelligence

CO2. Organize and Prepare the data needed for data mining using pre preprocessing techniques

CO3. Perform exploratory analysis of the data to be used for mining.

CO4. Implement the appropriate data mining methods like classification, clustering or Frequent Pattern mining on large data sets.

CO5. Define and apply metrics to measure the performance of various data mining algorithms.

UNIT 1

Introduction, what kind of patterns can be mined? which technologies are used? which kind of applications are targeted?, major issues in Data mining.

Getting to know your data: Data objects and attribute types, basic statistical description of data, Data Visualisation, Measuring Data similarity and dissimilarity.

UNIT 2

Data Preprocessing: data cleaning, Data integration, Data Reduction, Data transformation and Data Discretization

UNIT 3

Mining frequent patterns, Associations and correlations: Basic concepts, Frequent mining methods, pattern Evaluation methods, Pattern mining in Multilevel multi dimensional space, Decision tree induction.

UNIT 4

Cluster analysis, partioning methods, heirarchical methods, density based methods, grid based methods, evaluation of clustering.

References:

1. Data Mining: Concepts and Techniques, Third Edition, Jaiwei Han, Micheline Kamber, Jian Pei.

2. Learning Data Mining with Python, 2nd edition, Robert Layton.

3. Data Mining; The Text book, Charu C Aggarwal.

4. Data Mining, 4th edition: Practical Machine learning Tools and Techniques by Lan H Witten and Fibe Frank.

5. Introduction to Data Mining – Pang- Ning Tan and Micheal Steinbach

ARTIFICIAL INTELLIGENCE **3:1:0**

Course Code:CS A/B/C/D 350

Course Outcomes

CO 1. At the end of the course students will be able to:

CO 1. Create appreciation and understanding of both the achievements of AI and the theory underlying those achievements.

CO 2. Know concepts of a Rational Intelligent Agent and the different types of Agents that can be designed to solve problems

CO 3. Review the different stages of development of the AI field from human like behavior to Rational Agents.

CO4. Impart basic proficiency in representing difficult real life problems in a state space representation so as to solve them using AI techniques like searching and game playing.

CO5. The basic issues of knowledge representation and Logic and blind and heuristic search, as well as an understanding of other topics such as minimal, resolution, etc. that play an important role in AI programs.

CO6. Introduce advanced topics of AI such as planning, Bayes networks, natural language processing and Cognitive Computing.

UNIT 1

AI problems, AI techniques, defining the problem as state space search, production systems, problem characteristics

Heuristic Search: Generate and test, hill climbing, BFS, Problem Reduction, Constraint Satisfaction, Means-End Analysis

UNIT 2

Knowledge Representation: Representations and mappings, approaches to knowledge representation

procedural v/s declarative knowledge, normal forms in predicate logic and clausal forms, non-monotonic reasoning

Declarative Representations: semantic nets, conceptual dependency, frames, scripts

UNIT 3

Game playing: minimax search procedure, adding alpha-beta cut offs

Planning: An Example Domain – the blocks world, Components, goal stack planning

UNIT 4

Expert systems: expert systems v/s conventional computers, expert system shells, explanation based learning.

Learning: Learning from observation - Inductive learning – Decision trees – Explanation based learning – Reinforcement Learning, Neural Networks, Introduction to Natural Language Processing.

References:

1.Artificial Intelligence, Third Edition, Elaine Rich, Kevin Knight, Shivashankar B Nair, Tata McGraw-Hill.

2. Introduction to Artificial Intelligence, Wolfgang Ertl.

3. Artificial Intelligence,2nd edition, Stuart Russel, peter Norvig.

4. Artificial Intelligence, Jeorge F Luger

5. Artificial Intelligence, Saroj kaushik

.NET TECHNOLOGIES **2:0:2**

Course Code:CSB280

Course Outcomes

At the end of the course students will be able to:

CO1. Design web applications using .NET
CO2. Use .NET controls in web applications.
CO3. Debug and deploy .NET web applications
CO4. Create database driven .NET web applications and web services

Unit 1

Benefits of .NET Framework, Architecture of .NET Framework 4.0, Components of .NET Framework 4.0: CLR, CTS, Metadata and Assemblies, .NET Framework Class Library, Windows Forms, ASP .NET.

Need of C#, C# Pre-processor Directives, Creating a Simple C# Console Application, Identifiers and Keywords. Data Types, Variables and Constants: Value Types, Reference Types, Type Conversions, Boxing and Unboxing, Variables and Constants. Expression and Operators: Operator Precedence, Using the :: (Scope Resolution) Operator and Using the ***is*** and ***as*** Operators. Control Flow statements: Selection Statements, Iteration Statements and Jump Statements.

Unit 2

Arrays and Strings: One Dimensional and Multidimensional Arrays, Jagged Arrays

Classes and Objects: Creating a Class, Creating an Object, Using this Keyword, Creating an Array of Objects, Using the Nested Classes, Defining Partial Classes and Method, Returning a Value from a Method and Describing Access Modifiers. Static Classes and Static Class Members. Properties: Read-only Property, Static Property, Accessibility of accessors and Anonymous types. Indexers, Structs: Syntax of a struct and Access Modifiers for structs. Strings: Constructing Strings, Operating on Strings, Arrays of Strings, The String Class

Unit 3

Encapsulation: Encapsulation using accessors and mutators, Encapsulation using Properties. Inheritance: Inheritance and Constructors, Sealed Classes and Sealed Methods, Extension methods. Polymorphism: Compile time Polymorphism/Overloading, Runtime Polymorphism/

Overriding. Abstraction: Abstract classes, Abstract methods. Interfaces: Syntax of Interfaces, Implementation of Interfaces and Inheritance.
Delegates: Creating and using Delegates, Muticasting with Delegates. Events: Event Sources, Event Handlers, Events and Delegates, Multiple Event Handlers. Exception Handling: The try/catch/finally statement, Checked and Unchecked Statements.

Unit 4

Introduction, Windows Forms, Life Cycle, Event Handling: A Simple Event- Driven GUI, Visual Studio Generated GUI Code, Delegates and Event- Handling Mechanism, Another Way to Create Event Handlers, Locating Event Information. Control Properties and Layout, Labels, TextBoxes and Buttons, GroupBoxes and Panels, CheckBoxes and RadioButtons, ToolTips, Mouse-Event Handling, Keyboard-Event Handling. Menus, MonthCalendor Control, ListBox Control, CheckedListBox Control, ComboBox Control, TreeView Control, ListView Control, TabControl Control ; Building an Multiple Document Interface (MDI) Application. Introduction to ADO.NET

References:

1. Programming in C# 4.0, Tata McGraw Hill, Hebert Shildt
2. C# with .net 4.0 by Andrew Troelsen
3. Programming in C# , 3rd Edition, E Balaguruswamy
4. The Complete Reference C#, Herbert Schildt.
5. The Complete Reference ASP.NET, Robert Standefer III

OBJECT ORIENTED MODELING AND DESIGN WITH UML 2:1:1

Course Code:CSA/B/C/D 360

Course Outcomes

At the end of the course students will be able to:

CO1. Design & Programming course is a unique course that teaches students how to use object-oriented techniques to build software.
CO2. Gathering requirements & end with implementation.
CO3. Analyze and design classes, their relationships to each other in order to build a model of the problem domain.
CO4. Use common UML diagrams throughout this process, such as use-case, class, activity & other diagrams.
CO5. Create The diagrams through a free tool.
CO6. Capture and manage requirements.

Unit I

INTRODUCTION : Object-Oriented Analysis and Design - Iterative, Evolutionary, and Agile. - Case Studies : The NextGen POS System - INCEPTION : Inception is Not the Requirements Phase – Evolutionary Requirements - Use Cases – Other Requirements:NextGen Example

Unit II

ELABORATION ITERATION 1: Basics – Domain Models – System Sequence Diagrams – Operation Contracts – Requirements to Design-Iteratively – Logical Architecture of UML Package Diagrams

Unit III

On to Object Design – UML Interaction Diagrams – UML class Diagrams - GRASP : Designing Objects with Responsibilities – Object Design Example with GRASP:NextGen POS system – Designing for Visibility – Mapping Designs to Code

Unit IV

ELABORATION ITERATION 2: UML Tools and UML as Blueprint – Quick Analysis Update: NextGen POS – Iteration 2: More Patterns – GRASP: More Objects with Responsibilities – applying GoF Design Patterns

Reference:

1. "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development", Third Edition, Pearson Education, 2005, Craig Larman,
2. Advanced Object Oriented Analysis and Design using UML , James J Odell.
3. Object Oriented Analysis and Design , Mike O-Docherty.
4. Object Oriented Modeling and Design with UML, 2nd edition, Michael R Blaha, James R Rumbauh.
5. Object Oriented Systems and Analysis and Design using UML, Simon Bennetth, Steve McRovv and Ray Farmer.

ANDROID APPLICATION DEVELOPMENT **2:0:2**

Course Code:CSA/B/C/D 370

Course Outcomes

At the end of the course students will be able to:

CO1. Describe and compare different mobile application models/architectures and patterns.
CO2. Apply mobile application models/architectures and patterns to the development of a mobile software application.
CO3. Describe the components and structure of a mobile development framework (Google's Android Studio).
CO4. Apply a mobile development framework to the development of a mobile application.
CO5. Demonstrate advanced Java programming competency by developing a maintainable and efficient cloud based mobile application

Unit 1

Introduction to Android & Open Handset Alliance

Installation of Android Studio and other Development Environments like Gradle.

Understanding Android File System.

Creating First Android Application

Understanding Intent, Activity, Service, Content Providers, Broadcast Receivers.

Understanding Android Application, Manifests, Layouts, Drawables, Styles, Android Activity, View

Understanding Android XML based layout (Linear Layout, Relative Layout, Frame Layout).

Introduction to Android Life Cycle Events

initialization and Button Click Listeners.

Unit 2

Development of Simple app containing Dialog Box, Intents,Toast, Spinners, Listeners examples.

Android Listview / GridView and Adapters

Android Date Picker Dialog, Time Picker Dialog

Launching sub Activity

Building Custom ListView and Understanding Adapters in detail

Understanding SQLite database. Populating database.

Developing simple app by using SQLite database (insert, delete, update)

Unit 3

Working with web server basics

Background loading, AsyncTask , Using Threads

Developing simple app by downloading image from web and showing it in ImageView

Understanding Importance of External Libraries and demonstration of simple external library

Image lazy loading, Image loading in list view, grid view

Unit 4

Working with Google Maps

ViewPager

Introduction to fragment, add, remove, replace fragment

ViewPager

Side Navigation Drawer

Action bar/ Toolbar

ViewPager Adapter / Swipe View

References:

1. Android Programming for Beginners by John Horton.

2. Professional Android 4 application development by Reto Meir.

3. Android Book by Lan F Darwin.

4. Learning Android Building application for The Android Market by Marko Gargenta.

5. Programming Android Java programming for the new generation of Mobile Devises by Zigurd Mellieks

ADVANCED DATABASE MANAGEMENT SYSTEM **2:1:1**

Course Code:CS A/B/C/D 380

Course Outcomes

At the end of the course students will be able to:

CO1. Evaluate and Apply Advanced Database Development Techniques.

CO2. Evaluate Database Systems.

CO3. Administer Database Systems.

CO4. Design & Implement Advanced Database Systems.

Unit 1

Disk storage, Basic file Structures and hashing, indexing structures for files.

Algorithms for query optimization.

Unit 2

Physical database design and tuning, Introduction to transaction, Concurrency control techniques.

Concept for object databases, Object databases standard and design, database security.

Unit 3

Enhanced datamodels for advanced applications, distributed databases and client server architectures, Emerging database technologies and applications.

Unit 4

Definition of NoSQL, History of NoSQL and Different NoSQL products, NoSQL Basics. Exploring one among MongoDB/CouchDB/Cassandra along with Java/Ruby/Python interface : Interfacing and Interacting with NoSQL, NoSQL Storage Architecture, CRUD operations, Querying, Modifying and Managing NoSQL Datastores, Indexing and ordering datasets

References:

1. Fundamentals of Database System :5th Edition ,Navathe

2. Database Management System, Panneerselvam R.
3. Database Management System, Raghu Ramakrishnan and Johannes Gehrke.
4. Data Schemes: Models and algorithms (Advances in Database Systems), Charu C Aggarwal.
5. Multilevel secure Transaction Processing (Advances in Database system), Vijay Atluri and Sushin Jajodia.

COMPILER DESIGN **3:0:1**

Course Code:CS A/B/C/D 390

Course Outcomes

At the end of the course students will be able to:

CO1. Construct a parse tree, or explain why no parse tree exists, given a BNF grammar and a string over the appropriate alphabet.

CO2. Implement a lexical analyzer from a specification of a language's lexical rules.

CO3. Compute the FIRST set for a BNF grammar.

CO4. Compute the FOLLOW set for a BNF grammar.

CO5. Determine FIRST intersect FIRST constraint satisfaction - determine if a BNF grammar satisfies the constraint on intersection of FIRST sets required for single-symbol-lookahead, top-down, lookahead parsing ()

CO6. Determine FIRST intersect FOLLOW constraint satisfaction - determine if a BNF grammar satisfies the constraint on intersection of FIRST and FOLLOW sets required for single-symbol-lookahead, top-down, lookahead parsing ()

Unit-1

Introduction, Classification of grammars. Context free grammars. Deterministic finite state automata (DFA) Non-DFA.

Lexical analysis :Language processors; The structure of a Compiler; The evolution Of programming languages; The science of building a Compiler; Applications of compiler technology; Programming language basics. Lexical analysis: The Role of Lexical Analyzer; Input Buffering; Specifications of Tokens; Recognition of Tokens.

Unit-2

SyntaxAnalysis

Introduction; Context-free Grammars; Writing a Grammar. Top-down Parsing; Bottom-up Parsing.

Introduction to LR Parsing: Simple LR; More powerful LR parsers (excluding Efficient construction and compaction of parsing tables) ; Using ambiguous grammars; Parser Generators.

Unit-3

Intermediate Code Generation

Variants of syntax trees; Three-address code; Translation of expressions; Control flow; Back patching; Switch-statements; Procedure calls.

Run-Time Environments

Storage Organization; Stack allocation of space; Access to non-local data on the stack; Heap management; Introduction to garbage collection.

Unit-4

Code Generation

Issues in the design of Code Generator; The Target Language; Addresses in the target code; Basic blocks and Flow graphs; Optimization of basic blocks; A Simple Code Generator

Code optimization. Folding, redundant sub-expression evaluation. Optimization within iterative loops.

References:

1. Compilers Principles, Techniques and Tools, 2nd Edition, Addison-Wesley, 2007, Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D Ullman

2."The Theory and Practice of Compiler Writing". McGraw Hill, New York, 1985, Tremblay, et. al

3. Principles, Techniques and Tools of Compilers.- Allen I Holob.

4. Elements of Compiler Design.- Meduna

5. Compiler Design - K Muneeswaran.

OPEN ELECTIVES **2:0:2**

OP1: COMPUTER FUNDAMENTALS

Course Code: PHC/CHC/BCC/BTC/BOC/MAC/SWC/KAC/ENC/MCC/ZOC 640

Course Outcomes:

At the end of the course students will be able to:

CO1. Use technology ethically, safely, securely, and legally.
CO2. Identify and analyze computer hardware, software, and network components.
CO3. Design basic business web pages using current HTML/CSS coding standards.
CO4. Install, configure, and remove software and hardware.
CO5. Use systems development, word-processing, spreadsheet, and presentation software to solve basic information systems problems.

UNIT 1

INTRODUCTION

Computer, Characteristic of Computer, History of Computer, Components of Computer

Key Factors of Computers: Hardware, Software - types of Software (Application and system), forms of software (firmware, shareware, freeware), Translator - Assembler, Compiler and Interpreters. Computer Application – Business, Scientific, Entertainment and educational.

CLASSIFICATION OF COMPUTERS

Mode of operations – Analog, Digital and hybrid Computers

Size and capabilities – Micro, Mini, Main frame and Super computer

UNIT 2

MEMORY UNITS

Primary memory - RAM, ROM, PROM, EPROM, EEPROM, Flash memory

Secondary memory – Magnetic disk (Hard disk, Zip disk, Jaz disk, Super disk)

Optical disk (CD, CD – R, CD – RW, DVD), Magneto-optical disk device

COMPUTER PERIPHERALS DEVICES AND INTERFACES

Input devices – Working principle of Keyboard and mouse, Functional capabilities of Scanner, Digital Camera, OMR, OCR, touch pad, touch screen. Output Devices – Monitor, Printer, Plotter and projector.

Processors, Classification of Processors on speed, Motherboard, Power Supply, I/O Ports and its Maintenance

PROGRAMMING LANGUAGES

Machine, Assembly language and High Level Language

UNIT 3

Introduction to Windows, Elements of Word Processing, Spread Sheet, Presentations .

Nudi/Baraha.

UNIT 4: INTERNET

Basics of Internet: www, HTTP, DNS, IP address, Email, Web browsers, Search Engines

HTML: Introduction to HTML, CSS

E-Commerce: Introduction, Types, Advantages of e-commerce, Applications, survey on popular e-commerce sites

E-governance, Introduction to Cyber Ethics

References:

1. Computer Fundamentals (6th Edition) – Rajaraman.
2. Computer's Today – Suresh K Basandra.
3. Computer Fundamentals-P K Sinha
4. Computer System Architecture (3rd Edition) PHI-2002. Chapters 3.3 & 3.4- Morris Mano,
5. Digital Principles and application (4th Edition) – Malvino Leach, Tata Mc Graw-Hill Edition
6. Computer System Architecture (3rd Edition) – Morris Mano, PHI
7. Microsoft office 365-Katherine Murray.
8. Microsoft office 2016- Nita Rutkosky, Denise Seguin, Audrey Rutkosky Roggenkamp
9. The Complete reference HTML by Herbert Schildt
10. Learn to program HTML and CSS for beginners
11. HTML black book –Steven Holzner.

Choice Based Credit System & Continuous Assessment Grading Pattern

SYLLABUS FOR

MASTER OF ARTS IN ENGLISH

Programme Code: ENG

2021-24

JSS COLLEGE OF ARTS, COMMERCE & SCIENCE

(An Autonomous College of University of Mysore; Re-Accredited by NAAC with 'A' Grade**)**

POSTGRADUATE DEPARTMENT OF STUDIES & RESEARCH IN ENGLISH

OOTY ROAD, MYSURU-570 025, KARNATAKA

POSTGRADUATE DEPARTMENT OF STUDIES & RESEARCH IN ENGLISH

COURSES OFFERED

I SEMESTER

Course I – (Hard Core-I) English Literature from Chaucer to Milton	**ENA 010**
Course II – (Hard Core-II) Elizabethan Age	**ENA 020**
Course III – (Hard Core-III) 17th and 18thCentury English Literature	**ENA 030**
Course IV – (Hard Core-IV) 19th Century English Literature	**ENA 040**
Course V – *(Soft Core-I) Realism and Fiction	**ENA 250**
***(Soft Core-II) Contemporary Indian Novels in English**	**ENA 220**

II SEMESTER

Course I - (Hard Core – I) The Modern Age-I	**ENB 040**
Course II - (Hard Core-II) Literary Criticism-I	**ENB 020**
Course III – (Hard Core-III) Indian Writing in English – I	**ENB 030**
Course IV – (Hard Core-IV) 20th Century Women's Writing: Theory & Practice	**ENB 050**
Course V – *(Soft Core-I) Dalit Literature	**ENB 230**
***(Soft Core-II) English Essayists**	**ENB 220**

Note: * Soft Core Elective Courses

III SEMESTER

Course I – (Hard Core-I) The Modern Age-II	**ENC 010**
Course II – (Hard Core-II) Indian Writing in English-II	**ENC 020**
Course III – (Hard Core-III) New Literatures in English	**ENC 030**
Course IV (Open Electives) A Course in Written and Spoken English	**OE**
Course V –* (Soft Core-I) Indian English Poetry After Independence	**ENC 230**
***(Soft Core-II) Feminism**	**ENC 220**

IV SEMESTER

Course I – (Hard Core-I) Literary Criticism-II	**END 010**
Course II – (Hard Core-II) American Literature	**END 020**
Course III – (Hard Core) Major Project Work leading to a Dissertation	**END 030**
Course IV – *(Soft Core I) Indian Diaspora Fiction	**END 240**
***(Soft Core II) African Fiction**	**END 220**

Note: * Soft Core Elective Courses

POSTGRADUATE DEPARTMENT OF STUDIES & RESEARCH IN ENGLISH

Choice Based Credit System & Continuous Assessment Grading Pattern Syllabus

MA PROGRAMME IN ENGLISH

2021-24

Semester	Type of Course		Course Title	L	T	P	Credits	Credits required
First Semester	Hard Core	1.	English Literature from Chaucer to Milton	3	1	0	4	16
		2.	Elizabethan Age	3	1	0	4	
		3.	17th and 18thCentury English Literature	3	1	0	4	
		4.	19th Century English Literature	3	1	0	4	
	Soft Core Electives	1.	Realism and Fiction	3	1	0	4	4
		2.	Contemporary Indian Novels in English	3	1	0	4	
							Total Credits	**20**
Second Semester	Hard Core	1.	The Modern Age-I	3	1	0	4	16
		2.	Literary Criticism-I	3	1	0	4	
		3.	Indian Writing in English – I	3	1	0	4	
		4.	20th Century Women's Writing: Theory & Practice	3	1	0	4	
	Soft Core Electives	1.	Dalit Literature	3	1	0	4	4
		2.	English Essayists	3	1	0	4	
							Total Credits	**20**

Semester	Type of Course		Course Title	L	T	P	Credits	Credits required
Third Semester	Hard Core	1.	The Modern Age-II	3	1	0	4	12
		2.	Indian Writing in English-II	3	1	0	4	
		3.	New Literatures in English	3	1	0	4	
	Soft Core Electives	1.	Indian English Poetry After Independence	3	1	0	4	4
		2.	Feminism	3	1	0	4	
	Open Elective	1.	A Course in Written and Spoken English	3	1	0	4	4
							Total Credits	**20**
Fourth Semester	Hard Core	1.	Literary Criticism-II	3	1	0	4	12
		2.	American Literature	3	1	0	4	
		3.	Major Project Work leading to Dissertation	0	0	4	4	
	Soft Core Electives	1.	Indian Diaspora Fiction	3	1	0	4	4
		2.	African Fiction	3	1	0	4	
							Total Credits	**16**
							Total Credits at the end of the Course	**76**

Programme Outcomes

On graduating from this programme student is able to

PO1: Learn to write logically relating the real-life scenario with the issues depicted in literary texts.
PO2: Demonstrate critical reading, writing, and thinking skills in writing analytical essays.
PO3: Recognise and understand figurative language in literary works of various literatures.
PO4: Equips the students to understand theoretical developments in literary studies.
PO5: Acquire skills of criticism in reading literary works of different periods of various genres.
PO6: Write focused, organised, well-developed text-based essays.

Programme Specific Outcomes

On completion, the graduate of this programme is able to

PSO1: Acquire the competence to work as English Language teacher at Primary, Secondary, Higher secondary and Pre-University level.
PSO2: Gain basic knowledge needed to enroll for M Phil or PhD programmes.
PSO3: Demonstrate good communication skills.
PSO4: Draft literary essays demonstrating the skills of critical thinking and creative writing.
PSO5: Participate in discussions and debates demonstrating good communication skills.
PSO6: Learn the skills to work as English language trainer.

Course I – (HC-I) ENGLISH LITERATURE FROM CHAUCER TO MILTON

Course Code: ENA 010 **Credits: 4**
Teaching Hours: 60 (4 Hours/Week)

Course Outcomes

At the end of the Course, student able to

CO1: Recognize and understand figurative language, such as allegory and metaphor, and literary techniques, such as irony, rhyme, and allusion.
CO2: Identify the unique qualities of the authors studied, and compare and contrast them.
CO3: Develop a well-written argument about one or more literary texts or authors, and accurately cite literary and other sources.
CO4: Develop ability to read, summarize and critically analyse poems and sonnets of various themes.

UNIT –I

1. Background – 14th Century – 1658
2. Renaissance, Reformation, Puritan Upsurge
3. Jacobean, Metaphysical School

UNIT – II

1. Chaucer -- Prologue to the Canterbury Tales
2. John Milton – Paradise Lost: Book-I
3. Book of Job

UNIT – III

1. Sidney: Sonnets I, V &VI (Astrophel and Stella)
2. Spenser: Prothalamion, Epithalamion
3. Surrey: 1. Love that liveth and reigneth in my thought
   2. Set me whereas the sun doth parch the green
4. Wyatt: 1. Who so list to hunt 2. They flee from me

UNIT – IV

1. John Donne – The Goodmorrow, Song: Go and Catch a Falling Star, Death be Not Proud, At the Round Earth's Imagined Corner, Sunne Rising, Resurrection
2. George Herbert – The Pulley, The Collar, Virtue, Discipline
3. Andrew Marvell – To His Coy Mistress, Thoughts in a Garden
4. Robert Herrick- To the Virgins, To Find God.

Books for Reference and Further Reading:

1. David Daiches –*A Critical History of English Literature*- Four volumes.
2. Boris Ford (Ed) - *Pelican Guide to English Literature*- Eight volumes.
3. Herbert Grierson - *Metaphysical Poets.*
4. Abrams M H et al. *The Norton Anthology of English Literature*. New York: Norton, 2006.
5. Al Poplaski: *English Literature in Context.*

Course II – (HARD CORE-II) ELIZABETHAN AGE

Course Code: ENA-020 **Credits: 4**
Teaching Hours: 60 (4 Hours/Week)

Course Outcomes

At the end of the Course, student able to

CO1: Understand the origin and growth of English Theatres and Renaissance plays.
CO2: Demonstrate knowledge of Elizabethan culture, society and politics.
CO3: Analyse Shakespearean Tragedies and Comedies in terms of language, character and Themes.
CO4: Develop ability to read, summarize and critically analyse Shakespearean sonnets on various themes.

UNIT –I
Background – Elizabethan Age

Elizabethan theatre and audience Shakespeare- Tragedy and Comedy

UNIT – II
Marlowe: *Dr. Faustus*

Ben Jonson: *Volpone*

Thomas Nashe: *Dido: Queen of Carthage*

UNIT – III
William Shakespeare: 1) *King Lear*
2) *Julius Caesar*
3) *As you Like It*
4) *Tempest*

UNIT – IV
Shakespeare's Sonnets: **18, 19, 29, 30, 33, 55, 60, 71, 73, 114, 116, 130, 131, 133**

Books for Reference and Further Reading:

1. A.C. Bradley – *Shakespearean Tragedy*
2. F R Leavis – *The Common Pursuit*
3. Wilson Knight – *The Wheel of Fire*
4. Stewart Justman – *Shakespeare: The Drama of Generations*
5. S. Vishwanathan - *Exploring Shakespeare*
6. Cleanth Brooks - *Understanding Drama*
7. Toropov - Shakespeare for Beginners

Course III – (HARD CORE-III) 17th and 18th CENTURY ENGLISH LITERATURE

Course Code: ENA 030 **Credits: 4**
Teaching Hours: 60 (4 Hours/Week)

Course Outcomes

At the end of the Course, student able to

CO1: Apply knowledge of the historical and cultural contexts of the literature of this period to comprehend the works of major authors.
CO2: Recognize and understand figurative language, such as allegory and metaphor, and literary techniques - irony, rhyme, and allusion.
CO3: Reflect and write analytically about the literary texts and their contexts.
CO4: Develop skills of literary critical analysis reading the prescribed plays, novels and essays.

UNIT –I

Background – Restoration, Neo-Classical, Augustan Satire, Comedy of Manners Spectator Essays

UNIT – II

Dryden – *Absalom and Achitophel*

Alexander Pope – *The Rape of the Lock*

Bunyan – *Pilgrim's Progress Book-1*

UNIT – III

William Congreve - *The Way of the World*

Sheridan – *The School for Scandal*

Aphra Behn- *Oroonoko (Royal Author)*

UNIT – IV

Daniel Defoe: *Robinson Crusoe*

Jonathan Swift – *Gulliver's Travels – Book IV* (Voyage to the Land of Houyhnhnms)

Addison & Steele: Spectator Essays

Addison: (1) Sir Roger at Church, (2) Sir Roger at Assizes

Steele: (1) The Gentleman 2) The Spectator Club

Books for Reference and Further Reading:

1. M.H. Abrams (Ed) *The Norton Anthology of English Literature* (Vol.1 & 2)
2. David Daiches – *A Critical History of English Literature* –Four volumes
3. Arnold Kettle- *The English Novel*- Two volumes
4. Ian Jack – *The Augustan Satire: Intention and Idiom in English poetry 1660-1750*
5. Pramod Nayyar (ed) – *English Poetry 1660-1780: An Anthology*

Course IV (Hard Core – IV) – 19th CENTURY ENGLISH LITERATURE

Course Code: ENA 40 **Credits: 4**
Teaching Hours: 60 (4 Hours/Week)

Course Outcomes
At the end of the Course, student able to
CO1: Understand the impact of French Revolution on Romantic and Victorian age.
CO2: Learn the issues related to Woman's Question during the period and contributions of Mary Wollstonecraft and J S Mill to this movement.
CO3: Recognize and understand the use of allegory, metaphor, irony, rhyme, rhythm, allusion in Romantic and Victorian poetry
CO4: Reflect analytical skill of understanding literary essays of Victorian philosophers. .
CO5: Develop ability to read, summarize and critically analyse the novels of Jane Austen, Emily Bronte, Charles Dickens and Thomas Hardy.

Unit I: Background:
1. French Revolution;
2. The Romantic Movement in Literature with special reference to leading Romantic poets; Influence of German Philosophy on Romanticism (Schiller and Kant)
3. Introduction to 19th Century Prose and Victorian Poetry
4. Women Question with reference to J S Mill and Mary Wollstonecraft

Unit II: Poetry
1. William Blake: 1) Tyger; 2) London 3) The Chimney Sweeper
2. William Wordsworth: Tintern Abbey, Ode to Immortality, Lucy Poems: A Slumber Did My Spirit Seal, She Dwelt Among Untrodden Ways.
3. S T Coleridge: The Rime of the Ancient Mariner
4. P B Shelley: Ode to the West Wind; To A Skylark
5. John Keats: Ode on the Grecian Urn, Ode to Autumn
6. Robert Browning: My Last Duchess
4 Tennyson: Ulysses, Lotus Eaters

Unit III: Fiction
1. Jane Austen: Emma
2. Emily Bronte: Wuthering Heights
3. Charles Dickens: Hard Times
4. Thomas Hardy: Jude the Obscure

Unit IV: Prose
1. J. Ruskin: *Unto the Last* (Chs.1 and 2)
2. J.S. Mill: "On Liberty"
3. Mathew Arnold: Culture and Anarchy
(Ch 1: Sweetness & Light , Ch 2: Hellenism & Hebraism)

Books for Reference and Further Reading:
1. Russell Noyes (Ed.): *English Romantic Poetry and Prose*.
2. Harold Bloom and Lionel Trilling: *Romantic Poetry and Prose*.
3. M. Bowra: *The Romantic Imagination*.
4. William D. Templeman and Charles F. Harrold: *English Prose of the Victorian Era*.

Any one of the soft cores to be chosen for earning 4 credits

PAPER- V – (SOFT CORE-I) REALISM AND FICTION

Course Code: ENA-250 **Credits: 4**
Teaching Hours: 60 (4 Hours/Week)

Course Outcomes:
At the end of the Course, student able to
CO1: Understand Realism as a literary movement and types of Realism.
CO2: Learn the narrative techniques employed by the realistic novelists.
CO3: Critically analyse the use of symbolisms in the prescribed novels.
CO4: Understand and analyse the realistic novels of British, American, and Indian writers.
CO5: Read, summarize and critically analyse the novels of Charlotte Bronte, George Eliot, William Makepeace, Hawthorne, Henry James, Steinbeck, Premchand, Tagore and Kamal Markandaya.

Unit I:

Realism as a literary movement, Types: Social Realism, Regionalism, Kitchen Sink Realism, Naturalism and Realism, Narrative techniques, Realistic novelists

Unit II:

Charlotte Bronte: *Jane Eyre*
George Eliot: *Mill on the Floss*
William Makepeace Thackeray: *Vanity Fair*

Unit III:

Nathaniel Hawthorne: *The Scarlet Letter*
Henry James: *The Portrait of a Lady*
John Steinbeck: *The Grapes of Wrath*

Unit IV:

Premchand: *Nirmala*, translated into English by Alok Rai
Tagore: *The Home and the World*
Kamala Markandaya: *Nectar in a Sieve*

Books/Texts for Reference and Further Reading:

1. Henry James, *The Art of the Novel*, ed. R P Blackmore, 1934.
2. Percy Lubbock, *The Craft of Fiction*, 1921.
3. E M Forster, *Aspects of the Novel*, 1927.
4. Wayne C. Booth, *The Rhetoric of Fiction*, 1961.
5. Sandra Gilbert and Susan Gubar, *The Madwoman in the Attic: the Woman Writer and the Nineteenth-Century Literary Imagination*, 1979.

SOFT CORE II: Contemporary Indian Novels in English

Course Code: ENA-240 **Credits: 4**
Teaching Hours: 60 (4 Hours/Week)

Course Outcomes

At the end of the Course, student able to

CO1. Learn to explore the thematic paradigm shift in the contemporary Indian writings.
CO2. Appreciate the postmodern literary devices employed by the writers.
CO3. Read and critically analyse the Indian novels published in 2000 and after.
CO4. Develop ability to read, summarize and critically analyse various themes in the works of Anurag Mathur, Anita Desai, Vikram Seth, Shashi Deshpande, Amit Chaudhuri, Anita Nair, Upamanyu Chatterjee and Manju Kapur.

Unit I:

1. Anurag Mathur: The Inscrutable Americans (1991)
2. Anita Desai: Fasting, Feasting (1999)

Unit II:

1. Vikram Seth: A Suitable Boy (1993)
2. Shashi Deshpande: *A Matter of Time* (2000)

Unit III:

1. Amit Chaudhuri: *A New World (2000*)
2. Anita Nair: Ladies Coupe (2001)

Unit IV:

1.Upamanyu Chatterjee: Way to Go (2010)
2. Manju Kapur: Custody (2011)

***Note: Two lecture to introduce new themes and techniques of Contemporary Indian writing**

Books for Reference and Further Reading:

1. K.R. Srinivasa Iyengar: *Indian Writing in English,* 1994.
2. Mukherjee, Meenakshi, C. Vijayshree and Vijay Kumar, eds. *The Nation Across the World: Postcolonial Literary Representations*. New York: OUP, 2008.
3. P K Dhawan and Veena Noble Das, ed. Fiction of the Nineties. 1990.
4. Shukla, Sheo Bhushan and Anu Shukla, ed. The Novels of Amit Chaudhuri: An Exploration in the Alternative Tradition, Sarup and Sons, 2012.

II SEMESTER

Course I – (HARD CORE-I) THE MODERN AGE- I

Course Code: ENB 040 **Credits: 4**
Teaching Hours: 60 (4 Hours/Week)

Course Outcomes

At the end of the Course, student able to

CO1: Understand the social, political and cultural milieu of the age.

CO2: Learn the impact of World War I and II on 20th Century poetry.

CO3: Identify and analyse literary elements like rhyme, rhythm, tone, style, imagery and, symbols, etc.

CO4: Reflect the analytical skills of understanding war poetry.

UNIT – I

World Wars – I & II, Imagism, Surrealism, Symbolism, Free Verse, Existentialism, and Phenomenology

UNIT – II

G.M. Hopkins: The Wreck of Deutschland, Windhover

W.B Yeats: Sailing to Byzantium, Byzantium, Second Coming, Easter 1916

Thomas Hardy: The Darkling Thrush, The Man He Killed

Wilfred Owen: Strange Meeting, Insensibility

UNIT – III

T.S. Eliot – The Wasteland, The Journey of the Magi

W H Auden – In Memory of W. B. Yeats, Muse des Beaux Arts

Sylvia Plath: The Arrival of the Bee Box: Lady Lazarus

UNIT – IV

Dylan Thomas: After the Funeral, Fern Hill

Seamus Heaney: Tollund Man, Digging, Casuality

Philip Larkin: Church Going, Next Please

Ted Hughes: Thought Fox, Hawk Roosting

Books for Reference and Further Reading:

1. F. R. Leavis. *New Bearings in English Poetry*
2. Faber Book of Modern Verse
3. Norton Anthology of English Literature

Course II (Hard Core-II) - LITERARY CRITICISM-I

Course Code: ENB 020 **Credits: 4**

Course Outcomes

At the end of the Course, student able to

CO1: Learn the meaning, elements and characteristics of classical literary criticism.

CO2: Understand the basics of literary/ critical theories.

CO3: Learn the technique of early literary criticism.

CO4: Acquire the skills to interpret literary works using literary theories.

Unit I:
Origin, growth, and development of Literary Criticism, Various Posits and Literary Contexts

Principles of Literary and Practical Criticism

Unit II:
1. Longinus: *On the Sublime*

2. Plato on Mimesis in *A Short History of English Literary Criticism* by Wimsatt& Brooks

3. Aristotle: *Poetics*

Unit III:
1. Sidney: *Apology for Poetry*

2. Samuel Johnson: *Preface to Shakespeare*

3. Dryden: *On Dramatic Poesy*

Unit IV:
1. W. Wordsworth: *Preface to Lyrical Ballads*

2. Coleridge: *Biographia Literaria* (Chapters 13, 14, 17)

3. Arnold: *The Function of Criticism at the Present Time*

Books for Reference and Further Reading:

1. I.A. Richards. Principles of Literary Criticism
2. C.T. Indira et al. English Literary Criticism
3. M.S. Nagarajan. English Literary Criticism and Theory
4. Vernon Hall. A short history of literary criticism

Course III – (HC-II) INDIAN WRITING IN ENGLISH – I

Course Code: ENB 030 **Credits: 4**

Teaching Hours: 60 (4 Hours/Week)

Course Outcomes

At the end of the Course, student able to

CO1: Understand the Origin and Growth of Indian English Writing.
CO2: Study different phases of Indian writing and understand their features.
CO3: Understand the social, political and cultural milieu of Pre-independent India explored in literary works.
CO4: Explore different issues in Indian Writing in English depicted in poetry, plays, novels, and essays.

Unit I

Anglicists and Orientalists Debates, *Macaulay's Minute*, Rajaram Mohan Roy's *Letter to Lord Amherst*, The Rise of the Indian English Novel, Novel as a Social Act.

Unit II: Poetry

1. Toru Dutt: Prahlad; Our Casuarina Tree;
2. R. Tagore: Gitanjali: First five and last five poems
3. Sarojini Naidu: Coromandel Fishers, Indian Weavers
4. Aurobindo: *Savitri* Canto-I

Unit III: Drama

1. Girish Karnad: *Hayavadana*

2. Vijay Tendulkar: *Silence! The Court is in Session*

3. Mahesh Dattani: *The Final Solution*

Unit IV: Fiction

1. Mulk Raj Anand: *Untouchable*
2. Raja Rao: *Kanthapura*
3. R.K. Narayan: *A Tiger for Malgudi*

Unit IV: Criticism

1. Hiriyanna: *Art Experience*: Indian Aesthetics (Chs. 1 and 2)
2. Ananda Coomaraswamy: "The Dance of Shiva"
3. Aurobindo: The Poets of Dawn -1&2 (From Future Poetry)

Books/Texts for Reference and Further Reading:

K.R. Srinivasa Iyengar: *Indian Writing in English*
C.D. Narasimhaiah: "Towards an Understanding of the Species Called Indian Writing in English"
Meenakshi Mukherjee: *The Perishable Empire* Chapter on: "The Anxiety of Indianness"

Course IV – (HC-IV) 20th CENTURY WOMEN'S WRITING: THEORY AND PRACTICE

Course Code: ENB-040 **Credits: 4**
Teaching Hours: 60 (4 Hours/Week)

Course Outcomes

At the end of the Course, student able to

CO1: Learn history and growth of feminism as a movement, and the waves of feminism.
CO2: Understand the phrases such as Sex and Gender, women's rights.
CO3: Explore feminist issues in the novels of Buchi Emecheta, Margaret Atwood and Mahasweta Devi.
CO4: Read and understand the feminist ideas in the works of Simone de Beauvoir, Virginia Woolf and Showalter.
CO5: Appreciate and analyse the poems of Kamala Das and Maya Angelou.

Unit I (Background Study)

Feminism, History of Feminism, Feminist Movements, Sex and Gender, Society and Gender, Women's rights

Unit II (Novel)

Buchi Emecheta: *The Joys of Motherhood*
Mahasweta Devi: *Imaginary Maps* (A Collection of Short Stories)
Margaret Atwood: *Edible Woman*

Unit III (Prose)

Simone de Beauvoir: *The Second Sex*
Virginia Woolf: *A Room of One's Own*
Showalter Elaine: *"Feminist Criticism in Wilderness"*

Unit IV (Poetry)

Kamala Das: *An Introduction, My Grandmother's House, The Old Playhouse, Suicide*
Maya Angelou: *Phenomenal Woman, Caged Bird, Human Family, Women Work*

Books for Reference and Further Reading:

1. The Female Imagination: Patricia Mayor Spack
2. Gender Trouble: Feminism and Subversion of Identity: Judith Butler
3. The Feminine Mystique: Betty Friedan
4. Feminism and Recent Fiction in English: Sushila Singh
5. The New Feminist Criticism: Essays on Women's Literature and Theory: Elaine Showalter
6. Sexual / Textual Politics: Toril Moi

Any one of the soft cores to be chosen for earning 4 credits

Course IV – (SOFT CORE-II) DALIT LITERATURE

Course Code: ENB-230 **Credits: 4**

Teaching Hours: 60 (4 Hours/Week)

Course Outcomes

At the end of the Course, student able to

CO1: Understand the origin and growth of Dalit literature in India.

CO2: Understand the sufferings of marginalised in Dalit writings.

CO3: Compare and analyse the life of oppressed in the works various languages translated into English like Kannada, Gujarathi, Punjabi, Tamil and Telugu.

CO4: Compare and analyse the different forms of Dalit Literature based on different experiences.

UNIT I: Introduction to Dalit Literature

Essays:

1. Movements of Dalit identity- K C Das
2. Indian Dalits (Introduction- Sharankumar Limbale. (Dalit Literature and Aesthetics)
3. Dalit Literature- B Krishnappa (The Exercise of Freedom)
4. We Too Are Human-B R Ambedkar (The Exercise of Freedom)

Unit II: Poetry

1. H Govindaiah. "In The Soil of Tears" and "A Letter to Father Searching For Me"
2. Challapalli Swaroopa Rani: "Water" and "Forbidden Theory"
3. Sukirtharani: "Paraia God" and "Untitled Poem"
4. Jyoti Lanjewar: "Cave" and "Mother"
5. Gurudas Alam: "For Freedom" and "Treatment of Untouchables" (From The *Core Of Untouchable's)*
6. Bipin Gohel: "To The Fading Man I Sing" and "To A Poet At Mushaira"

Unit III: Short Stories

1. Devanoora Mahadeva: "Odallala"
2. Pathik Parmar : "Naked Feet"
3. M.M. Vinodini: "The Parable of Lost Daughter –Luke15"

Unit IV: Autobiographies

1. Dr. Siddalingaiah – "Ooru Keri-I"
2. Urmila Pawar – "The Weave of My Life: A Dalit Woman's Memoirs"
3. Bama Faustina- "Karukku"

Books for Reference and Further Reading:

D.R. Nagaraj *The Flaming Feet*

Eleanor Zelliot *From Untouchable To Dalit*

Mulk Raj Anand *Apology For Heroism*

Arjun Dangle *Poisoned Bread*

Encyclopedia of Dalits in India: Literature

Sathyanarayana: The Exercise of Freedom

K. Singh: Dalitism and Feminism: Locating Woman in Dalit Literature

(SOFT CORE-II) ENGLISH ESSAYISTS

Course Code: ENB-220 **Credits: 4**

Teaching Hours: 60 (4 Hours/Week)

Course Outcomes

At the end of the Course, student able to

CO1: Understand the genre of prose essays and appreciate the essayist's artistic statements.

CO2: Learn to appreciate the literary devices employed by the essayists.

CO3: Understand the importance of essays as a genre to bring social change based on close reading of the essayist's observations on society.

CO4: Appreciate and analyse the views in Bacon, Hazlitt, Charles Lamb, Bertrand Russell, Mathew Arnold and Orwell's essays.

Unit I

General Introduction to Essay as a genre of literary art, Notable Essayists of British Literature

Unit II

1. Francis Bacon: a) Of Studies
   b) Of Ambition

2. Hazlitt: a) On Going a Journey
   b) On the Ignorance of the Learned

Unit III

3. Charles Lamb: a) Poor Relations
   b) Chimney Sweepers

4. Bertrand Russell: a) Behaviorism and Values
   b) Freedom versus Authority in Education

Unit IV

5. Mathew Arnold: a) Wordsworth
   b) John Keats

6. George Orwell: a) Charles Dickens
   b) Politics and English Language

Books/Texts for Reference and Further Reading:

1. The English Critical Tradition: An Anthology of English Literary Criticism, Vol-2, Edited by S. Ramaswamy & V.S. Sethuraman
2. Wimsatt and Brook, Literary Criticism: A Short History
3. G. Tillostone, Criticism and the Nineteenth Century

III SEMESTER

Course I – (HARD CORE-I) THE MODERN AGE – II

Course Code: ENC 010 **Credits: 4**
Teaching Hours: 60 (4 Hours/Week)

Course Outcomes

At the end of the Course, student able to

CO1: Understand the social, political and cultural milieu of the age.
CO2: Learn and analyse the impact of World War I and II on 20th Century fiction.
CO3: Appreciate the use of various literary devices and postmodern techniques such as Stream of Consciousness, Dark Humour in modern writings.
CO4: Understand and write about the new theatres evolved in modern age.

UNIT – I
Post-World War Scenario, Twentieth Century Social Milieu, Twentieth Century Theatre, Twentieth Century Novel, Great Economic Depression, Stream of Consciousness, Postmodernism

UNIT – II
DH Lawrence: *The Rainbow*

Virginia Woolf: *To the Lighthouse*

E.M. Forster: *A Passage to India*

Doris Lessing: *The Golden Notebook*

UNIT – III
Samuel Beckett- *Waiting for Godot*

John Osborne: *Look Back in Anger*

UNIT – IV
Virginia Woolf: "On Modern Fiction"

George Lukacs: "The Meaning of Contemporary Realism" (chapters on Kafka & Modernist Fiction)

Raymond Williams: "When was Modernity"

Books for Reference and Further Reading:

1. Norton Anthology of English Literature
2. Vasudevan. *Perspectives: Selection from Modern English Prose and Fiction*

Course II – (HARD CORE-II) INDIAN WRITING IN ENGLISH - II

Course Code: ENC 020 **Credits: 4**
Teaching Hours: 60 (4 Hours/Week)

Course Outcomes

At the end of the Course, student able to

CO1: Understand characteristic features of post-independent Indian Writing in English.
CO2: Read, compare and critically analyse essays of Indian critics.
CO3: Describe the Indianness in Indian Writing in English.
CO4: Write about the use of various literary devices by Indian writers, such as Arundati Roy, Amitav Ghosh, Shanta Gokhale and RK Narayan.

UNIT –I
Colonization and its aftermath, Culture Vs Modernity: The Indian Context, The Modern Indian Psyche vis a vis Indian Writing in English and in Translation,

UNIT – II

1. Arundhati Roy: *God of Small Things*
2. Amitav Ghosh: *Shadow Lines*
3. Jahnavi Barua: *Next Door*

UNIT – III

1. M. K. Gandhi: *My Experiments with Truth*
2. Shanta Gokhale: *One Foot on the Ground*
3. R K Narayan: *My Days*

UNIT – IV

1. Gayathri Spivak: "Can the Subaltern Speak?"
2. Meenakshi Mukherjee: "The Anxiety of Indianness"
3. Aijaz Ahamed: *In Theory (Chapter 8* on Indian Literature)

Books for Reference and Further Reading:

1. K R Srinivasa Iyengar – *Indian Writing in English*
2. M. K Naik – *Critical Essays in Indian Writing in English*
3. Ramakrishnan E V- *Locating Indian Literature*
4. A K Mehrotra (ed): *A Concise History of Indian Literature in English*,
5. Saleem Peeradina (ed): *Contemporary Indian Poetry in English*
6. Makarand Paranjape (ed): *Indian Poetry in English*
7. Girish Karnad – *Fire and Rain*

Course III – (HARD CORE-III) NEW LITERATURES IN ENGLISH

Course Code: ENC 030 **Credits: 4**
Teaching Hours: 60 (4 Hours/Week)

Course Outcomes
At the end of the Course, student able to
CO1: Learn the emergence of New Literatures from Commonwealth literature.
CO2: Learn the thematic concerns in New Literatures.
CO3 Read and analyse the cultural conflict in New literatures such as African, Australian, Canadian and Caribbean and the impact of colonisation on native cultures.
CO4: Write focused analytical essays on the novels of Chinua Achebe, Wole Soyinka, Alice Munro, Patrick White, and V S Naipaul.
CO5: Appreciate the use of various literary devices in the poetry of Dennis Brutus, David Diop, AJM Smith, Judith Wright, Derek Walcott, and Braithwaite.
CO6: Learn and write critical analysis on the essays of Ngugi, Northrop Frye and Wilson Harris.

UNIT 1
Philosophy and Aesthetics of Commonwealth Literature, paradigm shifts from commonwealth to New Literatures

UNIT II- African Literature
Chinua Achebe: *A Man of the People*
Ngugi Wa Thiong'o: *Homecoming* Part-II (a) The Writer and His Past (b) The Writer in a Changing Society
Wole Soyinka: *The Lion and the Jewel*
Denis Brutus: If This Life is All That We Have, I am the tree...
I must conjure from my Past
2) David Diop: *Africa, Vultures*
3) Gabriel Okara: *Piano and Drums, Once Upon A Time*

UNIT III- Canadian and Australian Literature
Alice Munro*: Lives of Girls and Women*
Northrop Frye: "Conclusion" to *Literary History of Canada*
AJM Smith: *The Lonely Land E.J. Pratt: The Dying Eagle*
Patrick White: *Voss*
Judith Wright: *Preoccupations in Australian Poetry* (Chapter 13 on A.D. Hope)
Judith Wright: *Woman to Man, A.D. Hope: Australia*

UNIT- IV- Caribbean Literature
V S Naipaul: *Guerrillas*
Wilson Harris: *Tradition and the West Indian Novel*
Derek Walcott: *Almond Trees, A Far Cry from Africa*
Braithwaite: *Starvation, Caliban*

Books/Texts for Reference and Further Reading:
1. Anna Rutherford. Commonwealth
2. Oxford Companion to Canadian Literature
3. Macaulay. *A Map of Australian Verse*
4. Arnold. *Companion to Postcolonial Literature*
5. Helen Tiffin et al. *The Empire Writes Back*

Any one of the soft cores to be chosen for earning 4 credits

Course IV – (SOFT CORE-I) INDIAN ENGLISH POETRY AFTER INDEPENDENCE

Course Code: ENC 230 **Credits: 4**
Teaching Hours: 60 (4 Hours/Week)

Course Outcomes
At the end of the Course, student able to
CO1: Learn and appreciate the use of Indianness in the modern Indian poetry.
CO2: Analyse the themes, imagery, symbolism in the poems of Ezekiel, Ramanujan, Daruwalla, de Souza, Mahapatra, Parthasarathy, Anita Nair and Vikram Seth.
CO3: Understand and appreciate the human values and human predicament in modern Indian poetry.
CO4: Analyse the trend setting themes explored in contemporary Indian poetry.

Unit-I

1. Nissim Ezekiel: Night of the Scorpion; Enterprise
Urban; Poet, Lover, Birdwatcher

2. A K Ramanujan: Obituary, A River
Love Poem for a Wife II, Small Reflections on a Great House

Unit II

3. Keki N Daruwalla: Death of a Bird, The Mistress, The Ghaghra in Spate

4. Eunice de Souza: Bequest, Advice to Women, Women in Dutch Paintings, Feeding the Poor on Christmas

Unit III

5. Jayanta Mahapatra: Hunger, Freedom, Grandfather, Dhauli

6. R Parthasarathy: Rough Passage: a. Exile b. Trial c. Homecoming

Unit IV

7. Anita Nair: Happenings On the London Underground, The Last Rites
Hello Lust How Men Eat

8. Vikram Seth: How rarely all these few years, From California, The Wind

***Note:** Two lectures to introduce new themes and techniques of recent Indian poetry in English

Books/Texts for Reference and Further Reading:

1. King Bruce (ed): *Modern Indian Poetry in English*
2. *The Oxford Anthology of Modern Indian Poetry*
3. Saleem Peeradina (ed): *Contemporary Indian Poetry*
4. Zenia Mitra (ed): *Indian Poetry in English: Critical Essays*
5. R. Parthasarathy (ed): *Ten Twentieth Century Indian Poets*

Course V – (SOFT CORE-II) FEMINISM

Course Code: ENC 220 **Credits: 4**
Teaching Hours: 60 (4 Hours/Week)

Course Outcomes

At the end of the Course, student able to

CO1: Analyse the texts critically and write the main ideas given in the prescribed texts.
CO2: Write logically the feelings expressed by the feminists.
CO3: Learn to appreciate the literary theories employed by the feminists to bring gender justice in the society and in literary representation.
CO4: Analyse the critical ideas expressed by Shoshona Felman, Elaine Showalter, Toril Moi and Susie Tharu in their prescribed essays or prose works.

1. Shoshona Felman: "Women and Madness: The Critical Fallacy"

2. Elaine Showalter: "The Female Tradition"

3. Toril Moi: Feminist, Female, Feminine

4. Susie Tharu: Problems for a Contemporary Theory of Gender

Books for Reference and Further Reading:

The Female Imagination: Patricia Mayor Spack

Gender Trouble: Feminism and Subversion of Identity: Judith Butler

The Feminine Mystique: Betty Friedan

Feminism and Recent Fiction in English: Sushila Singh

The New Feminist Criticism: Essays on Women's Literature and Theory: Elaine Showalter
Sexual / Textual Politics: Toril Moi

OPEN ELECTIVES COURSE

A COURSE ON WRITTEN AND SPOKEN ENGLISH

Dept. code 570 **Credits: 4**

Teaching Hours: 60 (4 Hours/Week)
Course Outcomes

At the end of the Course, student able to

CO1: Learn the correct use of parts of speech and English grammar.
CO2: Understand grammar rules and apply them in conversation and communication.
CO3: Write effectively describing impressions, feelings and experiences.
CO4: Talk about familiar topics and give explanations and reasons for opinions, past actions and future plans.
CO5: Understand comprehension passages and answer the implied questions rightly.

UNIT I

Basic Grammar
Definition of Parts of Speech and correct usage

1. Noun 2. Pronoun 3. Adjectives: Degrees of comparison and correct usage.
4. Verb, Tenses: Present, Past and Future and their correct usage.
5. Adverb: Kinds of Adverbs and their correct usage
6. Conjunction 7. Preposition
8. Articles
9. Active and Passive voice
10. Direct and Indirect Speech
11. Punctuation

UNIT II

Oral communication is the ability to explain and present one's ideas in clear English, to diverse audiences; speaking effectively, Effective **Listening** and **Reading skills** to be taught.

Short and long conversation involving two or more people: Greeting, introducing, making an enquiry, casual/formal telephone conversation, Conversation at the bank, at the department store, at the post office, at the doctor's, at the travel agent, at the railway station/bus stop etc.
Informal conversation between friends.
Reading Skills with a focus on Idioms, Phrases, Antonyms, Homophones, Homonyms and Figures of Speech

Unit-III

Written communication: The ability to write effectively in a range of contexts and for different audiences and purposes, with a good command of the English language is taught.

1. Letter Writing:
   Personal letters
   Leave note
   Application for a job
   Letter to the editor

Letters of complaints
Placing orders

2. Precise Writing
3. Short Essay writing

Unit - IV
Writing skills to be taught through:

A. Guided Composition
B. Expansion of an Idea/ Proverb
C. Comprehension

Comprehension of Poetry/ Prose/ Short Story/ Essay of selected texts

Comprehension of Poetry: **1.** Robert Frost: **Stopping by Woods on a Snowy Evening**
2. Wole Soyinka: **Telephone Conversation**

Comprehension of Prose: Radhakrishnan: **Humanities V/S Science**

Comprehension of Short Story: Maxim Gorky: **One Autumn Night**

Books for Reference and Further Reading:

1. Sidney Green Baum, The Oxford English Grammar, Oxford University Press,
2. Cowie, A.P. & R. Macklin, Oxford Dictionary of Phrasal verbs, Oxford University Press,
3. Cowie, A.P. & R. Macklin& I.R. Mc Caig, Oxford Dictionary of Phrasal English Idioms, Oxford University Press,
4. Stuart Redman, English Vocabulary in Use pre-intermediate and intermediate; low price editions, Oxford University Press,
5. Rosemary T., Fruehling& Joan M. Lacombe, Communication for Results, A.I.T.B.S. Publishers and Distributors,
6. How to write and speak better, Reader's Digest
7. Modern Grammar with Practical Exercises, Vikas Publishing House Pvt. Ltd.

IV SEMESTER

Course I – (HARD CORE-I) LITERARY CRITICISM-II

Course Code: END 010 **Credits: 4**
Teaching Hours: 60 (4 Hours/Week)

Course Outcomes

At the end of the Course, student able to

CO1: Learn the meaning, elements and characteristics of contemporary literary criticism.

CO2: Writes the essays using the skills of literary critical analysis.

CO3: Learn to write analytical essays on the literary texts of the prescribed critics.

CO4: Articulate and discuss the latest developments in the specific field of practice of literary theories.

Unit I

Russian Formalism, Psychoanalysis, Structuralism, Deconstruction, Post colonialism, Phenomenology and certain other forms of Hermeneutics. The Archetypes of Literature‟ Marx, Nietzsche, Freud, Gramsci

Unit II:

1. T.S. Eliot: Tradition and Individual Talent
2. F.R. Leavis: Literature and Society, Tragedy and the Medium (From The Common Pursuit)
3. Carl Jung: "Psychology and Literature"

Unit III:

1. Northrop Frye: Architypes of Literature
2. G. Genette: "Structuralism and Literary Criticism
3. J. Derrida: "Structure, Sign and Play in the Discourse of Human Sciences"

Unit IV:

1. Elaine Showalter: Towards a Feminist Poetics
2. Helene Cixous: The Laugh of the Medusa
3. Sara Suleri: Woman Skin Deep: Feminism and Postcolonial Condition

Books for Reference and Further Reading:

Eagleton, Terry: *Theory – An Introduction*

Selden, Raman: *A Reader's Guide to Contemporary Literary Theory* Belsey, Catherine.

Critical Practice: Culler, Jonathan.

Structuralist Poetics: Structuralism, Linguistics and the Study of Literature Newton,

K.M. *Twentieth Century Literary Theory: A Reader*

Course II – (HARD CORE-II) AMERICAN LITERATURE

Course Code: END 020 **Credits: 4**

Teaching Hours: 60 (4 Hours/Week)

Course Outcomes

At the end of the Course, student able to

CO1: Understand the significance of Renaissance, Transcendentalism and journey metaphor in American literature.
CO2: Appreciate and analyse the poems of Emily Dickinson, Wallace Stevens, Walt Whitman and Robert Frost.
CO3: Understand and write critically about the themes, narrative techniques, character analysis in the novels of Mark Twain, Douglas, Toni Morisson and Ray Bradbury.
CO4: Acquire the ability to understand and explore the human condition in the plays of Arthur Miller, Eugene O'Neill and Edward Albee.

UNIT –I

American Renaissance, Journey as Metaphor, Westward Movement, Transcendentalism

UNIT – II

Emerson: American Scholar
Thoreau: Walden (Chapters on Economy & Where I Lived and What I Lived For)
Emily Dickinson: Because I Could Not Stop for Death, The Soul Selects her Own Society
I Heard a Fly Buzz
Wallace Stevens: Emperor of Ice-Cream, Anecdote of The Jar
Walt Whitman: When Lilacs Last in the Dooryard Bloomed, A Noiseless Patient Spider,
Robert Frost: Mending Wall, The Road Not Taken, Birches

UNIT III

Mark Twain: Huckleberry Finn
Fredrick Douglas: Narrative of the Life of an American Slave
Toni Morrison: The Bluest Eye
Ray Bradbury: Fahrenheit 451

UNIT – IV

Arthur Miller: Death of a Salesman
Eugene O'Neill: The Hairy Ape
Edward Albee: The Zoo Story

Books for Reference and Further Reading:

Norton Anthology of American Literature
Richard J Gray. *A History of American Literature*
The Cambridge History of American Literature. Vol. 1 to 4

Any one of the soft cores to be chosen for earning 4 credits

COURSE - III: SOFTCORE Elective I: INDIAN DIASPORA FICTION
Course Code: END 240 **Credits: 4**

Course Outcomes:
At the end of the Course, student able to
Course Outcomes

CO1: Learn the background of Diaspora Literature & major themes of Diaspora Literature
CO2: Compare and Contrast authors' treatment of themes, characters, subject matter etc.
CO3: Identify and analyse literary elements like plot, setting, tone, point of view, style, image, symbols, etc.
CO4: Trace the role of partition, corruption, fantasy, migration, etc. and psychological aspects behind human behaviour in the novels prescribed.

Unit I:
1. Salman Rushdie: *Midnight Children*
2. Tanuja Desai Hidier: *Born Confused*

Unit II:
1. Jhumpa Lahiri: *The Namesake*
2. Chitra Banerjee Divakaruni: *The Mistress of Spices*

Unit III:
1. Kiran Desai: *Inheritance of Loss*
2. Rohinton Mistry: *A Fine Balance*

Unit IV:
1. Aravind Adiga: *White Tiger*
2. Hari Kunzru: *Gods without Men*

***Note: Two lectures to introduce India Diaspora**

Books for Reference and Further Reading:

1. Avtar Brah. *Cartographies of Diaspora: Contesting Identities*. London: Routledge, 1996.
2. Homi K. Bhabha. *The Location of Culture*, 1994.
3. Edward W. Said. *Orientalism*. New Delhi: Penguin, 2001.

COURSE - III (SOFTCORE Elective-II) AFRICAN FICTION

Course Code: END-230 **Credits: 4**
Teaching Hours: 60 (4 Hours/Week)

Course Outcomes

At the end of the Course, student able to

CO1: Learn the social, political and cultural milieu of the African society represented in fiction.
CO2: Understand and write critical essays on contemporary African novels such as Anthills of the Savannah, Purple Hibiscus, The Bride Price and Changes: A Love Story.
CO3: Articulate and discuss the latest developments in the specific fields of postcolonial African writings to bring gender justice in the society.
CO4: Write critically on the role of the characters in the novels of Achebe, Adichie. Emecheta and Aidoo.

Unit I: Chinua Achebe: *Anthills of the Savannah*

Unit II: Chimamanda Adichie Ngozi: *Purple Hibiscus*

Unit III: Buchi Emecheta: *The Bride Price*

Unit IV: Ama Ata Aidoo: *Changes: A Love Story*

Suggested Reading:

1. Butler, Judith. *Gender Trouble*: *Feminism and the Subversion of Identity*. New York: Routledge, 1990.
2. Ogundipe-Leslie, Omolara. *Re-Creating Ourselves African Women and Critical Transformations*. Trenton, NJ: Africa World P, 1994.
3. Palmer, Eustace (ed.). An Introduction to the African Novel. A Critical Study of Twelve Books. London: Heinemann, 1979.
4. Ashcroft, Bill. *Post-Colonial Transformation*. London and New York: Routledge, 2001.
5. Ashcroft, Bill, Gareth Griffiths, and Helen Tiffin. Eds. *The Post-Colonial Studies Reader*. London and New York: Routledge, 2002.

Course – IV – (HARDCORE - III) Major Project Work Leading to a Dissertation

Course Code: END 030 **Credits: 4**
Teaching Hours: 60 (4 Hours/Week)

Course Outcomes

At the end of the Course, student able to

CO1: Learn to investigate the area of topic chosen for project work in detail.
CO2: Learn research skills and demonstrate scholarly expertise in exploring the subject to prepare the dissertation for the project work.
CO3: Learn the skills of research analysis in writing thesis.
CO4: Able to think logically and relate the issues and findings to real life scenario.

Students will be encouraged to undertake a major project work in disciplines related to literature of contemporary interest.

Suggested Areas:

Folklore
Performing Arts
Popular Culture
Gender and Sexuality
Dalit and Subaltern Discourses
Media Studies
World Literatures in English
General Survey of Poetic Works of Classical Writers
General Survey of Poetic Works of Modern Writers

The distribution of marks for The Project Work will be as per the stipulations laid down by the university.

SOFTCORES OFFERED

1. Cross Cultural Women Writers
2. Caribbean Literature
3. Novels of Childhood
4. Indian Classics in Translation
5. Folklore and Literature-I
6. Folklore and Drama
7. Myth and Drama-I
8. Myth and Drama-II
9. Cultural Theory
10. Canada and the World
11. Feminist Theory-I
12. Australian Poetry
13. Folk Epics of Karnataka
14. Postcolonial Theory
15. Writers from African Diaspora
16. Canadian Science Fiction by Women
17. Theories on Culture: An Introduction
18. Postcolonial Criticism
19. Travel Literature
20. Popular Culture and Censorship
21. Adventure Novels
22. Novels and Metropolis
23. Short Fictions of Russia and USA
24. Contemporary Indian Novels in English
25. Translations
26. Dalit Literature-I
27. Recent Indian Poetry in English
28. Dalit Literature-II
29. Women Writings from the Margins
30. English Essayists
31. Post 1990 Indian Women Narratives
32. Indian Novels in English: 2000 and after
33. Twentieth Century Indian Poets in English
34. Contemporary Indian Regional Poetry in English Translation
35. Realism and Fiction
36. Indian Women Novelists
37. African Fiction in English
38. Jewish American Fiction
39. Introduction to Canadian Literature
40. South Asian Immigrant Literature in Canada
41. Introduction to Australian Literature.
42. Feminist Theory-II
43. Indian Classics in Translation
44. Shakespeare Criticism
45. Literature and Popular Culture
46. Postcolonial African Fiction
47. Arab Women Short Stories
48. Indian Diaspora Fiction

POSTGRADUATE DEPARTMENT OF ENGLISH
Question Paper Pattern

END SEMSETER EXAM (C 3)

Course Code Title of the Course (HC/ SC)

Max Marks: 70 Time: 3 Hours

Instruction: Answer all sections.

SECTION – I

I. Answer the following questions in **one or two** sentences 10X1= 10

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

SECTION-II (from Unit-I)

II. Answer any one of the following. 1x15=15

1.
2.
3.

SECTION-III (from Unit-II)

III. Answer any one of the following. 1x15=15

1.
2.
3.

SECTION-IV (from Unit-III)

IV. Answer any one of the following. 1x15=15

1.
2.
3.

SECTION-V (from Unit-IV)

V. Answer any one of the following. 1x15=15

1.
2.
3.

ಜೆಎಸ್ಎಸ್ ಮಹಾವಿದ್ಯಾಪೀಠ

ಜೆಎಸ್ಎಸ್ ಕಲಾ, ವಾಣಿಜ್ಯ ಮತ್ತು ವಿಜ್ಞಾನ ಕಾಲೇಜು

(ಸ್ವಾಯತ್ತ)

ಬಿ.ಎನ್. ರಸ್ತೆ, ಮೈಸೂರು – ೫೭೦ ೦೨೫

ಕನ್ನಡ ಸ್ನಾತಕೋತ್ತರ ವಿಭಾಗ

ಪಠ್ಯ – ಪಾಠಕ್ರಮ – ಪರೀಕ್ಷಾ ಯೋಜನೆ

ಚಾತುರ್ಮಾಸ ಯೋಜನೆ (ಸಿಬಿಸಿಎಸ್-ಸಿಎಜಿಪಿ)

೨೦೨೧-೨೨

ಮೊದಲನೆಯ ವರ್ಷ ಎಂ.ಎ. ಕನ್ನಡ

ಮೊದಲನೆಯ ಚತುರ್ಮಾನ (ಆಗಸ್ಟ್ – ಡಿಸೆಂಬರ್ ೨೦೧೯)

ಪಠ್ಯ–ಪಾಠಕ್ರಮ ಮತ್ತು ಪರೀಕ್ಷಾ ಯೋಜನೆ

ಪತ್ರಿಕೆ ಸಂಖ್ಯೆ	ಪತ್ರಿಕೆಗಳ ಶೀರ್ಷಿಕೆ	ಕ್ರೆಡಿಟ್ ವಿನ್ಯಾಸ	ಕ್ರೆಡಿಟ್‌ಗಳ ಸಂಖ್ಯೆ	ಬೋಧನಾ ಗಂಟೆಗಳು (ವಾರಕ್ಕೆ)		ಪರೀಕ್ಷಾ ಅವಧಿ (ಗಂಟೆಗಳಲ್ಲಿ)	ಪರೀಕ್ಷಾ ಅಂಕಗಳು	ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನ ಅಂಕಗಳು	ಒಟ್ಟು ಅಂಕಗಳು
				ಉಪನ್ಯಾಸ	ಟ್ಯುಟೋರಿಯಲ್				
	ಪ್ರಧಾನ ವಿಷಯಗಳು (**Hard core**)								
೧	ಪ್ರಾಚೀನ ಕನ್ನಡ ಸಾಹಿತ್ಯ : ಪಠ್ಯ – ಆದಿಪುರಾಣ ಸಂಗ್ರಹ (ಸಂ: ಎಲ್. ಗುಂಡಪ್ಪ)	೩:೧	೪	೩	೧	೩	೭೦	೩೦	೧೦೦
೨	ಪ್ರಾಚೀನ ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಹಿನ್ನೆಲೆ	೨:೧	೩	೨	೧	೩	೭೦	೩೦	೧೦೦
೩	ಕನ್ನಡ ಛಂದಸ್ಸಿನ ಅಧ್ಯಯನ	೩:೧	೪	೩	೧	೩	೭೦	೩೦	೧೦೦
೪	ವಿಮರ್ಶೆಯ ಅಧ್ಯಯನ	೨:೧	೩	೨	೧	೩	೭೦	೩೦	೧೦೦
೫	ಉಪ ಪ್ರಧಾನ ವಿಷಯಗಳು (**Soft core**) ವಿದ್ಯಾರ್ಥಿ ಈ ಕೆಳಗಿನ ಯಾವುದಾದರೂ ಒಂದು ವಿಷಯವನ್ನು ಆಯ್ಕೆ ಮಾಡಿಕೊಂಡು ಮುಂದಿನ ಮೂರು ಚತುರ್ಮಾನಗಳಲ್ಲಿಯೂ ಅದೇ ವಿಷಯವನ್ನು ಮುಂದುವರಿಸತಕ್ಕದ್ದು								
೫.೧	ಭಾಷಾವಿಜ್ಞಾನ ಅಧ್ಯಯನ : ಭಾಷಾ ವಿಜ್ಞಾನದ ಮೂಲತತ್ತ್ವಗಳು	೩:೧	೪	೩	೧	೩	೭೦	೩೦	೧೦೦
೫.೨	ಜಾನಪದ ಅಧ್ಯಯನ : ಜಾನಪದ ಸಾಹಿತ್ಯದ ತಾತ್ವಿಕ ಅಧ್ಯಯನ	೩:೧	೪	೩	೧	೩	೭೦	೩೦	೧೦೦
೫.೩	ಚಾರಿತ್ರಿಕ ಅಧ್ಯಯನ : ಕರ್ನಾಟಕ ಸಾಂಸ್ಕೃತಿಕ ಚರಿತ್ರೆ	೩:೧	೪	೩	೧	೩	೭೦	೩೦	೧೦೦

ಮೊದಲನೆಯ ವರ್ಷ ಎಂ.ಎ. ಕನ್ನಡ

ಎರಡನೆಯ ಚತುರ್ಮಾಸ (ಜನವರಿ –ಮೇ ೨೦೨೦)

ಪಠ್ಯ–ಪಾಠಕ್ರಮ ಮತ್ತು ಪರೀಕ್ಷಾ ಯೋಜನೆ

ಪತ್ರಿಕೆ ಸಂಖ್ಯೆ	ಪತ್ರಿಕೆಗಳ ಶೀರ್ಷಿಕೆ	ಕ್ರೆಡಿಟ್ ವಿನ್ಯಾಸ	ಕ್ರೆಡಿಟ್‌ಗಳ ಸಂಖ್ಯೆ	ಬೋಧನಾ ಗಂಟೆಗಳು (ವಾರಕ್ಕೆ)		ಪರೀಕ್ಷಾ ಅವಧಿ (ಗಂಟೆಗಳಲ್ಲಿ)	ಪರೀಕ್ಷಾ ಅಂಕಗಳು	ಅಂತರಿಕ ಮೌಲ್ಯಮಾಪನ ಅಂಕಗಳು	ಒಟ್ಟು ಅಂಕಗಳು
				ಉಪನ್ಯಾಸ	ಟ್ಯುಟೋರಿಯಲ್				
	ಪ್ರಧಾನ ವಿಷಯಗಳು (**Hard core**)								
೧	ಮಧ್ಯಕಾಲೀನ ಕನ್ನಡ ಸಾಹಿತ್ಯ : ಪಠ್ಯ	೩:೧	೪	೩	೨	೩	೭೦	೩೦	೧೦೦
೨	ಮಧ್ಯಕಾಲೀನ ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಹಿನ್ನೆಲೆ	೨:೧	೩	೨	೨	೩	೭೦	೩೦	೧೦೦
೩	ದ್ರಾವಿಡ ಭಾಷಾವಿಜ್ಞಾನ	೨:೧	೩	೨	೨	೩	೭೦	೩೦	೧೦೦
೪	ಕನ್ನಡ ವಿಮರ್ಶೆ : ಆಯ್ದ ಲೇಖನಗಳು	೩:೧	೪	೩	೨	೩	೭೦	೩೦	೧೦೦
೫	ಉಪ ಪ್ರಧಾನ ವಿಷಯಗಳು (**Soft core**) ಕೆಳಗಿನ ಪತ್ರಿಕೆಗಳಲ್ಲಿ ವಿದ್ಯಾರ್ಥಿಯು ಹಿಂದೆ ಆಯ್ಕೆ ಮಾಡಿಕೊಂಡ ಪತ್ರಿಕೆಯನ್ನೇ ಈ ಚತುರ್ಮಾಸದಲ್ಲಿಯೂ ಅಧ್ಯಯನ ಮಾಡಬೇಕು.								
೫.೧	ಭಾಷಾವಿಜ್ಞಾನ ಅಧ್ಯಯನ : ಕನ್ನಡ ವ್ಯಾಕರಣಗಳ ತೌಲನಿಕ ಸಮೀಕ್ಷೆ	೩:೧	೪	೩	೨	೩	೭೦	೩೦	೧೦೦
೫.೨	ಜಾನಪದ ಅಧ್ಯಯನ : ಜನಪದ ಸಂಸ್ಕೃತಿಯ ತಾತ್ವಿಕ ಅಧ್ಯಯನ	೩:೧	೪	೩	೨	೩	೭೦	೩೦	೧೦೦
೫.೩	ಚಾರಿತ್ರಿಕ ಅಧ್ಯಯನ : ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ (೧೩ನೆಯ ಶತಮಾನ)	೩:೧	೪	೩	೨	೩	೭೦	೩೦	೧೦೦
೬	<u>ವಿಶೇಷ ಉಪ ಪ್ರಧಾನ ವಿಷಯಗಳು</u> (**Special Soft core**) ವಿದ್ಯಾರ್ಥಿಗಳು ಈ ಚತುರ್ಮಾಸದಲ್ಲಿ ಯಾವುದಾದರೂ ಒಂದು ವಿಶೇಷ ಉಪ ಪ್ರಧಾನ ವಿಷಯವನ್ನು ಆಯ್ಕೆ ಮಾಡಿ ಅಧ್ಯಯನ ಮಾಡಬೇಕು								
೬.೧	ಕನ್ನಡ ಸಂಸ್ಕೃತಿ ಚಿಂತನೆ (ಆಯ್ದ ಲೇಖನಗಳು)	೩:೧	೪	೩	೨	೩	೭೦	೩೦	೧೦೦
೬.೨	ಮಹಿಳೆ : ಸಮಾಜ-ಸಾಹಿತ್ಯ (ಆಯ್ದ ಲೇಖನಗಳು)	೩:೧	೪	೩	೨	೩	೭೦	೩೦	೧೦೦

ಎರಡನೆಯ ವರ್ಷ ಎಂ.ಎ ಕನ್ನಡ

ಮೂರನೆಯ ಚತುರ್ಮಾಸ (ಆಗಸ್ಟ್ – ಡಿಸೆಂಬರ್ ೨೦೨೦)

ಪಠ್ಯ–ಪಾಠಕ್ರಮ ಮತ್ತು ಪರೀಕ್ಷಾ ಯೋಜನೆ

ಪತ್ರಿಕೆ ಸಂಖ್ಯೆ	ಪತ್ರಿಕೆಗಳ ಶೀರ್ಷಿಕೆ	ಕ್ರೆಡಿಟ್ ವಿನ್ಯಾಸ	ಕ್ರೆಡಿಟ್‌ಗಳ ಸಂಖ್ಯೆ	ಬೋಧನಾ ಗಂಟೆಗಳು (ವಾರಕ್ಕೆ)		ಪರೀಕ್ಷಾ ಅವಧಿ (ಗಂಟೆಗಳಲ್ಲಿ)	ಪರೀಕ್ಷಾ ಅಂಕಗಳು	ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನ ಅಂಕಗಳು	ಒಟ್ಟು ಅಂಕಗಳು
				ಉಪನ್ಯಾಸ	ಟ್ಯುಟೋರಿಯಲ್				
	ಪ್ರಧಾನ ವಿಷಯಗಳು (**Hard core**)								
೧	ತೌಲನಿಕ ಸಾಹಿತ್ಯ : ಪಠ್ಯ : ಮಹಾಕಾವ್ಯ ಮತ್ತು ನಾಟಕ	೨:೧	೩	೨	೨	೩	೭೦	೩೦	೧೦೦
೨	ಆದುನಿಕ ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಹಿನ್ನೆಲೆ	೨:೧	೩	೨	೨	೩	೭೦	೩೦	೧೦೦
೩	ಭಾರತೀಯ ಕಾವ್ಯಮೀಮಾಂಸೆ	೨:೧	೩	೨	೨	೩	೭೦	೩೦	೧೦೦
೪	ಸಂಶೋಧನ ವಿಧಾನ ಮತ್ತು ಗಣಕ ಜ್ಞಾನ	೨:೧	೩	೨	೨	೩	೭೦	೩೦	೧೦೦
೫	ಉಪ ಪ್ರಧಾನ ವಿಷಯಗಳು (**Soft core**) ಕೆಳಗಿನ ಪತ್ರಿಕೆಗಳಲ್ಲಿ ವಿದ್ಯಾರ್ಥಿಯು ಹಿಂದೆ ಆಯ್ಕೆ ಮಾಡಿಕೊಂಡ ಪತ್ರಿಕೆಯನ್ನೇ ಈ ಚತುರ್ಮಾಸದಲ್ಲಿಯೂ ಅಧ್ಯಯನ ಮಾಡಬೇಕು.								
೫.೧	ಭಾಷಾ ವಿಜ್ಞಾನ ಅಧ್ಯಯನ : ಉಪಭಾಷಾ ವಿಜ್ಞಾನ (ಕನ್ನಡ)	೩:೧	೪	೩	೨	೩	೭೦	೩೦	೧೦೦
೫.೨	ಜಾನಪದ ಅಧ್ಯಯನ : ಕರ್ನಾಟಕ ಜನಪದ ಕಲೆಗಳು	೩:೧	೪	೩	೨	೩	೭೦	೩೦	೧೦೦
೫.೩	ಚಾರಿತ್ರಿಕ ಅಧ್ಯಯನ : ಶಾಸನಶಾಸ್ತ್ರ ಆಯ್ದ ಪಠ್ಯಗಳೊಡನೆ	೩:೧	೪	೩	೨	೩	೭೦	೩೦	೧೦೦
೬	ಮುಕ್ತ ಐಚ್ಛಿಕ (**Open Elective**)								
೬.೧	ಕನ್ನಡ ಭಾಷೆ ಸಾಹಿತ್ಯ (ಪ್ರಾಚೀನ, ಮಧ್ಯಕಾಲೀನ, ಆಧುನಿಕ)	೩:೧	೪	೩	೨	೩	೭೦	೩೦	೧೦೦

ಎರಡನೆಯ ವರ್ಷ ಎಂ.ಎ ಕನ್ನಡ

ನಾಲ್ಕನೆಯ ಚತುರ್ಮಾಸ (ಜನವರಿ–ಮೇ ೨೦೨೧)

ಪಠ್ಯ–ಪಾಠಕ್ರಮ ಮತ್ತು ಪರೀಕ್ಷಾ ಯೋಜನೆ

ಪತ್ರಿಕೆ ಸಂಖ್ಯೆ	ಪತ್ರಿಕೆಗಳ ಶೀರ್ಷಿಕೆ	ಕ್ರೆಡಿಟ್ ವಿನ್ಯಾಸ	ಕ್ರೆಡಿಟ್‌ಗಳ ಸಂಖ್ಯೆ	ಬೋಧನಾ ಗಂಟೆಗಳು (ವಾರಕ್ಕೆ)		ಪರೀಕ್ಷಾ ಅವಧಿ (ಗಂಟೆಗಳಲ್ಲಿ)	ಪರೀಕ್ಷಾ ಅಂಕಗಳು	ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನ ಅಂಕಗಳು	ಒಟ್ಟು ಅಂಕಗಳು
				ಉಪನ್ಯಾಸ	ಟ್ಯುಟೋರಿಯಲ್				
	ಪ್ರಧಾನ ವಿಷಯಗಳು (Hard core)								
೧	ಆಧುನಿಕ ಕನ್ನಡ ಸಾಹಿತ್ಯ : ಪಠ್ಯ : ಕಾವ್ಯ, ಕಾದಂಬರಿ	೨:೧	೩	೨	೨	೩	೭೦	೩೦	೧೦೦
೨	ಪಾಶ್ಚಾತ್ಯ ಕಾವ್ಯಮೀಮಾಂಸೆ	೨:೧	೩	೨	೨	೩	೭೦	೩೦	೧೦೦
೩	ಸಮೂಹ ಮಾಧ್ಯಮ	೨:೧	೩	೨	೨	೩	೭೦	೩೦	೧೦೦
೪	ಅವಧಿಕ ಕಾರ್ಯ	೧:೨	೩	೧	೪	೩	೭೦	೩೦	೧೦೦
೫	ಉಪ ಪ್ರಧಾನ ವಿಷಯಗಳು (**Soft core**) ಕೆಳಗಿನ ಪತ್ರಿಕೆಗಳಲ್ಲಿ ವಿದ್ಯಾರ್ಥಿಯು ಹಿಂದೆ ಆಯ್ಕೆ ಮಾಡಿಕೊಂಡ ಪತ್ರಿಕೆಯನ್ನೇ ಈ ಚತುರ್ಮಾಸದಲ್ಲಿಯೂ ಅಧ್ಯಯನ ಮಾಡಬೇಕು.								
೫.೧	ಭಾಷಾವಿಜ್ಞಾನ ಅಧ್ಯಯನ : ಕನ್ನಡ ಭಾಷಾಸ್ವರೂಪ : ಆಯ್ದ ಪಠ್ಯಗಳು	೩:೧	೪	೩	೨	೩	೭೦	೩೦	೧೦೦
೫.೨	ಜಾನಪದ ಅಧ್ಯಯನ : ಕನ್ನಡ ಜನಪದ ಸಾಹಿತ್ಯ (ಆಯ್ದ ಪಠ್ಯಗಳು)	೩:೧	೪	೩	೨	೩	೭೦	೩೦	೧೦೦
೫.೩	ಚಾರಿತ್ರಿಕ ಅಧ್ಯಯನ : ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ (ಆಯ್ದ ಪಠ್ಯಗಳು)	೩:೧	೪	೩	೨	೩	೭೦	೩೦	೧೦೦

ಪ್ರಧಾನ ವಿಷಯ	: ೫೨ ಕ್ರೆಡಿಟ್
ಉಪಪ್ರಧಾನ ವಿಷಯ	: ೧೬ ಕ್ರೆಡಿಟ್
ವಿಶೇಷ ಉಪಪ್ರಧಾನ ವಿಷಯ	: ೦೪ ಕ್ರೆಡಿಟ್
ಮುಕ್ತ ಐಚ್ಛಿಕ	: ೦೪ ಕ್ರೆಡಿಟ್
ಒಟ್ಟು ಟ್ಯುಟೋರಿಯಲ್ ಮತ್ತು ಪ್ರಾಯೋಗಿಕ ತರಗತಿಗಳು	: ೭೬ ಕ್ರೆಡಿಟ್

ಆಯಾ ಪತ್ರಿಕೆಗಳಿಗೆ ಅನುಸಾರವಾಗಿ ಈ ಕೆಳಗಿನ ಪ್ರಾಯೋಗಿಕ ಅಭ್ಯಾಸಗಳನ್ನು ಪತ್ರಿಕೆಗಳು ಒಳಗೊಂಡಿರುತ್ತವೆ.

೧. ಪದ್ಯ ಓದುವ ಕ್ರಮ, ಅರ್ಥೈಸುವ ಕ್ರಮ, ವಿಶ್ಲೇಷಣೆ ಮತ್ತು ವಿಮರ್ಶೆ

೨. ಭಾವಸ್ವಾರಸ್ಯ, ಸಂಭಾಷಣಾ ಕೌಶಲ, ಸನ್ನಿವೇಶಗಳ ಪರಿಚಯ

೩. ವಸ್ತು, ಪಾತ್ರ, ಭಾಷೆ ಬಳಕೆ, ರಚನೆ, ತಂತ್ರಗಾರಿಕೆ

ಮೊದಲನೆಯ ವರ್ಷ ಎಂ.ಎ ಕನ್ನಡ

ಮೊದಲನೆಯ ಚತುರ್ಮಾಸ

ಮೊದಲನೆಯ ಚತುರ್ಮಾಸ (ಆಗಸ್ಟ್-ಡಿಸೆಂಬರ್ ೨೦೧೮)

ಪ್ರಧಾನ ವಿಷಯಗಳು (Hard Core)

KNA 050: ಪತ್ರಿಕೆ: ೧ ಪ್ರಾಚೀನ ಕನ್ನಡ ಸಾಹಿತ್ಯ : ಪಠ್ಯ (೩:೧=೪)

ಪಂಪ: ಹಿನ್ನೆಲೆ, ಇತಿವೃತ್ತ, ಕೃತಿಗಳು

ಪಠ್ಯ: **ಆದಿಪುರಾಣ ಸಂಗ್ರಹ-(ಸಂ) ಎಲ್.ಗುಂಡಪ್ಪ**: ಪ್ರಸಾರಾಂಗ, ಮೈಸೂರು ವಿ.ವಿ., ಮೈಸೂರು

ಪರಾಮರ್ಶನ ಕೃತಿಗಳು:

೧. ನಾಡೋಜ ಪಂಪ	: ಮುಳಿಯ ತಿಮ್ಮಪ್ಪಯ್ಯ
೨. ಪಂಪ ಒಂದು ಅಧ್ಯಯನ	: ಜಿ.ಎಸ್. ಶಿವರುದ್ರಪ್ಪ
೩. ಪಂಪ ಕೆಲವು ಮುಖಗಳು	: ಸಿ.ಪಿ. ಕೃಷ್ಣ ಕುಮಾರ್
೪. ಕನ್ನಡ ಸಾಹಿತ್ಯ ವಿಶ್ವಪ್ರಜ್ಞೆ	: ಸಿ.ಪಿ. ಸಿದ್ಧಾಶ್ರಮ
೫. ಮತ್ತೆ ಮತ್ತೆ ಪಂಪ	: ಜಿ. ಎಚ್ ನಾಯಕ
೬. ಆದಿಪುರಾಣ ದೀಪಿಕೆ	: ಪಂ. ನಾಗರಾಜಯಗಯ್ಯ, ತ.ಸು.ಶಾಮರಾಯ

KNA 020:ಪತ್ರಿಕೆ: ೨ ಪ್ರಾಚೀನ ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಹಿನ್ನೆಲೆ(೨:೧=೩ ಕ್ರೆಡಿಟ್)

೧. ಸಾಹಿತ್ಯ ಹಿನ್ನೆಲೆಯಲ್ಲಿರುವ ಅಂಶಗಳು : ಕಾಡು, ಕಡಲು, ಪರ್ವತ, ಅಷ್ಟಾದಶ ವರ್ಣನೆಗಳು ಮುಂತಾದವುಗಳ ಭೌಗೋಳಿಕ ನೆಲೆಯಲ್ಲಿ ರೂಪಿತವಾದ ಸಾಹಿತ್ಯ

೨. ವಿವಿಧ ಕಾಲಘಟ್ಟಗಳ ಸಾಮಾಜಿಕ ಮತ್ತು ರಾಜಕೀಯ ಸ್ಥಿತಿಗಳು ಹಾಗೂ ವಿಶೇಷವಾಗಿ ಬಾದಾಮಿ ಚಾಲುಕ್ಯರು, ಗಂಗರು, ರಾಷ್ಟ್ರಕೂಟರ ಕಾಲದ ಕನ್ನಡ ಸಾಹಿತ್ಯ, ಹೊಯ್ಸಳರ ಕಾಲದ ಚಂಪೂ ಕೃತಿಗಳು– ಇವುಗಳ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ರೂಪಿತವಾದ ಸಾಹಿತ್ಯ ಪರಂಪರೆ

೩. ಧಾರ್ಮಿಕ ಹಿನ್ನೆಲೆ : ಬೌದ್ಧ, ಜೈನ, ವೈದಿಕ, ಶೈವ ಧರ್ಮಗಳ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ರೂಪಿತವಾದ ಸಾಹಿತ್ಯ ಪರಂಪರೆ

೪. ಸಂಸ್ಕೃತ, ಪ್ರಾಕೃತ ಭಾಷಾಸಾಹಿತ್ಯಗಳ ಪ್ರೇರಣೆ, ಪ್ರಭಾವಗಳ ಹಿನ್ನೆಲೆ– ಈ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ರೂಪಿತವಾದ ಶಾಸ್ತ್ರಕೃತಿಗಳು, ಕನ್ನಡ ಜೈನ ಪುರಾಣಗಳು, ರಾಮಾಯಣ, ಮಹಾಭಾರತಗಳು

ಪರಾಮರ್ಶನ:

೧. ಕನ್ನಡ ಅಧ್ಯಯನ ಸಂಸ್ಥೆಯ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆಯ ಸಂಪುಟಗಳು ೧, ೨ ಮತ್ತು ೩

೨. ಸಮಗ್ರ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ ಸಂಪುಟಗಳು, ಬೆಂಗಳೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ

೩. ಕನ್ನಡ ನಾಡಿನ ಧರ್ಮಗಳು : ಶಿ.ಚೆ. ನಂದೀಮಠ

೪. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ ಸಮೀಕ್ಷೆ : ಎಚ್. ತಿಪ್ಪೇರುದ್ರಸ್ವಾಮಿ

೫. ಕನ್ನಡ ಶಾಸನಗಳ ಸಾಂಸ್ಕೃತಿಕ ಅಧ್ಯಯನ : ಎಂ.. ಚಿದಾನಂದಮೂರ್ತಿ

೬. ಜೈನಧರ್ಮ : ಮಿರ್ಜಿ ಅಣ್ಣರಾಯ

೭. ಭಾರತೀಯ ಸಂಸ್ಕೃತಿ : (ಸಂ) ಅ.ನ.. ಕೃಷ್ಣರಾಯ

೮. ಕರ್ನಾಟಕ ಪರಂಪರೆ : ಭಾಗ ೧ ಮತ್ತು ೨, ಕನ್ನಡ ಮತ್ತು ಸಂಸ್ಕೃತಿ ಇಲಾಖೆ

೯. ಚಂಪೂ ಸಾಹಿತ್ಯ : ಪಿ.ವಿ. ನಾರಾಯಣ

೧೦. ಕರ್ನಾಟಕ ಸಾಹಿತ್ಯ ಅಕಾಡೆಮಿಯ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪುನರ್ ಮೌಲ್ಯೀಕರಣ ಮಾಲೆಯ ಸಂಪುಟಗಳು

೧೧. ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚಾರಿತ್ರಿಕ ಬೆಳವಣಿಗೆ (ಮಧ್ಯಕಾಲೀನ) : ಸಿ.ವೀರಣ್ಣ

KNA 030:<u>ಪತ್ರಿಕೆ: ೩ ಕನ್ನಡ ಛಂದಸ್ಸಿನ ಅಧ್ಯಯನ</u>(೩:೧=೪ ಕ್ರೆಡಿಟ್)

೧. ಅ) ಛಂದಸ್ಸಿನ ಉಗಮ, ನಿಷ್ಪತ್ತಿ ಮತ್ತು ಪ್ರಯೋಜನ

ಆ) ವರ್ಣಗಣ, ಮಾತ್ರಾಗಣ ಮತ್ತು ಅಂಶಗಣಗಳ ಸ್ವರೂಪ

ಇ) ಯತಿಯ ಸ್ವರೂಪ ಮತ್ತು ಪ್ರಸ್ತುತತೆ

೨. ಅ) ಪ್ರಾಸದ ಸ್ವರೂಪ, ಪ್ರಭೇದ ಮತ್ತು ಪ್ರಸ್ತುತತೆ

ಆ) ಖ್ಯಾತ ಕರ್ನಾಟಕಗಳ ಸ್ವರೂಪ

ಇ) ಕಂದದ ಉಗಮ ಮತ್ತು ಸ್ವರೂಪ

೩. ಅ) ತ್ರಿಪದಿಯ ಲಕ್ಷಣ ಮತ್ತು ಪ್ರಭೇದಗಳು

ಆ) ಷಟ್ಪದಿಯ ಮೂಲ, ಲಕ್ಷಣ ಮತ್ತು ಪ್ರಭೇದಗಳು

ಇ) ಸಾಂಗತ್ಯದ ಮೂಲ ಮತ್ತು ಲಕ್ಷಣ

೪. ಅ) ಹೊಸಗನ್ನಡ ಛಂದಸ್ಸು : ತತ್ತ್ವಗಳು, ಪರಿಭಾಷೆ

ಆ) ಸರಳ ರಗಳೆಯ ಮೂಲ ಮತ್ತು ಸ್ವರೂಪ

ಇ) ಸಾನೆಟ್ನ ಮೂಲ ಮತ್ತು ಸ್ವರೂಪ

ಪರಾಮರ್ಶನ ಕೃತಿಗಳು

೧. ಕನ್ನಡ ಛಂದಸ್ಸಂಪುಟ : (ಸಂ) ಎಲ್. ಬಸವರಾಜು
೨. ಕನ್ನಡ ಕೈಪಿಡಿ ಸಂಪುಟ ೧ ಭಾಗ ೨ : ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ
೩. ಜಯದಾಮನ್ : (ಸಂ) ಎಚ್.ಡಿ. ವೇಲಣಕರ್
೪. ಕನ್ನಡ ಛಂದೋವಿಕಾಸ : ಡಿ.ಎಸ್. ಕರ್ಕಿ
೫. ಸಮಾಲೋಕನ : ತೀನಂಶ್ರೀ
೬. ಕನ್ನಡ ಛಂದಸ್ವರೂಪ : ಟಿ.ವಿ. ವೆಂಕಟಾಚಲಶಾಸ್ತ್ರೀ
೭. ಪೀಠಿಕೆಗಳು, ಲೇಖನಗಳು : ಡಿ.ಎಲ್. ನರಸಿಂಹಾಚಾರ್
೮. ಕನ್ನಡ ಛಂದೋವಿಹಾರ : ಟಿ.ವಿ. ವೆಂಕಟಾಚಲಶಾಸ್ತ್ರೀ
೯. ಛಂದೋಗತಿ : ಸೇಡಿಯಾಪು ಕೃಷ್ಣಭಟ್ಟ
೧೦. ಕನ್ನಡ ಛಂದಸ್ಸು : ಸೇಡಿಯಾಪು ಕೃಷ್ಣಭಟ್ಟ
೧೧. ಹೊಸಗನ್ನಡ ಕವಿತೆಯ ಛಂದಸ್ಸು : ಕೆ.ಜಿ. ನಾರಾಯಣಪ್ರಸಾದ್
೧೨. ಭಾರತೀಯ ಛಂದಶ್ಯಾಸ್ತ್ರ : ಪ್ರ.ಗೋ. ಕುಲಕರ್ಣಿ
೧೩. ಛಂದೋತರಂಗ : ಎಂ. ಚಿದಾನಂದಮೂರ್ತಿ
೧೪. ಹೊಸಗನ್ನಡ ಕವಿತೆಯ ಮೇಲೆ ಇಂಗ್ಲಿಷ್ ಕಾವ್ಯದ ಪ್ರಭಾವ : ಎಸ್.ಅನಂತನಾರಾಯಣ
೧೫. The Commonness in the Meters of the Dravidian Languages : S.Subrahmanyan
೧೬. A Study of Metre : T.S. Omond
೧೭.Metre, Rhyme and Free verse : G.S. Fraser

KNA 040: ಪತ್ರಿಕೆ: ೪ ವಿಮರ್ಶೆಯ ಅಧ್ಯಯನ(೨:೧=೩ ಕ್ರೆಡಿಟ್)

೧. (ಅ) Preface to Lyrical Ballads : W. Wordsworth
(ಆ) Literature & Pshychology : Carl Jung. S

೨. (ಅ) ಪ್ರಾಯೋಗಿಕ ವಿಮರ್ಶೆ, ಸ್ವರೂಪ, ವ್ಯಾಪ್ತಿ
(ಆ) ವಚನ, ಆಧುನಿಕ ಕಾವ್ಯಗಳು (ನವೋದಯ, ನವ್ಯ, ದಲಿತ, ಬಂಡಾಯ)

೩. (ಅ) ರೂಪನಿಷ್ಠ ವಿಮರ್ಶೆ, ಮಾರ್ಕ್ಸ್ ವಿಮರ್ಶೆ, ಸ್ತ್ರೀವಾದಿ ವಿಮರ್ಶೆ

೪. (ಅ) ವಸಾಹತು– ವಸಾಹತೋತ್ತರ ವಿಮರ್ಶೆ

ಪರಾಮರ್ಶನ ಕೃತಿಗಳು:

೧. ಪಾಶ್ಚಾತ್ಯ ಕಾವ್ಯಮೀಮಾಂಸೆ : ವಿ.ಎಂ. ಇನಾಂದಾರ್
೨. ಸಾಹಿತ್ಯ ವಿಮರ್ಶೆಯ ತತ್ವಗಳು :ಎಚ್.ತಿಪ್ಪೇರುದ್ರಸ್ವಾಮಿ (ಸಂ.ಶೈಲಜ ಎಚ್.ಟಿ)
೩. ಇಂಗ್ಲಿಷ್ ಭಾಷೆಯಲ್ಲಿ ಆಧುನಿಕ ಸಾಹಿತ್ಯ ವಿಮರ್ಶೆ : ಎಲ್.ಎಸ್. ಶೇಷಗಿರಿರಾವ್
೪ ಪ್ರಮಾಣ : ಗಿರಿಡ್ಡಿ ಗೋವಿಂದರಾಜು
೫. ಕಾವ್ಯಾರ್ಥ ಚಿಂತನ : ಜಿ.ಎಸ್. ಶಿವರುದ್ರಪ್ಪ
೬. ಸಾಹಿತ್ಯ ವಿಮರ್ಶೆ : ಸಿ.ಎನ್. ರಾಮಚಂದ್ರನ್
೭. ವಿಮರ್ಶೆಯ ಪರಿಭಾಷೆ : ಓ.ಎಲ್. ನಾಗಭೂಷಣಸ್ವಾಮಿ
೮. ವಿಮರ್ಶೆಯ ತತ್ತ್ವಗಳು ವಿಧಾನಗಳು :(ಸಂ) ವಿ.ಕೃ ಗೋಕಾಕ್ & ಕುಲಕರ್ಣಿ
೯. ಪ್ರಾಯೋಗಿಕ ವಿಮರ್ಶೆ :(ಸಂ)ಜಿ.ಎಸ್. ಶಿವರುದ್ರಪ್ಪ
ಎನ್.ಎಸ್. ಲಕ್ಷ್ಮೀನಾರಾಯಣ ಭಟ್ಟ
೧೦. ಓದುಗರು ಮತ್ತು ಓದುವಿಕೆ : ಸಿ.ಎನ್. ರಾಮಚಂದ್ರನ್
೧೧. ವಸಾಹತೋತ್ತರ ಚಿಂತನೆ : ಸಿ.ಎನ್. ರಾಮಚಂದ್ರನ್
೧೨. ಸ್ತ್ರೀವಾದ : ಸುಮಿತ್ರಾಬಾಯಿ ಬಿ.ಎನ್
೧೩..Literary Criticism – A Short History : W.K.Wimsatt & Cleanth Brooks
೧೪. .Contemporary Criticism : (Ed)Sethuraman V S

ಉಪಪ್ರಧಾನ ವಿಷಯಗಳು (Soft Core)

KNA 210: ಪತ್ರಿಕೆ: ೫.೧ ಬಾಷಾ ವಿಜ್ಞಾನದ ಮೂಲತತ್ತ್ವಗಳು(೩:೧=೪ ಕ್ರೆಡಿಟ್)

೧. ಭಾಷೆ: ವ್ಯಾಖ್ಯಾನಗಳು–ಲಕ್ಷಣಗಳು, ಸ್ವರೂಪ ; ಭಾಷಾ ವಿಜ್ಞಾನದ ಸ್ವರೂಪ–ವ್ಯಾಪ್ತಿ–ಪ್ರಯೋಜನಗಳು, ಭಾಷೆಯ ಉಗಮ ಸಿದ್ಧಾಂತಗಳು; ಭಾಷೆಗಳ ವರ್ಗೀಕರಣದ ಕ್ರಮಗಳು ಭಾರತೀಯ ಭಾಷೆಗಳ ವರ್ಗೀಕರಣ

೨. ಧ್ವನಿ–ಉಪಧ್ವನಿ :ವ್ಯಾಖ್ಯೆ, ಸ್ವರೂಪ ; ಧ್ವನಿವಿಜ್ಞಾನದ ಶಾಖೆಗಳು, ಧ್ವನಿಮಾ : ವ್ಯಾಖ್ಯೆ, ಸ್ವರೂಪ– ಧ್ವನಿಮಾ ನಿರ್ಣಯದ ತತ್ತ್ವಗಳು

೩.ಆಕೃತಿಮಾ : ವ್ಯಾಖ್ಯೆ, ಸ್ವರೂಪ, ವ್ಯಾಪ್ತಿ – ಆಕೃತಿಮಾ ನಿರ್ಣಯ, ನೈಡಾ ತತ್ತ್ವಗಳು, ಆಕೃತಿಮಾದ ಬಗೆಗಳು

೪. ಭಾಷಿಕ ಬದಲಾವಣೆ ; ಭಾಷಿಕ ಸ್ವೀಕರಣ, ಭಾಷೆ ಮತ್ತು ಬರಹ

ಪರಾಮರ್ಶನ ಕೃತಿಗಳು:

೧.ವರ್ಣನಾತ್ಮಕ ವ್ಯಾಕರಣ : ಎಚ್.ಎಸ್. ಬಿಳಿಗಿರಿರಿ

೨. ಭಾಷಾವಿಜ್ಞಾನದ ಮೂಲತತ್ವಗಳು : ಎಂ. ಚಿದಾನಂದಮೂರ್ತಿ

೩.ಭಾಷೆ ಮತ್ತು ಭಾಷಾವಿಜ್ಞಾನ : ಕೆ.ಕೆಂಪೇಗೌಡ

೪.ಸಾಮಾನ್ಯ ಭಾಷಾವಿಜ್ಞಾನ : ಕೆ.ಕೆಂಪೇಗೌಡ

೫.ಆಧುನಿಕ ವರ್ಣನಾತ್ಮಕ ಭಾಷಾವಿಜ್ಞಾನ : ರಾಜೇಶ್ವರೀ ಮಹೇಶ್ವರಯ್ಯ

೬.ಭಾಷೆ : (ಸಂ) ಕೆ.ವಿ. ನಾರಾಯಣ

೭.Language : Leonard Bloomfield

೮.Language : Edward Sapir

೯.A Course in Modern Linguistics : C.F. Hackett

೧೦.Modern Linguistics : S Potter

೧೧. Introduction to theoretical Linguistics : J. Lyons

೧೨. Historical Linguistics An Introduction : W.P. Lehmann

KNA 210 :ಪತ್ರಿಕೆ ೫.೧

ಜಾನಪದ ಅಧ್ಯಯನ: ಜಾನಪದ ಸಾಹಿತ್ಯದ ತಾತ್ತ್ವಿಕ ಅಧ್ಯಯನ

೧. ಜನಪದ – ಜಾನಪದ : ವ್ಯಾಖ್ಯಾನ, ಸ್ವರೂಪ, ವ್ಯಾಪ್ತಿ, ವರ್ಗೀಕರಣ ; ಆದಿವಾಸಿ (ಬುಡಕಟ್ಟು) ಮತ್ತು ನಗರ ಜಾನಪದ, ಜಾನಪದ ಮತ್ತು ಇತರ ವಿಜ್ಞಾನಗಳು, ಜಾನಪದ ಮತ್ತು ದೇಶೀವಾದ; ಜನಪದ ಸಾಹಿತ್ಯದ ವರ್ಗೀಕರಣ, ಶಿಷ್ಟ ಮತ್ತು ಜನಪದ ಸಾಹಿತ್ಯ

೨. ಜನಪದ ಗೀತೆ, ಕಥನ ಕಾವ್ಯ, ಲಾವಣಿ, ಜನಪದ ಮಹಾಕಾವ್ಯ, ಜನಪದ ಕಥೆಗಳು – ಇವುಗಳ ಸ್ವರೂಪ, ಲಕ್ಷಣ, ಹಿನ್ನೆಲೆ, ಪ್ರಕಾರ

೩. ಜನಪದ ಗಾದೆ – ಜನಪದ ಒಗಟು, ಒಡಪು, ದಂತಕತೆ, ಇತಿಹ್ಯ, ಪವಾಡ, ಪುರಾಣ ಇವುಗಳ ಸ್ವರೂಪ, ಲಕ್ಷಣ, ಹಿನ್ನೆಲೆ, ಪ್ರಕಾರ

೪. ಜನಪದ ಕ್ಷೇತ್ರಕಾರ್ಯ : ಸ್ವರೂಪ – ಕ್ಷೇತ್ರಜ್ಞರ ವ್ಯಕ್ತಿತ್ವ ಮತ್ತು ಗುಣಗಳು – ಕ್ಷೇತ್ರಕಾರ್ಯದ ಪೂರ್ವಸಿದ್ಧತೆಗಳು– ಕ್ಷೇತ್ರಕಾರ್ಯದ ಪರಿಕರಗಳು

ಪರಾಮರ್ಶನ ಕೃತಿಗಳು:

೧. ಜಾನಪದ ತತ್ತ್ವಗಳು : (ಸಂ)ಅರವಿಂದ ಮಾಲಗತ್ತಿ

೨. ಜಾನಪದ ಅಧ್ಯಯನ : ದೇಜಗೌ

೩. ಜನಪದ ಪುರಾಣಗಳು : ರಾಗೌ

೪. ಜಾನಪದ : ಜೀ.ಶಂ.. ಪರಮಶಿವಯ್ಯ

೫. ಜಾನಪದ ಸ್ವರೂಪ : ಹಾ.ಮಾ. ನಾಯಕ

೬. ಭಾರತೀಯ ಜಾನಪದ ಸಮೀಕ್ಷೆ : ದುರ್ಗಾಭಾಗವತ್ ಅನು: ಕೆ. ಮರುಳಸಿದ್ದಪ್ಪ

೭ ಭಾರತೀಯ ಪರಂಪರೆ ಹಾಗೂ ಸಾಹಿತ್ಯದಲ್ಲಿ ಒಗಟು : ದುರ್ಗಾಭಾಗವತ್ ಅನು: ಬಿ.ಎ.ವಿವೇಕ ರೈ

೮. ನಮ್ಮ ಗಾದೆಗಳು : ರಾಗೌ

೯. ಜನಪದ ಕಥಾಮಾರ್ಗಗಳು : ಹಿ.ಶಿ. ರಾಮಚಂದ್ರಗೌಡ

೧೦. ಜನಪದ ಆಟಗಳು : ಕರ್ನಾಟಕ ಜಾನಪದ ಯಕ್ಷಗಾನ ಅಕಾಡೆಮಿ

೧೧. ಜಾನಪದ ಅಧ್ಯಯನ –ಸಂಕ್ಷಿಪ್ತ ಇತಿಹಾಸ : ನಂ. ತಪಸ್ವೀಕುಮಾರ್

೧೨. ಜಾನಪದ ಕೆಲವು ಮುಖಗಳು : ಜೀ.ಶಂ. ಪರಮಶಿವಯ್ಯ

೧೩. ಜನಪದ ಸಾಹಿತ್ಯ ರೂಪಗಳು : ರಾಗೌ

೧೪. ಜಾನಪದ ಪ್ರವೇಶ : ಚಂದ್ರು ಕಾಳೇನಹಳ್ಳಿ

೧೫. ಜಾನಪದ ಸಮಾವೇಶ :(ಸಂ) ಜೀ.ಶಂ. ಪರಮಶಿವಯ್ಯ

೧೬. ಜಾನಪದ ವಾಹಿನಿ : ದೇ. ಜವರೇಗೌಡ

೧೭. ದಕ್ಷಿಣ ಕರ್ನಾಟಕದ ಜನಪದ ಪ್ರಕಾರಗಳು : ಜೀ.ಶಂ. ಪರಮಶಿವಯ್ಯ

೧೮. ಜಾನಪದ ಸಮೀಕ್ಷೆ : ಅಂಬಳಿಕೆ ಹಿರಿಯಣ್ಣ

೧೯. ಕರ್ನಾಟಕ ಜಾನಪದ : (ಸಂ)ಜಿ.ಎಸ್.ಶಿವರುದ್ರಪ್ಪ

೨೦. ಜಾನಪದ ಮೂಲಭೂತ ತತ್ತ್ವಗಳು : ದೇವೇಂದ್ರಕುಮಾರ ಹಕಾರಿ

೨೧. ಕನ್ನಡ ಜಾನಪದ: ಕೆಲವು ಮುಖಗಳು : ಟಿ.ಎಸ್. ಸತ್ಯನಾಥ

೨೨. ಜಾನಪದ: ವೈಜ್ಞಾನಿಕ ಕ್ಷೇತ್ರಕಾರ್ಯ : ಸಿ.ಸಿ.ಎ.ಪೈ

೨೩. ದ್ರಾವಿಡ ಜಾನಪದ : (ಸಂ)ಎಚ್.ಜೆ. ಲಕ್ಕಪ್ಪ ಗೌಡ

೨೪. ಮಲೆನಾಡು ಜಾನಪದ : (ಸಂ)ಎಚ್.ಜೆ. ಲಕ್ಕಪ್ಪ ಗೌಡ

೨೫. ಜಾನಪದ ಸಾಹಿತ್ಯ ದರ್ಶನ ಸಂಪುಟಗಳು : ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ

೨೬. ಜಾನಪದದ ವಿವಿಧ ಮುಖಗಳು : (ಸಂ) ಪ್ರೊ. ಶ್ರೀಕಂಠಕೂಡಿಗೆ

೨೭. ಸೈದ್ಧಾಂತಿಕ ಜಾನಪದ : ಅಂಬಳಿಕೆ ಹಿರಿಯಣ್ಣ

೨೮. Folklore and Folk life : Ed. Richard M Dorson

೨೯. The study of Folklore : Ed: Alan Dundes

೩೯. Folklore Genres : Dass Ben Amos

೩೦. The Folktale : Stith Thompson

೩೧. Current Trends in Folklore : Jawaharlal Handoo

೩೨. Story Performance and Event : Richard Bauman

KNA 210: ಪತ್ರಿಕೆ ೫.೩ ಚಾರಿತ್ರಿಕ ಅಧ್ಯಯನ: ಕರ್ನಾಟಕ ಸಾಂಸ್ಕೃತಿಕ ಚರಿತ್ರೆ

೧. ಸಂಸ್ಕೃತಿ ಎಂದರೇನು? ಕರ್ನಾಟಕ ಸಾಂಸ್ಕೃತಿಕ ಚರಿತ್ರೆಯ ಅಧ್ಯಯನದ ಮೂಲ ಸಾಮಗ್ರಿಗಳು; ಕರ್ನಾಟಕದ ಪ್ರಾಚೀನತೆ – ದೊರೆಯುವ ಆಕರಗಳು ಮತ್ತು ಅವುಗಳ ಸ್ವರೂಪ

೨. ಕದಂಬರು : ಮಯೂರವರ್ಮ, ಕಾಕುತ್ಸವರ್ಮ ; ಗಂಗರು: ದುರ್ವಿನೀತ, ಶ್ರೀಪುರುಷ

ಬಾದಾಮಿಯ ಚಾಲುಕ್ಯರು: ಇಮ್ಮಡಿ ಪುಲಿಕೇಶಿ, ಇಮ್ಮಡಿ ವಿಕ್ರಮಾದಿತ್ಯ

೩. ರಾಷ್ಟ್ರಕೂಟರು: ಮುಮ್ಮಡಿ ಗೋವಿಂದ, ಅಮೋಘವರ್ಷ ನೃಪತುಂಗ, ಮುಮ್ಮಡಿ ಕೃಷ್ಣ

ಕಲ್ಯಾಣದ ಚಾಲುಕ್ಯರು:ಇಮ್ಮಡಿ ತೈಲಪ, ಇಮ್ಮಡಿ ಜಯಸಿಂಹ, ಆರನೆಯ ವಿಕ್ರಮಾದಿತ್ಯ

ಹೊಯ್ಸಳರು: ವಿಷ್ಣುವರ್ಧನ, ಇಮ್ಮಡಿ ಬಲ್ಲಾಳ

೪. ವಿಜಯನಗರ: ಇಮ್ಮಡಿ ದೇವರಾಯ, ಕೃಷ್ಣದೇವರಾಯ; ಮೈಸೂರು ಒಡೆಯರು, ಚಿಕ್ಕದೇವರಾಯ, ಮುಮ್ಮಡಿ ಕೃಷ್ಣರಾಜ

೨, ೩ ಮತ್ತು ೪ನೇ ಘಟಕಗಳಲ್ಲಿ ಆಯಾ ರಾಜರ ಕಾಲದ ರಾಜಕೀಯ, ಧಾರ್ಮಿಕ ಸಾಮಾಜಿಕ, ಸಾಂಸ್ಕೃತಿಕ ಸ್ಥಿತಿಗತಿಗಳನ್ನು ಅಭ್ಯಾಸ ಮಾಡತಕ್ಕದ್ದು, ರಾಜಕೀಯ ಎಂದರೆ ಚಾರಿತ್ರಿಕ ವಿವರಗಳು ; ಧಾರ್ಮಿಕ ಎಂದರೆ ಬೌದ್ಧ, ಜೈನ, ವೈದಿಕ, ವೀರಶೈವ ಧರ್ಮಗಳ ವಿವರಗಳು; ಸಾಮಾಜಿಕ ಸಾಂಸ್ಕೃತಿಕ ಶಿಕ್ಷಣ, ಆಡಳಿತ, ಜನಜೀವನ, ಆತ್ಮಬಲಿದಾನ ಪದ್ಧತಿಗಳು; ದೇವಸ್ಥಾನಗಳ ವಾಸ್ತುಶಿಲ್ಪ

ಪರಾಮರ್ಶನ ಕೃತಿಗಳು:

೧.ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ ೧,೨,೩,೪,೫,	: ಕುವೆಂಪು ಕನ್ನಡ ಅಧ್ಯಯನ ಸಂಸ್ಥೆ, ಮೈಸೂರು
೨. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ ಸಮೀಕ್ಷೆ	: ಎಚ್. ತಿಪ್ಪೇರುದ್ರಸ್ವಾಮಿ
೩. ಕನ್ನಡ ಶಾಸನಗಳ ಸಾಂಸ್ಕೃತಿಕ ಅಧ್ಯಯನ	: ಎಂ.. ಚಿದಾನಂದಮೂರ್ತಿ
೪. ಮಾರ್ಗ ೧,೨,೩	: ಎಂ.ಎಂ. ಕಲಬುರ್ಗಿ
೫. ಕರ್ನಾಟಕದ ಅರಸು ಮನೆತನಗಳು	: ಎನ್. ಲಕ್ಷ್ಮೀನಾರಾಯಣರಾವ್ ಮತ್ತು ಆರ್.ಎಸ್., ಪಂಚಮುಖಿ
೬. ಕರ್ನಾಟಕ ಇತಿಹಾಸ	: ಎಂ.ವಿ. ಕೃಷ್ಣರಾವ್ ಮತ್ತು ಕೇಶವಭಟ್ಟ
೭. ಕರ್ನಾಟಕ ಪರಂಪರೆ ೧,೨	: ಕನ್ನಡ ಮತ್ತು ಸಂಸ್ಕೃತಿ ಇಲಾಖೆ

೮. ಕರ್ನಾಟಕ ಚರಿತ್ರೆ : ಕನ್ನಡ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಹಂಪಿ

೯. ವಿಷಯ ವಿಶ್ವಕೋಶ : ಕರ್ನಾಟಕ : ಕುವೆಂಪು ಕನ್ನಡ ಅಧ್ಯಯನ ಸಂಸ್ಥೆ

೧೦. Karnataka Darshana : R.R. Diwakar

೧೧. The Heritage of Karnataka : R.S. Mugali

೧೨. A History of south India : K.A. Nilakntha Shastry

೧೩. Early History of Deccan I & II : Yazdani

೧೪. Administration and Social Life Under Vijaynagar : T.V. Mahlingam

ಮೊದಲನೆಯ ವರ್ಷ ಎಂ. ಎ. ಕನ್ನಡ

ಎರಡನೆಯ ಚತುರ್ಮಾಸ (ಜನವರಿ–ಮೇ ೨೦೧೦)

ಪ್ರಧಾನ ವಿಷಯಗಳು (Hard core)

KNB 010 : ಪತ್ರಿಕೆ:೧ ಮಧ್ಯಕಾಲೀನ ಕನ್ನಡ ಸಾಹಿತ್ಯ:ವಚನ ಸಾಹಿತ್ಯ

(೩:೧=೪ ಕ್ರೆಡಿಟ್)

ಹಿನ್ನೆಲೆ, ಅಂದಿನ ಸಾಮಾಜಿಕ ಸಾಂಸ್ಕೃತಿಕ ಜೀವನ ವಚನಾಂದೋಲನದ ಸ್ವರೂಪ, ಜೇಡರ ದಾಸಿಮಯ್ಯ, ಬಸವಣ್ಣ, ಅಕ್ಕಮಹಾದೇವಿ, ಅಂಬಿಗರ ಚೌಡಯ್ಯ–ಈ ನಾಲ್ಕು ಮಂದಿ ವಚನಕಾರರ ಹಿನ್ನೆಲೆ ಮತ್ತು ಇತಿವೃತ್ತ.

೧. ಜೇಡರ ದಾಸಿಮಯ್ಯನ ವಚನಗಳು (ಆಯ್ದ ಇಪ್ಪತ್ತೈದು ವಚನಗಳು)

೭೨೧, ೭೨೨, ೭೪೨, ೭೪೪, ೭೬೪, ೭೬೫, ೭೬೮, ೭೭೪, ೭೮೫, ೭೯೩, ೭೯೯, ೮೦೧, ೮೦೮, ೮೧೦, ೮೧೮, ೮೩೧, ೮೩೮, ೮೪೧, ೮೫೩, ೮೬೨, ೮೬೬, ೮೭೮, ೮೮೦, ೮೮೪, ೮೯೩

೨.ಬಸವಣ್ಣನ ವಚನಗಳು (ಆಯ್ದ ಇಪ್ಪತ್ತೈದು ವಚನಗಳು)

೨೬, ೨೯, ೩೪, ೫೯, ೬೨, ೮೩, ೯೨, ೯೩, ೯೭, ೧೧೫, ೧೨೯, ೧೩೦, ೧೫೫, ೧೬೧, ೧೮೩, ೨೦೮, ೨೧೨, ೨೨೩, ೨೩೫, ೨೪೧, ೨೯೧, ೪೩೬, ೪೩೮, ೪೪೭, ೫೫೭,

೩..ಅಕ್ಕಮಹಾದೇವಿಯ ವಚನಗಳು (ಆಯ್ದ ಇಪ್ಪತ್ತೈದು ವಚನಗಳು)

೨೮, ೩೩, ೫೨, ೯೫, ೧೨೫, ೧೪೩, ೧೬೩, ೧೯೬, ೨೬೮, ೨೯೦, ೩೦೩, ೩೦೭, ೩೨೧, ೩೩೦, ೩೪೦, ೩೬೪, ೩೬೫, ೩೯೮, ೪೧೧, ೪೧೨, ೪೧೩, ೪೧೯, ೪೨೬, ೪೨೯, ೪೩೨

೪.ಅಂಬಿಗರ ಚೌಡಯ್ಯನ ವಚನಗಳು (ಆಯ್ದ ಇಪ್ಪತ್ತೈದು ವಚನಗಳು)

೬, ೭, ೯, ೧೭, ೨೫, ೨೭, ೩೫, ೫೩, ೫೪, ೭೯, ೮೮, ೧೦೬, ೧೧೦, ೧೩೯, ೧೫೭, ೧೫೮, ೧೬೯, ೧೮೭, ೧೮೯, ೨೪೨, ೨೪೩, ೨೪೪, ೨೪೫, ೨೪೭, ೨೫೨

ಪಠ್ಯ ಮೂಲ :

೧, ಸಂಕೀರ್ಣ ವಚನ ಸಂಪುಟ ೨ : (ಸಂ) ಎಸ್. ವಿದ್ಯಾಶಂಕರ, ಕನ್ನಡ ಮತ್ತು ಸಂಸ್ಕೃತಿ ಇಲಾಖೆ, ಬೆಂಗಳೂರು

೨. ಬಸವಣ್ಣನವರ ವಚನ ಸಂಪುಟ: (ಸಂ) ಎಂ.ಎಂ. ಕಲಬುರ್ಗಿ, ಕನ್ನಡ ಮತ್ತು ಸಂಸ್ಕೃತಿ ಇಲಾಖೆ, ಬೆಂಗಳೂರು

೩. ಶಿವಶರಣೆಯರ ವಚನ ಸಂಪುಟ: (ಸಂ) ವೀರಣ್ಣ ರಾಜೂರ, ಕನ್ನಡ ಪುಸ್ತಕ ಪ್ರಾಧಿಕಾರ, ಬೆಂಗಳೂರು

೪, ಸಂಕೀರ್ಣ ವಚನ ಸಂಪುಟ ೧: (ಸಂ) ಎಂ.ಎಂ. ಕಲಬುರ್ಗಿ, ಕನ್ನಡ ಮತ್ತು ಸಂಸ್ಕೃತಿ ಇಲಾಖೆ, ಬೆಂಗಳೂರು

ಪರಾಮರ್ಶನ ಕೃತಿಗಳು:

೧.ವಚನಧರ್ಮಸಾರ : ಎಂ.ಆರ್.. ಶ್ರೀನಿವಾಸಮೂರ್ತಿ
೨.ವಚನಶಾಸ್ತ್ರ ರಹಸ್ಯ : ರಂ.ರಾ. ದಿವಾಕರ
೩.ಬಸವಣ್ಣನವರ ಷಟ್‌ಸ್ಥಲದ ವಚನಗಳು : ಎಲ್.ಬಸವರಾಜು
೪.ಬಸವಣ್ಣನವರ ವಚನಾಮೃತ ಭಾಗ ೧ ಮತ್ತು ೨ : ಎಲ್. ಬಸವರಾಜು
೫.ಬಸವಣ್ಣನವರ ವಚನಗಳು : ಫ.ಗು.ಹಳಕಟ್ಟಿ
೬.ಭಕ್ತಿ ಭಂಡಾರಿ ಬಸವಣ್ಣನವರು : ಎಂ.ಆರ್.ಶ್ರೀನಿವಾಸಮೂರ್ತಿ
೭.ಶರಣರ ಅನುಭಾವ ಸಾಹಿತ್ಯ : ಎಚ್. ತಿಪ್ಪೇರುದ್ರಸ್ವಾಮಿ
೮.ಬಸವೇಶ್ವರ ವಚನ ದೀಪಿಕೆ : ಎಚ್. ತಿಪ್ಪೇರುದ್ರಸ್ವಾಮಿ
೯.ಅಕ್ಕನ ವಚನ ಚಿಂತನ : ಅನ್ನದಾನೀಶ್ವರ ಸ್ವಾಮಿಗಳು
೧೦. Sri Basaveswara and His contemporaries : A R Jayaram
೧೧. The thoughts of Basava : N K Sanakalmath
೧೨. Hand book of Veerashavism : S C Nadimath
೧೩. Speaking of Siva : A.K. Ramanujan

KNB 020 : <u>ಪತ್ರಿಕೆ: ೨ ಮಧ್ಯಕಾಲೀನ ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಹಿನ್ನೆಲೆ</u>

(೨:೧=೩ ಕ್ರೆಡಿಟ್)

೧.ರಾಜಕೀಯ ಹಿನ್ನೆಲೆ :ಕಲ್ಯಾಣ ಚಾಲುಕ್ಯರು ನೀಡಿದ ಸಾಹಿತ್ಯ ಪ್ರೇರಣೆ-ಪೋಷಣೆ, ಹೊಯ್ಸಳರು ನೀಡಿದ ಜೈನ – ವೈಷ್ಣವ ಸಾಹಿತ್ಯ ಪೋಷಣೆ, ಕಲಚುರಿಗಳ ವಚನಾಂದೋಲನ ಎದುರಿಸಿದ ಪ್ರಭುತ್ವ ವಿರೋಧಿ ನಿಲುವುಗಳು – ಪ್ರತಿಭಟನೆ, ಸಮಾನತೆ ಘೋಷಣೆ; ವಿಜಯನಗರ ಅರಸರ ಕಾಲದ ವೈದಿಕ – ವೀರಶೈವ ಧರ್ಮ ಪುನರುತ್ಥಾನ
೨.ಧಾರ್ಮಿಕ ಹಿನ್ನೆಲೆ : ಶೈವ, ವೀರಶೈವ, ವೈಷ್ಣವ, ಜೈನ ಧರ್ಮ: ಸ್ವರೂಪ, ಸ್ಥಿತಿಗತಿ, ಸ್ಪರ್ಧೆ, ಜೈನ ಧರ್ಮ ಎದುರಿಸಿದ ಆತಂಕಗಳು : ವೈದಿಕ ಧರ್ಮದ ಪುನರುಜ್ಜೀವನ
೩.ವಚನ-ರಗಳೆ ಸಾಹಿತ್ಯಗಳ ನವೀನತೆ, ಸಾಮಾಜಿಕ ನಿಲುವುಗಳು : ರಗಳೆ-ಷಟ್ಪದಿ ಕೃತಿಗಳಲ್ಲಿ ಬಂದ ಕರ್ನಾಟಕದ ಧಾರ್ಮಿಕ ಪುರುಷರ ಚರಿತ್ರೆ : ಭಾಗವತ – ಭಕ್ತಿ ಸಾಹಿತ್ಯದ ಪುನರುತ್ಥಾನ, ಕೀರ್ತನ ಸಾಹಿತ್ಯದ ಸಾಮಾಜಿಕ ನೆಲೆಗಳು
೪.ಕನ್ನಡ ಭಾಷೆ-ಸಾಹಿತ್ಯದ ಮೇಲೆ ತಮಿಳು, ತೆಲುಗು, ಸಂಸ್ಕೃತ ಭಾಷೆ–ಸಾಹಿತ್ಯಗಳು ಬೀರಿದ ಪ್ರಭಾವ, ಪರಸ್ಪರ ಸಂಬಂಧ

ಪರಾಮರ್ಶನ ಕೃತಿಗಳು:

೧.ಕನ್ನಡ ಅಧ್ಯಯನ ಸಂಸ್ಥೆಯ ಕನ್ನಡ ಚರಿತ್ರೆಯ ಸಂಪುಟಗಳು ೧, ೨ ಮತ್ತು ೩
೨ ಸಮಗ್ರ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆಯ ಸಂಪುಟಗಳು, ಬೆಂಗಳೂರು ವಿಶ್ವವಿದ್ಯಾಲಯ
೩.ಕನ್ನಡ ನಾಡಿನ ಧರ್ಮಗಳು : ಶಿ.ಚೆ. ನಂದೀಮಠ
೪.ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ ಸಮೀಕ್ಷೆ : ಎಚ್. ತಿಪ್ಪೇರುದ್ರಸ್ವಾಮಿ
೫.ಕನ್ನಡ ಶಾಸನಗಳ ಸಾಂಸ್ಕೃತಿಕ ಅಧ್ಯಯನ : ಎಂ..ಚಿದಾನಂದಮೂರ್ತಿ
೬.ಜೈನಧರ್ಮ : ಮಿರ್ಜಿ ಅಣ್ಣರಾಯ
೭.ಭಾರತೀಯ ಸಂಸ್ಕೃತಿ : (ಸಂ) ಅ.ನ.ಕೃಷ್ಣರಾಯ
೮.ಕರ್ನಾಟಕ ಪರಂಪರೆ : ಭಾಗ ೧ ಮತ್ತು ೨
೯.ಚಂಪೂ ಸಾಹಿತ್ಯ : ಪಿ.ವಿ ನಾರಾಯಣ
೧೦.ಕರ್ನಾಟಕ ಸಾಹಿತ್ಯ ಅಕಾಡೆಮಿಯ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪುನರ್ ಮೌಲೀಕರಣ ಮಾಲೆಯ ಸಂಪುಟಗಳು
೧೧.ಹರಿದಾಸ ಸಾಹಿತ್ಯ : ಆರ್.ಎಸ್. ಪಂಚಮುಖಿ
೧೨ ವಚನಧರ್ಮಸಾರ : ಎಂ.ಆರ್.ಶ್ರೀನಿವಾಸಮೂರ್ತಿ

KNB 030: ಪತ್ರಿಕೆ: ೩ ದ್ರಾವಿಡ ಭಾಷಾವಿಜ್ಞಾನ (೨:೧=೩ ಕ್ರೆಡಿಟ್)

೧ ದ್ರಾವಿಡ ಪದದ ನಿಷ್ಪತ್ತಿ – ದ್ರಾವಿಡ ಭಾಷೆಗಳ ಸಂಖ್ಯೆ, ಸ್ವರೂಪ ಮತ್ತು ವರ್ಗೀಕರಣ

೨ ದ್ರಾವಿಡ ಭಾಷಾವಿಜ್ಞಾನದ ಇತಿಹಾಸ–ಸ್ವರವ್ಯತ್ಯಯ ವಿಚಾರ–ದ್ರಾವಿಡ ಧ್ವನಿಮಾಗಳ ಚರಿತ್ರೆ –ಕ್, ಚ್, ಟ್, ಪ್. ಜ್, ಲ್

೩ ಆಕೃತಿಮಾ ಅಧ್ಯಯನ : ಸರ್ವನಾಮ, ಲಿಂಗ, ವಚನ, ವಿಭಕ್ತಿ, ಸಂಖ್ಯಾವಾಚಕಗಳ ಸ್ಥೂಲಪರಿಚಯ, ಚರಿತ್ರೆ, ಕ್ರಿಯಾಪದ ಮತ್ತು ಕರ್ಮಣಿ ಪ್ರಯೋಗ

೪ ಭಾಷಾವಿಜ್ಞಾನದ ದೃಷ್ಟಿಯಿಂದ ಮುಖ್ಯವೆನಿಸಿದ ಕೆಲವು ಪದಗಳ ಇತಿಹಾಸ

ಪರಾಮರ್ಶನ ಕೃತಿಗಳು:

೧ ಭಾಷಾವಿಜ್ಞಾನದ ಮೂಲತತ್ವಗಳು : ಎಂ.ಚಿದಾನಂದಮೂರ್ತಿ

೨ ದ್ರಾವಿಡ ಭಾಷಾವಿಜ್ಞಾನ : ಹಂಪ ನಾಗರಾಜಯ್ಯ

೩ ದ್ರಾವಿಡ ಸಂಖ್ಯಾ ವಾಚಕಗಳು : ಹಂಪ ನಾಗರಾಜಯ್ಯ

೪ ದ್ರಾವಿಡ ಭಾಷಾವ್ಯಾಸಂಗ : ಸಂಗಮೇಶ ಸವದತ್ತಿಮಠ

೫ ದ್ರಾವಿಡ ಭಾಷೆಗಳು : ಸಂಗಮೇಶ ಸವದತ್ತಿಮಠ

೬ ಕನ್ನಡ ಭಾಷಾವ್ಯಾಸಂಗ : ಸಂಗಮೇಶ ಸವದತ್ತಿಮಠ

೭ ಆಲೋಕ : ಎಚ್.ಎಸ್. ಬಿಳಿಗಿರಿ

೮ ಕನ್ನಡ ಭಾಷೆಯ ರೂಪರೇಷೆಗಳು : ವಿಲಿಯಂ ಮಾಡ್ತಾ

೯ ಕನ್ನಡ ಭಾಷೆಯ ಸಂಕ್ಷಿಪ್ತ ಚರಿತ್ರೆ : ಡಿ.ಎನ್.ಶಂಕರ ಭಟ್ಟ

೧೦ ಕನ್ನಡ ಭಾಷೆಯ ಚರಿತ್ರೆ : ಪ್ರ.ಗೋ. ಕುಲಕರ್ಣಿ

೧೧ ಕನ್ನಡ ಭಾಷೆಯ ಸ್ವರೂಪ : ಕೆ.ಎಂ.ಕೃಷ್ಣರಾವ್

೧೨ ಐತಿಹಾಸಿಕ ಭಾಷಾವಿಜ್ಞಾನ : ಜೆ.ಎಸ್.ಕುಳ್ಳಿ

೧೩ ವರ್ಣನಾತ್ಮಕ ಭಾಷಾವಿಜ್ಞಾನ : ಜೆ.ಎಸ್.ಕುಳ್ಳಿ

೧೪ ದ್ರಾವಿಡ ಭಾಷೆಗಳ ತೌಲನಿಕ ಅಧ್ಯಯನ : ಟಿ.ಮಣಿಯನ್

೧೫ ತಮಿಳು ಭಾಷಾಚರಿತ್ರೆ : ಟಿ.ಮಣಿಯನ್

೧೬ ತೌಲನಿಕ ದ್ರಾವಿಡ ಭಾಷಾವಿಜ್ಞಾನ ಪರಿಚಯ : ಕೆ.ಕೆಂಪೇಗೌಡ

೧೭ ಸಂಕ್ಷಿಪ್ತ ಕನ್ನಡ ಭಾಷಾ ಚರಿತ್ರೆ : .ಎಂ.ಎಚ್.ಕೃಷ್ಣಯ್ಯ

೧೮ A Comparative Grammar of the Dravidian Languages : R. Caldwell

೧೯ History of Kannada Language : R Narasimahacharaya

೨೦ Collected Papers on Dravidian Lingusistics : T. Burrow

೨೧ Dravidian Comparative Phonology – A sketch : M.B. Emeneau

೨೨ Dravidian Nouns : S.V. Shanmugam

೨೩ Dravidian Verb Morphology : P.S. Subramanyam

KNB 040: ಪತ್ರಿಕೆ: ೪ ಕನ್ನಡ ವಿಮರ್ಶೆ – ಪಠ್ಯ : ಆಯ್ದ ಲೇಖನಗಳು

(೩:೧=೪ ಕ್ರೆಡಿಟ್)

ಆಧುನಿಕ ಕನ್ನಡ ವಿಮರ್ಶೆಯ ಸ್ವರೂಪ, ಬೆಳವಣಿಗೆ, ವಿವಿಧ ಪಂಥಗಳು–ಧೋರಣೆಗಳು

೧ ಮುಳಿಯ ತಿಮ್ಮಪ್ಪಯ್ಯ : ಕಾವ್ಯಧರ್ಮವೂ ಧರ್ಮವೂ

೨ ಕುವೆಂಪು : ಹೊಸ ಸಾಹಿತ್ಯ ಮತ್ತು ಹೊಸ ದೃಷ್ಟಿ

೩ ನಿರಂಜನ : ಪ್ರಗತಿಶೀಲ ಸಾಹಿತ್ಯ ಗೊತ್ತು ಗುರಿಗಳು

೪ ಶಂಕರ ಮೊಕಾಶಿ ಪುಣೇಕರ :ಸ್ವಾತಂತ್ರ್ಯ ಪೂರ್ವ ಹೊಸಗನ್ನಡ ಸಾಹಿತ್ಯ

೫ ಚಂದ್ರಶೇಖರ ಕಂಬಾರ : ಮೌಖಿಕ ಪರಂಪರೆ ಮತ್ತು ಭಾರತೀಯ ಸಾಹಿತ್ಯ

೬ ನಾಗರಾಜ ಡಿ.ಆರ್. : ಕುವೆಂಪು ಕಾವ್ಯದ ಪ್ರಕೃತಿ ದರ್ಶನ ಮತ್ತು ಭೂಮಿ

೭ ಬರಗೂರು ರಾಮಚಂದ್ರಪ್ಪ: ಬಂಡಾಯ ಸಾಹಿತ್ಯಮೀಮಾಂಸೆ

೮ ದೇವಯ್ಯ ಹರವೆ : ದಲಿತ ಸಾಹಿತ್ಯ : ಕೆಲವು ತಾತ್ವಿಕ ಚಿಂತನೆಗಳು

೯ ವಿಜಯಾ ದಬ್ಬೆ: ಹೊನ್ನಮ್ಮನ ಕಿವಿಮಾತಿಗೆ ಒಂದು ಪ್ರತಿಕ್ರಿಯೆ

೧೦ ಅರವಿಂದ ಮಾಲಗತ್ತಿ : ಸ್ತ್ರೀವಾದ ದಲಿತವಾದದಿಂದ – ದಲಿತ ಸ್ತ್ರೀವಾದದೆಡೆಗೆ

ಪರಾಮರ್ಶನ ಸಾಹಿತ್ಯ

೧ ಗಿರಡ್ಡಿ ಗೋವಿಂದರಾಜ : ಪ್ರಮಾಣು, ಕವಿವಿ ಹಂಪಿ, ೨೦೦೩

೨ ಬಿ.ದಾಮೋದರರಾವ್ :ಆಯಾಮಗಳು, ಪರಿಸರ ಸಾಹಿತ್ಯ ಪ್ರ. ಶಿವಮೊಗ್ಗ, ೧೯೯೨

೩ ರಹಮತ್ ತರೀಕೆರೆ ಸಂ) : ಕನ್ನಡ ಸಾಹಿತ್ಯ ಮೀಮಾಂಸೆ, ಕವಿವಿ, ಹಂಪಿ, ೨೦೦೧

೪ ರಹಮತ್ ತರೀಕೆರೆ (ಸಂ) : ಮಾತು ತಲೆ ಎತ್ತುವ ಬಗೆ, ಕವಿವಿ, ಹಂಪಿ, ೨೦೦೫

೫ ಲಕ್ಷ್ಮಣ ಕೊಡಸೆ (ಸಂ) : ಕನ್ನಡ ವಿಮರ್ಶಾ ವಿವೇಕ, ಸುಮುಖ ಪ್ರ. ಬೆಂ, ೨೦೦೮

೬ ಕೀರ್ತಿನಾಥ ಕುರ್ತಕೋಟಿ : ಯುಗಧರ್ಮ ಮತ್ತು ಸಾಹಿತ್ಯ ದರ್ಶನ

೭ ಅರವಿಂದ ಮಾಲಗತ್ತಿ (ಸಂ) : ಸೀಮಾತೀತ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ ಸಂಪುಟಗಳು

ಉಪ ಪ್ರಧಾನ ವಿಷಯಗಳು (Soft Core)

KNB 210: ಪತ್ರಿಕೆ: ೫.೧

ಭಾಷಾವಿಜ್ಞಾನ ಅಧ್ಯಯನ: ಕನ್ನಡ ವ್ಯಾಕರಣಗಳ ತೌಲನಿಕ ಸಮೀಕ್ಷೆ

(೩:೧=೪ ಕ್ರೆಡಿಟ್)

ಈ ಕೆಳಗಿನ ಪಠ್ಯ ವಿವರಗಳನ್ನು ಮಾತ್ರ ಪ್ರಧಾನವಾಗಿ ಶಬ್ದಮಣಿದರ್ಪಣದ ತತ್ಸಂಬಧಿತ ಸೂತ್ರಗಳನ್ನು ಆಧರಿಸಿ ಅಭ್ಯಾಸ ಮಾಡಬೇಕು. ಇತರ ವ್ಯಾಕರಣಗಳ ಸೂತ್ರಗಳನ್ನು ಅನುಷಂಗಿಕವಾಗಿ ಪ್ರಸ್ತಾಪಿಸಬೇಕು.

೧. ಹಳಗನ್ನಡ ವ್ಯಾಕರಣಗಳು : ಕರ್ತೃ, ಕಾಲ, ಸ್ವರೂಪ, ಸ್ಥಾನ, ವೈಶಿಷ್ಟ್ಯ, ಕನ್ನಡ ವರ್ಣಸಮಾಮ್ನಯ– ಮಹಾಪ್ರಾಣಗಳು –ಱ–ಕುಳ–ಕ್ಷಳ ವಿಚಾರ, ಶಿಥಿಲದ್ವಿತ್ವ

೨. ಸ್ವರಸಂಧಿ – ವ್ಯಂಜನಸಂಧಿ ; ಲಿಂಗ: ಲಕ್ಷಣ, ಸ್ವರೂಪ; ವಚನ : ಲಕ್ಷಣ, ಸ್ವರೂಪ, ಪ್ರತ್ಯಯಗಳು; ವಿಭಕ್ತಿ : ಲಕ್ಷಣ, ಸ್ವರೂಪ, ಪ್ರತ್ಯಯಗಳು.

೩. ಸಮಾಸ : ಲಕ್ಷಣ, ಸ್ವರೂಪ–ತತ್ಪುರುಷ, ಕರ್ಮಧಾರೆಯ, ದ್ವಿಗು, ಅಂಶಿ, ಬಹುವ್ರೀಹಿ, ದ್ವಂದ್ವ, ಗಮಕ ಮತ್ತು ಕ್ರಿಯಾ ಸಮಾಸ

೪. ಆಖ್ಯಾತ ಪ್ರತ್ಯಯ, ಪುರುಷತ್ರಯ, ಕಾಲತ್ರಯ – ತದ್ಧಿತ – ಸಮಸಂಸ್ಕೃತ – ಅಪಭ್ರಂಶ, ತತ್ಸಮ

ಪರಾಮರ್ಶನ ಕೃತಿಗಳು:

೧ ಪೀಠಿಕೆಗಳು, ಲೇಖನಗಳು : ಡಿ.ಎಲ್. ನರಸಿಂಹಾಚಾರ್

೨ ಆಲೋಕ : ಎಚ್.ಎಸ್. ಬಿಳಿಗಿರಿ

೩ ಪ್ರಾಚೀನ ಕನ್ನಡ ವ್ಯಾಕರಣಗಳು : ಎಂ.ವಿ. ಸೀತಾರಾಮಯ್ಯ

೪ ವ್ಯಾಕರಣಗಳು : ವಿ. ಸೀತಾರಾಮಯ್ಯ

೫ ಕನ್ನಡ ವ್ಯಾಕರಣ ಪರಂಪರೆಯ ಮೇಲೆ ಸಂಸ್ಕೃತದ ಪ್ರಭಾವ : ಪಿ. ಶ್ರೀಕೃಷ್ಣಭಟ್

೬ ಕನ್ನಡ ಭಾಷಾವಲೋಕನ : ಕೆ. ಕುಶಾಲಪ್ಪಗೌಡ

೭ ಕನ್ನಡ ಭಾಷೆ ಮತ್ತು ವ್ಯಾಕರಣಗಳ ಅಧ್ಯಯನ : ಕೆ. ಕುಶಾಲಪ್ಪಗೌಡ

೮ ಶಬ್ದಮಣಿದರ್ಪಣದಲ್ಲಿ ಗ್ರಾಂಥಿಕ ವ್ಯಾವಹಾರಿಕ ಶೈಲಿಗಳು : ವಿ. ಶಿವಾನಂದ

೯ ಶಬ್ದಮಣಿದರ್ಪಣಂ : (ಸಂ) ಟಿ.ವಿ. ವೆಂಕಟಾಚಲಶಾಸ್ತ್ರೀ

೧೦ ಕರ್ನಾಟಕ ಶಬ್ದಾನುಶಾಸನ ವಿವೇಚನೆ : ಉಪ್ಪಂಗಳ ರಾಮಭಟ್ಟ
೧೧ ಕನ್ನಡ ವ್ಯಾಕರಣಗಳ ತೌಲನಿಕ ವಿಶ್ಲೇಷಣೆ : ದೊಡ್ಡಸ್ವಾಮಿ
೧೨ ಶೋಧನಲೋಕ : ಎನ್.ಎಸ್. ತಾರಾನಾಥ
೧೩ ಕನ್ನಡ ವಾಗ್ಪ್ರಯೋಗಗಳು : ಡಿ.ಎನ್. ಶಂಕರಭಟ್ಟ
೧೪ ಭಾಷೆಯ ಸುತ್ತಮುತ್ತ : ಕೆ.ವಿ. ನಾರಾಯಣ
೧೫ ಕನ್ನಡ ಭಾಷಾ ಕೈಪಿಡಿ : ಸವದತ್ತಿಮಠ
೧೬ ಭಾಷೆ : ಸಂ : ಕೆ.ವಿ. ನಾರಾಯಣ
೧೭ ಕನ್ನಡ ಕೈಪಿಡಿ : ಬಿಎಂಶ್ರೀ

KNB 210:<u>ಪತ್ರಿಕೆ: ೫.೨</u>

<u>ಜಾನಪದ ಅಧ್ಯಯನ: ಜನಪದ ಸಂಸ್ಕೃತಿಯ ತಾತ್ವಿಕ ಅಧ್ಯಯನ</u>

(೩:೧=೪ ಕ್ರೆಡಿಟ್)

೧. ಸಂಸ್ಕೃತಿ ಎಂದರೇನು? ಸ್ವರೂಪ, ಕಾರ್ಯಗಳು, ನಾಗರಿಕತೆ ಮತ್ತು ಸಂಸ್ಕೃತಿ, ಜನಪದ ಸಂಸ್ಕೃತಿ ಮತ್ತು ಸಂಸ್ಕೃತೀಕರಣ, ಜನಪದ ಧರ್ಮ

೨. ಜಾನಪದರ ಆರಾಧನೆಯ ಪರಿಕಲ್ಪನೆ, ಸ್ವರೂಪ, ಮಹತ್ವ, ಜನಪದ ದೇವತೆಗಳು, ಭೂತಾರಾಧನೆ, ಜಾತ್ರೆ ಮತ್ತು ಹಬ್ಬಗಳು, ನಂಬಿಕೆ, ಸಂಪ್ರದಾಯ, ಆಚರಣೆ, ಮಂತ್ರ–ಮಾಟ

೩. (ಅ) ಕರ್ನಾಟಕ ಜನಪದ ಕಲೆಗಳು : ಹಿನ್ನೆಲೆ, ಸ್ವರೂಪ, ಮಹತ್ವದ ಪ್ರಕಾರಗಳು : ವೇಷಗಾರರು, ನೀಲಗಾರರು, ತೊಗಲುಗೊಂಬೆ, ಚೌಡಿಕೆಯವರು, ಡೊಳ್ಳುಕುಣಿತ, ಕಂಸಾಳೆ

(ಆ) ಕರ್ನಾಟಕ ಜನಪದ ರಂಗಭೂಮಿ – ಹಿನ್ನೆಲೆ, ಸ್ವರೂಪ, ಮಹತ್ವ, ಯಕ್ಷಗಾನ, ಬಯಲಾಟ, ದೊಡ್ಡಾಟ, ಸಣ್ಣಾಟ

೪. ಭೌತಿಕ ಜಾನಪದ, ಜನಪದ ಆಯಗಾರರು–ಕೈಕಸುಬುದಾರರು, ಜನಪದ ಆಟಗಳು, ಜನಪದ ವೈದ್ಯ, ಆಕಾಶ ಜಾನಪದ

ಪರಾಮರ್ಶನ ಕೃತಿಗಳು:

೧. ಕರ್ನಾಟಕ ಜಾನಪದ : ಕರ್ನಾಟಕ ಜಾನಪದ ಯಕ್ಷಗಾನ ಅಕಾಡೆಮಿ
೨. ಕರ್ನಾಟಕ ಜನಪದ ಕಲೆಗಳು : ಗೊ.ರು. ಚನ್ನಬಸಪ್ಪ

೩. ಕರ್ನಾಟಕ ಕಲೆಗಳು ೩ನೆಯ ಸಂಪುಟ ಕರಕುಶಲ ಕಲೆಗಳು : ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪರಿಷತ್ತು, ಬೆಂಗಳೂರು

೪. ಸುವರ್ಣ ಜಾನಪದ ಭಾಗ – ೧, ೨ : ಕರ್ನಾಟಕ ಜಾನಪದ ಯಕ್ಷಗಾನ ಅಕಾಡೆಮಿ

೫. ನಮ್ಮ ಸುತ್ತಿನ ನಂಬಿಕೆಗಳು : ಡಿ.ಕೆ. ರಾಜೇಂದ್ರ

೬. ಕರ್ನಾಟಕದ ಜಾತ್ರೆಗಳು : ಸಿ.ಎಸ್. ಶಿವಕುಮಾರಸ್ವಾಮಿ

೭. ಜಾನಪದ ಸಾಹಿತ್ಯ ದರ್ಶನ ಸಂಪುಟಗಳು : ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ ಧಾರವಾಡ

೮. ಜಾನಪದ ಸಂಶೋಧನೆ : ರಾಗೌ

KNB 210: <u>ಪತ್ರಿಕೆ: ೫.೩</u>

<u>ಚಾರಿತ್ರಿಕ ಅಧ್ಯಯನ: ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ(೧೩ ನೆಯ ಶತಮಾನ)</u>

(೩:೦=೪ ಕ್ರೆಡಿಟ್)

ಪ್ರವೃತ್ತಿಗಳು ಮತ್ತು ಕವಿಗಳು

೧. ಪ್ರವೃತ್ತಿಗಳು : ಸ್ವತಂತ್ರ ಮನೋಧರ್ಮ, ಭಕ್ತಿ, ಮತನಿಷ್ಠೆ, ಧಾರ್ಮಿಕ ಶಾಸ್ತ್ರ ಒಲವು, ಪ್ರಸಾರಾಕಾಂಕ್ಷೆ, ಲೌಕಿಕಶಾಸ್ತ್ರ ಒಲವು, ಉಪಯುಕ್ತತೆ

೨. ಪ್ರಕಾರ : ಚಂಪೂ, ಷಟ್ಪದಿ, ರಗಳೆ ಇತ್ಯಾದಿ ನೆಲೆಯಲ್ಲಿ: ಜನ್ನ, ಕವಿಕಾಮ, ದೇವಕವಿ, ಹರಿಹರ, ಕೆರೆಯ ಪದ್ಮರಸ, ತ್ರಿಭುವನತಾತ, ಎರಡನೇ ಗುಣವರ್ಮ, ರಾಘವಾಂಕ

೩. ಕವಿಗಳು : ಆಂಡಯ್ಯ, ಮಲ್ಲಿಕಾರ್ಜುನ, ಮಹಾಬಲ, ಕೇಶಿರಾಜ, ಪುಲಿಗೆರೆಯ ಸೋಮ, ರಟ್ಟಕವಿ, ಚೌಂಡರಸ, ಪಾಲ್ಕುರಿಕೆ ಸೋಮನಾಥ

೪. ಹೆಚ್ಚು ಮಾಹಿತಿ ದೊರಕದ ಕವಿಗಳು : ಕೇಶಿಯಣ್ಣ, ಮುನಿಚಂದ್ರ, ನಯವರ್ಮ, ಅಮೃತನಂದಿ

ಪರಾಮರ್ಶನ ಕೃತಿಗಳು:

೧. ಕನ್ನಡ ಅಧ್ಯಯನ ಸಂಸ್ಥೆಯ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ ಸಂಪುಟ ೪, ಭಾಗ ೨ : ಮೈ.ವಿ.ವಿ,

೨. ಸಮಗ್ರ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ ಸಂಪುಟಗಳು ಸಂಪುಟ ೪ : ಬೆಂಗಳೂರು ವಿ.ವಿ

೩. ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ : ರಂ.ಶ್ರೀ.ಮುಗಳಿ

೪. ಚಂಪೂ ಕವಿಗಳು (ಸಾಮಾನ್ಯನಿಗೆ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ ಸಂ.೨) : ಬೆಂಗಳೂರು ವಿ.ವಿ

೫. ಷಟ್ಪದಿ ಸಾಹಿತ್ಯ (ಸಾಮಾನ್ಯನಿಗೆ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ ಸಂ. ೫) : ಬೆಂಗಳೂರು ವಿ.ವಿ

೬. ಶಾಸ್ತ್ರ ಸಾಹಿತ್ಯ (ಸಾಮಾನ್ಯನಿಗೆ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ ಸಂ.೩) : ಬೆಂಗಳೂರು ವಿ.ವಿ

೭. ವೀರಶೈವ ಧರ್ಮದರ್ಶನ ಭಾಗ ೨ ಮತ್ತು ೩ : ಜೆಎಸ್ಎಸ್ ಗ್ರಂಥಮಾಲೆ

೮. ಪೀಠಿಕೆಗಳು, ಲೇಖನಗಳು : ಡಿ.ಎಲ್. ನರಸಿಂಹಾಚಾರ್

೯.ಹರಿಹರದೇವ : ಕರ್ನಾಟಕ ಸಂಘ, ರಾಜಾರಾಮ ಕಾಲೇಜು, ಕೊಲ್ಲಾಪುರ

೧೦. ಋಷಿಕವಿ ರಾಘವಾಂಕ :ಎಚ್. ತಿಪ್ಪೇರುದ್ರಸ್ವಾಮಿ

೧೧. ಸಾಹಿತ್ಯಾಲೋಕ : ಎಂ.ಆರ್.ಶ್ರೀನಿವಾಸಮೂರ್ತಿ

೧೨. ಲಿಂಗಾಯತ ಅಧ್ಯಯನಗಳು : ಎಂ. ಚಿದಾನಂದಮೂರ್ತಿ

ವಿಶೇಷ ಉಪ ಪ್ರಧಾನ ವಿಷಯಗಳು(Special Soft core)

KNB 220:ಪತ್ರಿಕೆ : ೬.೧. ಕನ್ನಡ ಸಂಸ್ಕೃತಿ ಚಿಂತನೆ (ಆಯ್ದ ಲೇಖನಗಳು)

(೩:೧=೪ ಕ್ರೆಡಿಟ್)

೧. ಸಂಸ್ಕೃತಿ ಎಂದರೇನು? – ದೇವುಡು ನರಸಿಂಹಶಾಸ್ತ್ರಿ

೨. ಸಂಸ್ಕೃತಿ ಮತ್ತು ನಾಗರೀಕತೆ – ಡಾ. ಎನ್. ಶ್ರೀಕಂಠಶಾಸ್ತ್ರಿ

೩. ಸಂಸ್ಕೃತಿ ಮತ್ತು ಸಾಹಿತ್ಯ –ಎ.ಎನ್. ಮೂರ್ತಿರಾವ್

೪. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ –ಎಚ್. ತಿಪ್ಪೇರುದ್ರಸ್ವಾಮಿ

೫. ವಿಚಾರ ಕ್ರಾಂತಿಗೆ ಆಹ್ವಾನ – ಕುವೆಂಪು

೬. ಕನ್ನಡ ಮಾತು ತಲೆಯೆತ್ತುವ ಬಗೆ – ಬಿ.ಎಂ.ಶ್ರೀ

೭. ಹೊಸ ದಿಗಂತದೆಡೆಗೆ ಮತ್ತು ಮಣ್ಣಿನ ವಾಸನೆ, ಸಮಕಾಲೀನ ಪ್ರಜ್ಞೆ, ಇತ್ಯಾದಿ – ಪೂಚಂತೇ

೮. ಜನಪದರು ಮತ್ತು ಇತಿಹಾಸ – ಕೃಷ್ಣಮೂರ್ತಿ ಹನೂರು

೯. ಆಧುನಿಕ ಸಾಹಿತ್ಯ ಮತ್ತು ಸಾಮಾನ್ಯ ಮನುಷ್ಯ – ಡಿ.ಆರ್. ನಾಗರಾಜ್

೧೦ ಧರ್ಮ ಮತ್ತು ಮಹಿಳೆ – ಸಾ.ರಾ. ಅಬೂಬಕರ್

ಪಠ್ಯ ಮೂಲ:

೧. ಸಂಸ್ಕೃತಿ, ಕನ್ನಡ ಮತ್ತು ಸಂಸ್ಕೃತಿ ಇಲಾಖೆ, ಕನ್ನಡ ಭವನ, ಜೆ.ಸಿ. ರಸ್ತೆ, ಬೆಂಗಳೂರು ೨೦೦೭,

೨. ಭಾರತೀಯ ಸಂಸ್ಕೃತಿ , ಡಾ. ಎಸ್. ಶ್ರೀಕಂಠಶಾಸ್ತ್ರಿ, ಪ್ರಸಾರಾಂಗ, ಮೈಸೂರು. ವಿ.ವಿ. ಮೈಸೂರು, ೧೯೬೯

೩. ಗದ್ಯ ವಿಹಾರ–೨, ಕನ್ನಡ ಅಧ್ಯಯನ ಸಂಸ್ಥೆ, ಮೈಸೂರು. ವಿ.ವಿ ಮೈಸೂರು ೧೯೮೩

೪. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ ಸಮೀಕ್ಷೆ – ಎಚ್. ತಿಪ್ಪೇರುದ್ರಸ್ವಾಮಿ೨೦೧೧, ಡಿ.ವಿ.ಕೆ. ಮೂರ್ತಿ ಪ್ರಕಾಶನ, ಮೈಸೂರು

೫. ಕುವೆಂಪು ಸಮಗ್ರ ಗದ್ಯ, ಸಂಪುಟ–೨, ೨೦೧೩, ರಾಷ್ಟ್ರಕವಿ ಕುವೆಂಪು ಪ್ರತಿಷ್ಠಾನ, ಕುಪ್ಪಳ್ಳಿ, ಶಿವಮೊಗ್ಗ

೬. ಮಾತು ತಲೆಯೆತ್ತುವ ಬಗೆ (ಕನ್ನಡ ಸಾಹಿತ್ಯ ಮೀಮಾಂಸೆ) – ಸಂ: ರಹಮತ್ ತರೀಕೆರೆ; ಕವಿವಿ, ಹಂಪಿ ೨೦೧೧,

೭. ವಿಮರ್ಶೆಯ ವಿಮರ್ಶೆ –ಕೆ.ಪಿ. ಪೂರ್ಣಚಂದ್ರ ತೇಜಸ್ವಿ, ಪುಸ್ತಕ ಪ್ರಕಾಶನ, ಮೈಸೂರು–೨೦೦೯

೮. ಹೊನ್ನಾರು, ಪ್ರೊ ಎಚ್.ಜೆ. ಲಕ್ಕಪ್ಪಗೌಡರ ಅಭಿನಂದನ ಗ್ರಂಥ, ೨೦೦೪, ತಳುಕಿನ ವೆಂಕಣ್ಣಯ್ಯ ಸ್ಮಾರಕ ಗ್ರಂಥಮಾಲೆ, ಮೈಸೂರು

೯. ಅಮೃತ ಮತ್ತು ಗರುಡ, ಡಿ.ಆರ್. ನಾಗರಾಜ್, ೨೦೦೯, ಅಕ್ಷರ ಪ್ರಕಾಶನ, ಹೆಗ್ಗೋಡು, ಸಾಗರ, ಕರ್ನಾಟಕ

೧೦. ಮಹಿಳೆ ಮತ್ತು ಕನ್ನಡ ಸಾಹಿತ್ಯ, ಸಂ: ಜಿ.ಎಸ್. ಶಿವರುದ್ರಪ್ಪ, ೧೯೭೯, ಪ್ರಸಾರಾಂಗ, ಬೆಂಗಳೂರು ವಿವಿ, ಬೆಂಗಳೂರು

ಪರಾಮರ್ಶನ ಗ್ರಂಥಗಳು:

೧. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ ಸಮೀಕ್ಷೆ	: ಎಚ್. ತಿಪ್ಪೇರುದ್ರಸ್ವಾಮಿ
೨. ಶಕ್ತಿ ಶಾರದೆಯ ಮೇಳ	: ಡಿ.ಆರ್. ನಾಗರಾಜ್
೩. ಸಾಂಸ್ಕೃತಿಕ ಅಧ್ಯಯನ	: ರಹಮತ್ ತರಿಕೆರೆ
೪. ಶ್ರೀ ಸಾಹಿತ್ಯ	: ಬಿ.ಎಂ.ಶ್ರೀ
೫. ಸಂಸ್ಕೃತಿ	: ಡಿ.ವಿ.ಜಿ
೬. ಜೀವನ ಸೌಂದರ್ಯ ಮತ್ತು ಸಾಹಿತ್ಯ	: ಡಿ.ವಿ.ಜಿ
೭. ಸಂಸ್ಕೃತಿ ಕಥನ	: ಡಿ.ಆರ್. ನಾಗರಾಜ್
೮. ಭಾರತೀಯ ಸಂಸ್ಕೃತಿ	: (ಸಂ) ಅ.ನ.ಕೃಷ್ಣರಾಯ

KNB 220: ಪತ್ರಿಕೆ ೬.೨ ಮಹಿಳೆ : ಸಮಾಜ–ಸಾಹಿತ್ಯ(ಆಯ್ದ ಲೇಖನಗಳು)

೧. ಮಹಿಳಾವಾದ ಮತ್ತು ಮಹಿಳಾ ಸಾಹಿತ್ಯ	- ವಿಜಯಾದಬ್ಬೆ
೨. ಹೆಣ್ಣು ಮತ್ತು ಭಾಷೆ : ಅಭಿವ್ಯಕ್ತಿ	– ಎಚ್.ಎಸ್.ರಾಘವೇಂದ್ರರಾವ್
೩. ಭಾರತೀಯ ಸ್ತ್ರೀವಾದ (ಪೀಠಿಕಾ ಭಾಗ-ಮೊದಲಭಾಗ)	- ಮನು ಚಕ್ರವರ್ತಿ
೪. ಕಪ್ಪು ಸ್ತ್ರೀವಾದಿ ವಿಮರ್ಶೆ	– ವಿಜಯಾದಬ್ಬೆ
೫. ಪಾಡ್ದನಗಳಲ್ಲಿ ಸ್ತ್ರೀತ್ವದ ಪ್ರತಿನಿಧೀಕರಣ	– ಗಾಯತ್ರಿ ನಾವಡ

೬. ಜನ್ನನ ಕಾವ್ಯಗಳು : ಹೆಣ್ಣನ್ನು ಪಳಗಿಸುವ ವ್ಯವಸ್ಥೆಯ ಕನ್ನಡಿ – ಸಬಿಹಾ ಭೂಮಿಗೌಡ

೭. ಚಕ್ರಾಧಿಪತ್ಯ, ರಾಷ್ಟ್ರ ಮತ್ತು ಸಾಹಿತ್ಯಕ ಪಠ್ಯ – ಸೂಸಿ ಥಾರು ಮತ್ತು ಕೆ. ಲಲಿತ
ಅನು: ಎಚ್.ಎಸ್. ರಾಘವೇಂದ್ರರಾವ್

೮.ಮುಸ್ಲಿಂ ಮಹಿಳಾ ಸಂವೇದನೆ ಮತ್ತು ಪ್ರತಿಭಟನಾ ನೆಲೆಗಳು – ಕೆ. ಷರೀಫಾ

೯. ದಲಿತ ಸಾಹಿತ್ಯದಲ್ಲಿ ಮಹಿಳೆ – ಧರಣಿದೇವಿ ಮಾಲಗತ್ತಿ

೧೦.ವಾಸ್ತವತೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಲೇಖಕಿ – ಅನುಪಮಾ ನಿರಂಜನ

ಪಠ್ಯ ಮೂಲ:

೧. **ನಾರಿ: ದಾರಿ-ದಿಗಂತ**-ವಿಜಯಾದಬ್ಬೆ ೧೯೯೭, ರಚನಾ ಪ್ರಕಾಶನ, ಮೈಸೂರು

೨. **ಭಾರತೀಯ ಸ್ತ್ರೀವಾದ – ಅಕ್ಷರ ಪ್ರಕಾಶನ**, ೧೯೯೩, ಹೆಗ್ಗೋಡು, ಸಾಗರ

೩. **ಹೆಣ್ಣು ಮತ್ತು ಭಾಷೆ-** ಸಂ: **ಎಚ್.ಎಸ್.ಶ್ರೀಮತಿ**, **ಶಿವಾನಂದ ಎಸ್. ವಿರಕ್ತಮಠ**, ೨೦೦೭, ಮಹಿಳಾ ಅಧ್ಯಯನ ಕೇಂದ್ರ ಕನ್ನಡ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಹಂಪಿ

೪. **ಸ್ತ್ರೀವಾದಿ ಪ್ರವೇಶಿಕೆ-** ಸಂ: ಬಿ.ಎನ್. ಸುಮಿತ್ರಾಬಾಯಿ, ಎನ್.ಗಾಯತ್ರಿ, ೧೯೯೫, ಕರ್ನಾಟಕ ಲೇಖಕಿಯರ ಸಂಘ, ಚಾಮರಾಜಪೇಟೆ, ಬೆಂಗಳೂರು

೫. **ವಿರಚನೆ-** ಗಾಯತ್ರಿ ನಾವಡ, ೧೯೯೭, ಎನ್.ಆರ್.ಎ.ಎಂ.ಎಚ್. ಪ್ರಕಾಶನ, ಕೋಟೇಶ್ವರ, ದಕ್ಷಿಣ ಕನ್ನಡ

೬. **ಬಗೆ** – ಸಬಿಹಾ ಭೂಮಿಗೌಡ, ೨೦೦೧, ಲೋಹಿಯಾ ಪ್ರಕಾಶನ, ಬಳ್ಳಾರಿ

೭. **ಸ್ತ್ರೀವಾದಿ ಸಾಹಿತ್ಯ ವಿಮರ್ಶೆ**– (ಸಂ) ತೇಜಸ್ವಿನಿ ನಿರಂಜನ, ೧೯೯೪, ಕನ್ನಡ ಸಂಘ, ಕ್ರೈಸ್ಟ್ ಕಾಲೇಜ್, ಬೆಂಗಳೂರು

೮. **ಮುಸ್ಲಿಂ ಮಹಿಳಾ ಸಂವೇದನೆ**–ಕೆ.ಷರೀಫಾ, ೨೦೧೧, ಅಂಕಿತ ಪುಸ್ತಕ, ಬೆಂಗಳೂರು

೯. **ಸ್ತ್ರೀವಾದ ಮತ್ತು ಭಾರತೀಯತೆ- ಧರಣೀದೇವಿ ಮಾಲಗತ್ತಿ**, ೧೯೯೮, ಚೇತನ ಬುಕ್ ಹೌಸ್, ಮೈಸೂರು

೧೦. **ಸಾಹಿತ್ಯ ಮತ್ತು ಪ್ರಗತಿ-** ಅನುಪಮಾ ನಿರಂಜನ, ೨೦೦೮, ಡಿ.ವಿ.ಕೆ. ಮೂರ್ತಿ, ಮೈಸೂರು

ಪರಾಮರ್ಶನ ಗ್ರಂಥಗಳು

೧. ಮಹಿಳಾ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ	: (ಸಂ) ಎಚ್.ಎಸ್. ಶ್ರೀಮತಿ
೨. ಹೆಣ್ಣು ಮತ್ತು ಭಾಷೆ	: (ಸಂ) ಎಚ್ ಎಸ್. ಶ್ರೀಮತಿ, ಶಿವಾನಂದ ಎಸ್. ವಿರಕ್ತಮಠ
೩. ಸ್ತ್ರೀವಾದಿ ಪ್ರವೇಶಿಕೆ	: (ಸಂ) ಬಿ.ಎನ್. ಸುಮಿತ್ರಾಬಾಯಿ, ಎನ್. ಗಾಯತ್ರಿ
೪. ವಿರಚನೆ	: ಗಾಯತ್ರಿ ನಾವಡ
೫. ವಿಜಯಾನ್ವೇಷಣಂ	: (ಸಂ) ಎಸ್.ಡಿ. ಶಶಿಕಲಾ

ಮೂರನೆಯ ಚತುರ್ಮಾಸ (ಆಗಸ್ಟ್–ಡಿಸೆಂಬರ್ ೨೦೨೦)

ಪ್ರಧಾನ ವಿಷಯಗಳು (**Hard core)**

KNC 050: ಪತ್ರಿಕೆ: ೧

ತೌಲನಿಕ ಸಾಹಿತ್ಯ : ಪಠ್ಯ : ಮಹಾಕಾವ್ಯ ಮತ್ತು ನಾಟಕ (೨:೧=೩ ಕ್ರೆಡಿಟ್)

೧. ತೌಲನಿಕ ಸಾಹಿತ್ಯದ ಸೂತ್ರ ಸ್ವರೂಪ - ರಾಷ್ಟ್ರೀಯ ಸಾಹಿತ್ಯ, ಜಾಗತಿಕ ಸಾಹಿತ್ಯ ಮತ್ತು ಸಾಮಾನ್ಯ ಸಾಹಿತ್ಯ - ತೌಲನಿಕ ಸಾಹಿತ್ಯದ ಪಂಥಗಳು, ಸ್ವೀಕಾರ ಮತ್ತು ಪ್ರಭಾವ

೨. **ತುಘಲಕ್-** ಕಾರ್ನಾಡ್, **ಕ್ಯಾಲಿಗುಲ**- ಆಲ್ಬರ್ಟ್ ಕಮು (ಅನು-ಡಿ.ಎ. ಶಂಕರ್)

೩. **ಹ್ಯಾಮ್ಲೆಟ್**– ಕೆ.ಎಸ್. ಭಗವಾನ್, **ರಕ್ತಾಕ್ಷಿ**- ಕುವೆಂಪು

೪. (ಅ) Illiad – Homer Prescribed Books 1,7

(ಆ) Aeneid – Virgil Prescribed Books 5, 6

ಪರಾಮರ್ಶನ ಕೃತಿಗಳು:

೧. ಪಾಶ್ಚಾತ್ಯ ಮಹಾಕಾವ್ಯಗಳು	: ಶ್ರೀಕಂಠಕೂಡಿಗೆ (ಸಂ) ಪ್ರ,ಮೈವಿವಿ
೨. ಮಹಾಕಾವ್ಯ ಸ್ವರೂಪ	: ಜಿ.ಎಸ್. ಶಿವರುದ್ರಪ್ಪ
೩. ಮಹಾಕಾವ್ಯ ಲಕ್ಷಣ	: ಟಿ.ವಿ. ವೆಂಕಟಾಚಲಶಾಸ್ತ್ರಿ
೪. Comparative Literary studies	: S.S. Pawar
೫. Comparative Literary and Literary Theory	: Ulrich Weisstein
೬. Comparative Literature Method & perspective	: (Ed) Newton P Stalknecht
೭. Method and perspective Discriminations (First two Essays on Comparative Literature)	: Horst Frenz

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KNC 020:ಪತ್ರಿಕೆ: ೨ ಆಧುನಿಕ ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಹಿನ್ನೆಲೆ (೨:೧=೩ ಕ್ರೆಡಿಟ್)

೧. ನವೋದಯ ಸಾಹಿತ್ಯ : ಪ್ರಭಾವ, ಪ್ರೇರಣೆ, ರೋಮ್ಯಾಂಟಿಸಿಸಂ, ರಾಷ್ಟ್ರೀಯತೆ, ಸುಧಾರಣಾವಾದ, ದೇಶೀಯತೆ, ನಾಡು-ನುಡಿ

೨. ಪ್ರಗತಿಶೀಲ ಸಾಹಿತ್ಯ : ಪ್ರಭಾವ, ಪ್ರೇರಣೆ, ಮಾರ್ಕ್ಸ್ ವಾದ, ವಾಸ್ತವವಾದ

೩. ನವ್ಯ ಸಾಹಿತ್ಯ : ಪ್ರಭಾವ, ಪ್ರೇರಣೆ, ಅಸ್ತಿತ್ವವಾದ, ಅಸಂಗತವಾದ

೪. ದಲಿತ ಬಂಡಾಯ : ಪ್ರಭಾವ, ಪ್ರೇರಣೆ, ಮಾರ್ಕ್ಸ್ ವಾದ, ಅಂಬೇಡ್ಕರ್ ವಾದ, ಲೋಹಿಯಾವಾದ, ಸ್ತ್ರೀವಾದ

ಪರಾಮರ್ಶನ ಕೃತಿಗಳು :

೧. ಹೊಸಗನ್ನಡದ ಅರುಣೋದಯ	: ಶ್ರೀನಿವಾಸ ಹಾವನೂರ
೨.ಹೊಸಗನ್ನಡದ ಕವಿತೆಯ ಮೇಲೆ ಇಂಗ್ಲಿಷ್ ಕಾವ್ಯದ ಪ್ರಭಾವ	: ಎಸ್. ಅನಂತನಾರಾಯಣ
೩ ಯುಗಧರ್ಮ ಹಾಗೂ ಸಾಹಿತ್ಯ ದರ್ಶನ	: ಕೀರ್ತಿನಾಥ ಕುರ್ತಕೋಟಿ
೪ ಪ್ರಗತಿಶೀಲ ಸಾಹಿತ್ಯ	: ಅನಕೃ (ಸಂ)
೫ ಭಾರತೀಯ ಪತ್ರಿಕೋದ್ಯಮ	: ನಾಡಿಗ ಕೃಷ್ಣಮೂರ್ತಿ
೬ ಹೊಸಗನ್ನಡ ಸಾಹಿತ್ಯ	: ಎಲ್. ಎಸ್.ಶೇಷಗಿರಿರಾವ್
೭ ೨೦ನೆಯ ಶತಮಾನದ ಕನ್ನಡ ಸಾಹಿತ್ಯ :	: ಡಾ. ಬಸವರಾಜ ಸಾದರ
೮ ಕರ್ನಾಟಕ ಸಂಗಾತಿ	: ಕನ್ನಡ ಅಭಿವೃದ್ಧಿ ಪ್ರಾಧಿಕಾರ ಪ್ರಕಟಣೆ
೯ Impact of Marxism on Indian life and Literature	: H.M. Nayak (Ed)
೧೦ Heritage of Karnataka	: R.S. Mugali

KNC 030:<u>ಪತ್ರಿಕೆ: ೩ ಭಾರತೀಯ ಕಾವ್ಯಮೀಮಾಂಸೆ</u> (೨:೦=೩ ಕ್ರೆಡಿಟ್)

೧. ಸಂಸ್ಕೃತ ಕಾವ್ಯಮೀಮಾಂಸೆ : ಕವಿ-ಕಾವ್ಯ-ಸಹೃದಯ, ಕವಿತೆಯ ಆಕರ-ಪ್ರತಿಭೆ, ಪರಿಕರ-ವ್ಯುತ್ಪತ್ತಿ, ಪ್ರಮುಖ ಸಿದ್ಧಾಂತಗಳು : ರಸ-ಧ್ವನಿ, ಔಚಿತ್ಯ

೨. ಕನ್ನಡ ಕಾವ್ಯಮೀಮಾಂಸೆ : ಕವಿರಾಜಮಾರ್ಗ ಮತ್ತು ಇತರ ಪ್ರಾಚೀನ ಲಕ್ಷಣ ಗ್ರಂಥಗಳು, ಆಧುನಿಕ ಕನ್ನಡ ಕಾವ್ಯಮೀಮಾಂಸೆಯ ವಿವಿಧ ಚಿಂತನೆಗಳು: ನವೋದಯ, ನವ್ಯ, ಪ್ರಗತಿಶೀಲ, ದಲಿತ ಬಂಡಾಯ, ಸ್ತ್ರೀವಾದ

೩. ಕನ್ನಡ ಕವಿಗಳ ಕಾವ್ಯ ಕಲ್ಪನೆ-ಪ್ರಾಚೀನ, ಆಧುನಿಕ

೪. ತಮಿಳು ಕಾವ್ಯಮೀಮಾಂಸೆ ಮತ್ತು ಕನ್ನಡ ಜಾನಪದ ಕಾವ್ಯಮೀಮಾಂಸೆ

ಪರಾಮರ್ಶನ ಕೃತಿಗಳು:

೧ ಭಾರತೀಯ ಕಾವ್ಯಮೀಮಾಂಸೆ	:ತೀನಂಶ್ರೀ
೨ ತೌಲನಿಕ ಕಾವ್ಯಮೀಮಾಂಸೆ	: ಎಚ್. ತಿಪ್ಪೇರುದ್ರಸ್ವಾಮಿ
೩ ಕಾವ್ಯಾರ್ಥ ಚಿಂತನ	: ಜಿ.ಎಸ್.ಶಿವರುದ್ರಪ್ಪ
೪ ಕನ್ನಡ ಕವಿಗಳ ಕಾವ್ಯಕಲ್ಪನೆ	: ಜಿ.ಎಸ್. ಶಿವರುದ್ರಪ್ಪ

೫ ಕನ್ನಡದಲ್ಲಿ ಸರಸ್ವತೀ ತತ್ತ್ವ : ಜಿ.ಎಸ್. ಶಿವರುದ್ರಪ್ಪ
೬ ಕಾವ್ಯಾರ್ಥ ಪದಕೋಶ : ಜಿ.ಎಸ್ ಶಿವರುದ್ರಪ್ಪ
೭ ವಿಮರ್ಶೆಯ ಪರಿಭಾಷೆ : ಓ.ಎಲ್. ನಾಗಾಭೂಷಣಸ್ವಾಮಿ
೮ ಕನ್ನಡ ಧ್ವನ್ಯಾಲೋಕ ಲೋಚನಸಾರ : ಕೆ.ಕೃಷ್ಣಮೂರ್ತಿ
೯ ಔಚಿತ್ಯ ವಿಚಾರ ಚರ್ಚೆ : ಕೆ.ಕೃಷ್ಣಮೂರ್ತಿ
೧೦ ತಮಿಳು ಕಾವ್ಯ ಮೀಮಾಂಸೆ : ಡಾ.ಕಾರ್ಲೂಸ್

KNC 040: ಪತ್ರಿಕೆ: ೪

ಸಂಶೋಧನ ವಿಧಾನ ಮತ್ತು ಗಣಕ ಜ್ಞಾನ (೨:೦=೩ ಕ್ರೆಡಿಟ್)

ಸಂಶೋಧನ ವಿಧಾನ

೧. ಸಂಶೋಧನೆ, ಅರ್ಥವ್ಯಾಪ್ತಿ, ಪ್ರಕಾರಗಳು, ಸಂಶೋಧಕನ/ಳ ಅರ್ಹತೆ ಹಾಗೂ ಮನೋಧರ್ಮ, ಸಂಶೋಧನ ಲೇಖನ (Research Paper), ನಿಬಂಧ (Dissertation), ಮಹಾಪ್ರಬಂಧ (Thesis)- ಇವುಗಳ ಸ್ವರೂಪ ಮತ್ತು ವ್ಯಾತ್ಯಾಸ, ಸಂಶೋಧನ ಸಾರಲೇಖ (Synopsis)

೨. **ಸಂಶೋಧನೆಯ ಭಾಷೆ ಮತ್ತು ಶೈಲಿ, ಉದ್ಧರಣೆ, ಅಡಿಟಿಪ್ಪಣಿ, ಅನುಬಂಧ, ಗ್ರಂಥಸೂಚಿ, ಕ್ಷೇತ್ರಕಾರ್ಯದ ಸ್ವರೂಪ ಹಾಗೂ ವಿಧಾನ**

ಗಣಕ ಜ್ಞಾನ

೩. **ಕನ್ನಡದಲ್ಲಿ ಗಣಕ ಬಳಕೆ:** ಎಂ.ಎಸ್. ಆಫೀಸ್, ಓಪನ್ ಆಫೀಸ್-ವರ್ಡ್-ರೈಟ್, ಪವರ್ ಪಾಯಿಂಟ್, ಸಾಮಾಜಿಕ ಜಾಲ ತಾಣಗಳು, ಅವುಗಳ ಉಪಯೋಗ ಮತ್ತು ಸಾಹಿತ್ಯ ಸಂಬಂಧ

೪. ಅಂತರ್‌ಜಾಲ ತಾಣಗಳು: ಕನ್ನಡ ತಾಣಗಳು, ವಿ-ಅಂಚೆ, ವಿ-ಸಂದರ್ಶನ, ವಿ-ಪುಸ್ತಕಗಳು, ಕನ್ನಡ ಸಂಶೋಧನೆಯಲ್ಲಿ ಗಣಕ ಮತ್ತು ಅಂತರ್ಜಾಲದ ಬಳಕೆ

ಪರಾಮರ್ಶನ ಕೃತಿಗಳಳು:

೧ ಸಂಶೋಧನೆ : ಎಂ.ಚಿದಾನಂದಮೂರ್ತಿ
೨ ಕನ್ನಡ ಸಂಶೋಧನ : ಎಂ.ಎಂ.ಕಲಬುರ್ಗಿ
೩ ಸಂಶೋಧನ ಸ್ವರೂಪ : ಬಿ.ವಿ.ಶಿರೂರ
೪ ಸಂಶೋಧನ ಪ್ರಜ್ಞೆ :(ಸಂ) ಹೇರಂಜೆ ಕೃಷ್ಣಭಟ್ಟ
೫ ಸಂಶೋಧನೆ ತಾತ್ತ್ವಿಕ ವಿಚಾರ : ರಹಮತ್ ತರೀಕೆರೆ

೬ ಅಧ್ಯಯನದ ವಿಧಿವಿಧಾನಗಳು : ಕೆ.ರವೀಂದ್ರನಾಥ
೭ ಮಹಾಮಾರ್ಗ : ಎಂ.ಎಂ.ಕಲಬುರ್ಗಿ
೮ ಅದ್ಭುತ ಯಂತ್ರ ಗಣಕ : ಜಿ.ವಿ.ನಿರ್ಮಲ, ಎಸ್.ಕ್ಷಮಾ
೯ ಮಾನವಮಿತ್ರ ಗಣಕ : ಜಿ.ವಿ.ನಿರ್ಮಲ, ಎಸ್.ಕ್ಷಮಾ
೧೦ ಕ್ರಾಂತಿಕಾರಿ ಗಣಕ ಯಂತ್ರ : ಜಿ.ವಿ.ನಿರ್ಮಲ, ಎಸ್.ಕ್ಷಮಾ
೧೧ ಕಂಪ್ಯುಟರ್ : ಪ್ರಕಾಶ

ಉಪ ಪ್ರಧಾನ ವಿಷಯಗಳು(Soft core)

KNC 210: ಪತ್ರಿಕೆ: ೫.೧ ಭಾಷಾವಿಜ್ಞಾನ ಅಧ್ಯಯನ : ಉಪಭಾಷಾವಿಜ್ಞಾನ (ಕನ್ನಡ) (೩:೧=೪ ಕ್ರೆಡಿಟ್)

೧.ಉಪಭಾಷಾವಿಜ್ಞಾನ : ಸ್ವರೂಪ ಮತ್ತು ವ್ಯಾಪ್ತಿ, ಭಾಷಾಭೂಗೋಳ, ಉಪಭಾಷಾಭೂಗೋಳ ಮತ್ತು ಭಾಷಾ ಭೂಪಟ- ಈ ಶಬ್ದಗಳ ಅರ್ಥ ಮತ್ತು ವ್ಯಾಪ್ತಿ: ಕನ್ನಡದ ಸಾಮಾಜಿಕ ಉಪಭಾಷೆಗಳು ಮತ್ತು ಪ್ರಾದೇಶಿಕ ಉಪಭಾಷೆಗಳು

೨.ಉಪಭಾಷಾವಿಜ್ಞಾನದ ಸಂಕ್ಷಿಪ್ತ ಇತಿಹಾಸ : ಭಾರತ, ಫ್ರಾನ್ಸ್, ಅಮೆರಿಕಾ, ಇಂಗ್ಲೆಂಡ್ ಮತ್ತು ಜರ್ಮನಿ ದೇಶಗಳಲ್ಲಿ ಉಪಭಾಷಾ ಅಧ್ಯಯನಗಳು, 'ಲಿಂಗ್ವಿಸ್ಟಿಕ್ ಸರ್ವೆ ಆಫ್ ಇಂಡಿಯಾ'ದ ಮಹತ್ವ

೩.ಅ) ಭಾಷೆ, ಉಪಭಾಷೆ, ವ್ಯಕ್ತಿಭಾಷೆ, ಪ್ರಮಾಣ ಭಾಷೆ, ಭಾಷಾಗುಂಪು, ಪರಸ್ಪರ ಅರಿವು, ಸಾಮಾನ್ಯ ತಿರುಳು

ಆ) ಉಪಭಾಷಾವಿಜ್ಞಾನದ ವಿಧಾನಗಳು :ಏಕಕಾಲಿಕ, ದ್ವಿಕಾಲಿಕ

೪. ಭಾಷಾವಿಜ್ಞಾನದಲ್ಲಿ ಕ್ಷೇತ್ರಕಾರ್ಯದ ಸ್ವರೂಪ ಮತ್ತು ಪ್ರಯೋಜನ, ವಕ್ತೃ, ಪ್ರತಿವಕ್ತೃ-ಅರ್ಹತೆ ಕಾರ್ಯನಿರ್ವಹಣೆ, ದತ್ತಸಂಗ್ರಹ, ಸ್ವರೂಪ, ಉದ್ದೇಶ, ಪರಿಶೀಲನ ರೀತಿ ಮತ್ತು ಸಂಗ್ರಹದ ವಿವಿಧ ಹಂತಗಳು, ದತ್ತಸಂಗ್ರಹ, ಸ್ವರೂಪ, ಉದ್ದೇಶ, ಪರಿಶೀಲನ ರೀತಿ ಮತ್ತು ಸಂಗ್ರಹದ ವಿವಿಧ ಹಂತಗಳು, ಸಂಗ್ರಹ ಕಾರ್ಯದಲ್ಲಿ ಪ್ರಶ್ನಾವಳಿಗಳು ಮತ್ತು ಇತರ ಉಪಕರಣಗಳು

ಪರಾಮರ್ಶನ ಕೃತಿಗಳು

೧. ಉಪಭಾಷೆ : ಕೃಷ್ಣ ಪರಮೇಶ್ವರ ಭಟ್ಟ

೨. ಉಪಭಾಷಾ ಅಧ್ಯಯನ : ಶಾಲಿನಿ ರಘುನಾಥ

೩. ಭಾಷಾಕ್ಷೇತ್ರಕಾರ್ಯ : ಎಸ್.ಎಸ್.ಅಂಗಡಿ

೪. ಕ್ಷೇತ್ರಕಾರ್ಯದ ಹಾದಿಯಲ್ಲಿ : ಕ್ಯಾತನಹಳ್ಳಿ ರಾಮಾಣ್ಣ

೫. ಹಾದಿಯೊಳಗಣ ಜ್ಯೋತಿ : ಹನೂರು ಕೃಷ್ಣಮೂರ್ತಿ

೬. ಸಾಮಾಜಿಕ ಉಪಭಾಷೆ : ಮಹಾದೇವಯ್ಯ

೭. ಸುವರ್ಣ ಸಂಚಯ : (ಸಂ) ದೇ ಜವರೇಗೌಡ

೮. ಕರ್ನಾಟಕ ಭಾರತಿ : (ಸಂ) ಸುಂಕಾಪುರ ಎಂ.ಎಸ್

೯, Field Linguistics : William J Samarien

೧೦,The Structure of Karnataka : R.C. Hiremath

೧೧. An Outline of Colloquial Kannada : William Bright

೧೨, Kannada –Literary and colloquial : H.M. Nayak

೧೩. Field Study : Sen Gupta

೧೪. World Geography of the Eastern United States : H Kurath

೧೫. Handbook of the Linguistic Geography of New England : H Kurath

೧೬. Reading in American Dialectology : Allen and Underwood

೧೭, The Study of dialect : K.M. Petyt

೧೮, A course in Modern Linguistics : Charles F Hockett

KNC 210: <u>ಪತ್ರಿಕೆ: ೫.೨</u>

<u>ಜಾನಪದ ಅಧ್ಯಯನ: ಕರ್ನಾಟಕ ಜನಪದ ಕಲೆಗಳು (೩:೧=೪ ಕ್ರೆಡಿಟ್)</u>

೧.ತಾತ್ತ್ವಿಕತೆ : ಜನಪದ ಕಲೆಗಳ ಉಗಮ, ಸ್ವರೂಪ, ವ್ಯಾಪ್ತಿ, ಬುಡಕಟ್ಟು ಕಲೆಗಳು, ಗ್ರಾಮಾಂತರ ಜನಪದ ಕಲೆಗಳು, ಶಿಷ್ಟಕಲಾ ಪ್ರಕಾರಗಳು, ಜನಪದಕಲೆ, ಕಲಾವಿದರು ಮತ್ತು ಆಧುನಿಕತೆಯ ಮುಖಾಮುಖಿ

೨.ಪ್ರದರ್ಶನಾತ್ಮಕ ಕಲೆಗಳು : ವಾದ್ಯಪ್ರಧಾನ : ವೀರಗಾಸೆ, ಕರಪಾಲ, ತಮಟೆವಾದನ, ನೀಲಗಾರರು, ಮುಖವೀಣೆ

೩.ಆರಾಧನಾ ಪ್ರಧಾನ ಕಲೆಗಳು : ಮೊಹರಂ, ಆಟಿಕಳಂಜ, ವೀರಭದ್ರನ ಕುಣಿತ, ಗೊರವರ ಕುಣಿತ, ಗೊಂದಲಿಗರು, ಹಾಲಕ್ಕಿ ಕುಣಿತ, ಆಸಾದಿ ಹಾಡುಗಳು, ಭೂತಾರಾಧನೆ

೪.ರಂಗಭೂಮಿ : ಹಗರಣ, ಜಾಲಾಟ, ಬಹುರೂಪಿ, ಕೇಳಿಕೆ, ತಾಳಮದ್ದಳೆ, ಸೂತ್ರದಬೊಂಬೆಯಾಟ, ತೊಗಲುಬೊಂಬೆಯಾಟ, ಕೋಲಾಟ, ಮೂಡಲಪಾಯ, ಪಡುವಲಪಾಯ ಯಕ್ಷಗಾನ (ತೆಂಕುತಿಟ್ಟು, ಬಡಗುತಿಟ್ಟು)

ಪರಾಮರ್ಶನ ಕೃತಿಗಳು:

೧. ಉತ್ತರ ಕರ್ನಾಟಕದ ಜನಪದ ರಂಗಭೂಮಿ : ಚಂದ್ರಶೇಖರ ಕಂಬಾರ

೨. ದಕ್ಷಿಣ ಕರ್ನಾಟಕದ ಜನಪದ ರಂಗಭೂಮಿ : ಡಿ.ಕೆ. ರಾಜೇಂದ್ರ

೩. ಕರಪಾಲ ಮೇಳ : ಡಿ.ಕೆ. ರಾಜೇಂದ್ರ

೪. ಕರ್ನಾಟಕ ಜನಪದ ಕಲೆಗಳ ಕೋಶ : (ಸಂ) ಹಿ.ಚಿ. ಬೋರಲಿಂಗಯ್ಯ

೫. ಕರ್ನಾಟಕ ಜನಪದ ಕಲೆಗಳು : ಗೊ.ರು. ಚನ್ನಬಸಪ್ಪ

೬. ಹೊನ್ನಬಿತ್ತೇವು ಹೊಲಕೆಲ್ಲ : ಗೊ.ರು. ಚನ್ನಬಸಪ್ಪ

೭. ಕನ್ನಡ ಜಾನಪದ ವಿಶ್ವಕೋಶ : (ಸಂ) ಚಂದ್ರಶೇಖರ ಕಂಬಾರ

೮. ಭೂತಾರಾಧನೆ : ಕೆ.ಚಿನ್ನಪ್ಪಗೌಡ

೯. ಮೌಖಿಕ ಕಥನ : ಜಿ.ಆರ್. ತಿಪ್ಪೇಸ್ವಾಮಿ

೧೦.ಜಾನಪದ ಪರಿಭಾವನೆ : ಜಿ.ಆರ್. ತಿಪ್ಪೇಸ್ವಾಮಿ

೧೧.ದಕ್ಷಿಣ ಕರ್ಣಾಟಕ ಜನಪದ ಕಾವ್ಯಪ್ರಕಾರಗಳು : ಜೀ.ಶಂ.ಪರಮಶಿವಯ್ಯ

೧೨.ಯಕ್ಷಗಾನ : ಕೆ.ಶಿವರಾಮಕಾರಂತ

೧೩.ಕನ್ನಡ ಜಾನಪದ ಕಲಾ ಪ್ರವೇಶ : ಚಕ್ಕರೆ ಶಿವಶಂಕರ

೧೪.The Encyclopedia of folk culture of Karnataka : Krishna Murthy Hanur

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KNC 210: ಪತ್ರಿಕೆ: ೫.೩ ಚಾರಿತ್ರಿಕ ಅಧ್ಯಯನ : ಶಾಸನಶಾಸ್ತ್ರ

(ಆಯ್ದ ಪಠ್ಯಗಳೊಡನೆ ೩:೧=೪ ಕ್ರೆಡಿಟ್)

೧ ಶಾಸನ ಎಂದರೇನು? ಕರ್ನಾಟಕದಲ್ಲಿ ಶಾಸನ ಅಧ್ಯಯನದ ಇತಿಹಾಸ-ಶಾಸನಗಳ ಪ್ರಾಮುಖ್ಯ, ಶಾಸನಗಳ ವರ್ಗೀಕರಣ

೨ ಶಾಸನಕವಿ, ಲಿಪಿಕಾರ, ರೂವಾಲಿ-ಶಾಸನಗಳ ವಿಷಯಾನುಪೂರ್ವಿ - ದಾನಶಾಸನ, ಕೂಟಶಾಸನ-ವೀರಗಲ್ಲು, ಮಾಸ್ತಿಗಲ್ಲು, ನಿಸಿದಿಗಲ್ಲು

೩ ಹಲ್ಮಿಡಿ ಶಾಸನ - ಬಾದಾಮಿಯ ಕಪ್ಪೆ ಅರಭಟ್ಟನ ಶಾಸನ - ಕುರ್ಕ್ಯಾಲದ ಜಿನವಲ್ಲಭನ ಶಾಸನ ಶಾಸನ

೪ ಲಕ್ಕುಂಡಿಯ ಅತ್ತಿಮಬ್ಬೆಯ ಶಾಸನ - ಬಳ್ಳಿಗಾವಿಯ ಕೋಡಿಮಠದ ಶಾಸನ-
ಶ್ರವಣಬೆಳಗೊಳದ ಬುಕ್ಕರಾಯನ ಶಾಸನ

ಪರಾಮರ್ಶನ ಕೃತಿಗಳು :

೧ ಶಾಸನ ವ್ಯಾಸಂಗ ೧,೨ : ಎಂ.ಎಂ. ಕಲಬುರ್ಗಿ
೨ ಕನ್ನಡ ಶಾಸನಗಳ ಸಾಂಸ್ಕೃತಿಕ ಅಧ್ಯಯನ : ಎಂ. ಚಿದಾನಂದಮೂರ್ತಿ
೩ ಕರ್ನಾಟಕ ಶಾಸನ ಸಮೀಕ್ಷೆ : ಕೆ.ವಿ. ರಮೇಶ
೪ ಕನ್ನಡ ಲಿಪಿಯ ಉಗಮ ಮತ್ತು ವಿಕಾಸ : ಎ.ವಿ. ನರಸಿಂಹಮೂರ್ತಿ
೫ ಕನ್ನಡ ಶಾಸನ ಸಂಗ್ರಹ : ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪರಿಷತ್ತು
೬ ಶಾಸನಶಾಸ್ತ್ರ ಪ್ರವೇಶ :ಸಿಪಿಕೆ
೭ ಭಾರತೀಯ ಶಾಸನಶಾಸ್ತ್ರ ಪರಿಚಯ : (ಅನು) ಸಿಪಿಕೆ
೮ ಶಾಸನ ಪದ್ಯಮಂಜರಿ (ಪ್ರಸ್ತಾಪನೆ) : (ಸಂ) ಎಂ. ಚಿದಾನಂದಮೂರ್ತಿ
೯ Indian Epigraphy : D.C. Sircar
೧೦ Indian Epigraphy and South Indian Scripts : C. Shivaramamurthy
೧೧ Indian Paleography : Ahmed Hussain Dani
೧೨ The Alphabet : David Diringer

ಮುಕ್ತ ಐಚ್ಛಿಕ (Open Elective)

KNC 530: ಪತ್ರಿಕೆ: ೬.೧

ಕನ್ನಡ ಭಾಷೆ ಮತ್ತು ಸಾಹಿತ್ಯ (ಪ್ರಾಚೀನ, ಮಧ್ಯಕಾಲೀನ, ಆಧುನಿಕ)

(೩:೧=೪ ಕ್ರೆಡಿಟ್)

೧. ಪ್ರಾಚೀನ ಸಾಹಿತ್ಯ :

(ಅ) ಕವಿರಾಜಮಾರ್ಗ – ನಾಡು ನುಡಿಯ ವರ್ಣನೆ: ಪ್ರಥಮ ಪರಿಚ್ಛೇದದಲ್ಲಿ ಪದ್ಯ ಸಂಖ್ಯೆ:
೩೬,೩೭,೩೮,೩೯,೪೦. ಮೂರನೆಯ ಪರಿಚ್ಛೇದದಲ್ಲಿ: ೧೭೪, ೧೭೬, ೧೭೭,
೧೭೯ನೇ ಪದ್ಯ, (ಸಂ): ಎಂ.ವಿ.ಸೀತಾರಾಮಯ್ಯ

(ಆ) ವಡ್ಡಾರಾಧನೆ:'ಕಾರ್ತೀಕ ರಿಸಿಯ ಕತೆ' (ಸಂ) ಡಿ.ಎಲ್.ನರಸಿಂಹಾಚಾರ್

(ಇ) **ಪಂಪಭಾರತ**: ಭೀಷ್ಮರ ಪಟ್ಟಾಭಿಷೇಕ ಪ್ರಸಂಗ - ವಿಕ್ರಮಾರ್ಜುನ ವಿಜಯ; (ಸಂ) ಟಿ.ವಿ. ವೆಂಕಟಾಚಲಶಾಸ್ತ್ರೀ.; ದಶಮಾಶ್ವಾಸಂ ಭಾಗದಲ್ಲಿ ಪದ್ಯ ಸಂಖ್ಯೆ ೧೫ ರಿಂದ ೨೫ರವರೆಗೆ

೨. ಮಧ್ಯಕಾಲೀನ ಸಾಹಿತ್ಯ –೧ :

(ಅ) ಬಸವಣ್ಣನವರ ವಚನ ಸಂಪುಟ (ಸಂ) ಎಂ.ಎಂ.ಕಲಬುರ್ಗಿ

ವಚನಗಳ ಸಂಖ್ಯೆ: ೧೦೫, ೧೫೮, ೧೯೪, ೨೩೫, ೨೪೧, ೩೪೫, ೪೪೭, ೬೩೮,೮೨೧, ೫೮೦

(ಆ) ಅಕ್ಕಮಹಾದೇವಿ:ಶಿವಶರಣೆಯರ ವಚನ ಸಂಪುಟ (ಸಂ) ವೀರಣ್ಣ ರಾಜೂರ

ವಚನಗಳ ಸಂಖ್ಯೆ: ೭೮, ೧೪೩, ೧೯೬, ೧೯೭, ೨೦೬, ೨೧೧, ೨೬೮, ೩೬೪, ೩೬೫, ೪೧೩

೩. ಮಧ್ಯಕಾಲೀನ ಸಾಹಿತ್ಯ –೨ :

(ಅ) ಸರ್ವಜ್ಞ: ಸರ್ವಜ್ಞನ ವಚನಗಳು-(ಸಂ) ಉತ್ತಂಗಿ ಚೆನ್ನಪ್ಪ

ವಚನಗಳ ಸಂಖ್ಯೆ: : ೫೩೧, ೫೩೪, ೫೪೫, ೫೬೩, ೮೯೩, ೧೨೩೯, ೧೧೪೫, ೧೧೪೮, ೧೧೫೫, ೧೨೭೫

(ಅ) ಕೀರ್ತನೆಗಳು :

ಪುರಂದರದಾಸ: ಧರ್ಮವೇ ಜಯವೆಂಬ ದಿವ್ಯಮಂತ್ರ
ಕನಕದಾಸ: ಕುಲಕುಲ ಕುಲವೆಂದು ಹೊಡೆದಾಡದಿರಿ

೪. ಆಧುನಿಕ ಸಾಹಿತ್ಯ :

(ಅ) ಕಾವ್ಯಗಳು : ಕುವೆಂಪು – ಅಖಂಡ ಕರ್ನಾಟಕ

ಜಿ.ಎಸ್. ಶಿವರುದ್ರಪ್ಪ – ಮಬ್ಬಿನಿಂದ ಮಬ್ಬಿಗೆ

(ಆ) ಆಧುನಿಕ ಕತೆಗಳು : ಕುಂ.ವೀರಭದ್ರಪ್ಪ – ದೇವರ ಹೆಣ

ಸಾ.ರಾ ಅಬೂಬಕ್ಕರ್ – ಚಪ್ಪಲಿಗಳು

ಪರಾಮರ್ಶನ ಕೃತಿಗಳು :

೧. ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ : ರಂ.ಶ್ರೀ. ಮುಗಳಿ

೨. ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯದ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆಯ ಸಂಪುಟಗಳು

೩. ಸಾಮಾನ್ಯನಿಗೆ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆಯ ಸಂಪುಟಗಳು : ಬೆಂಗಳೂರು ವಿ.ವಿ

೪. ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ : ಕೆ.ವೆಂಕಟರಾಮಪ್ಪ

೫. ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ : ತ.ಸು. ಶಾಮರಾಯ

೬. ಕನ್ನಡ ಸಾಹಿತ್ಯ ಇತಿಹಾಸ : ರಂ.ಶ್ರೀ. ಮುಗಳಿ

ನಾಲ್ಕನೆಯ ಚತುರ್ಮಾಸ (ಜನವರಿ-ಮೇ ೨೦೨೧)

ಪ್ರಧಾನ ವಿಷಯಗಳು (Hard core)

KND 050: ಪತ್ರಿಕೆ: ೧

ಆಧುನಿಕ ಕನ್ನಡ ಸಾಹಿತ್ಯ : ಪಠ್ಯ : ಕಾವ್ಯ, ಕಾದಂಬರಿ, ಪ್ರಬಂಧ (೨:೧=೩ ಕ್ರೆಡಿಟ್)

ಕಾವ್ಯ: ೧೨ ನಿಗದಿತ ಕವನಗಳು

೧. ಶಿಶುನಾಳ ಶರೀಫ : ಬಿದ್ದಿಯಬ್ಬೇ ಮುದುಕಿ
೨. ದ.ರಾ.ಬೇಂದ್ರೆ : ನರಬಲಿ
೩. ಕುವೆಂಪು : ಹೋಗುವೆನು ನಾ
೪. ಬೆಳಗೆರೆ ಜಾನಕಮ್ಮ : ಚಂಡ ಶಾಸನ
೫. ಕೆಎಸ್ಎನ್ : ಭೂಮಿಗೀತ
೬. ಗೋಪಾಲಕೃಷ್ಣ ಅಡಿಗ : ಭೂತ
೭. ಜಿಎಸ್ಎಸ್ : ಸಂಜೆದಾರಿ
೮. ರಂಜಾನ್ ದರ್ಗಾ : ಪ್ರಣಾಳಿಕೆ
೯. ಸಿದ್ದಲಿಂಗಯ್ಯ : ಸಾವಿರಾರು ನದಿಗಳು
೧೦. ಮೊಗಳ್ಳಿ ಗಣೇಶ್ : ಅನಾದಿಯ ಏಕಾಂತ ಗೀತೆ
೧೧. ಶಶಿಕಲಾ ವಸ್ತ್ರದ : ಗುಬ್ಬೀಮನಿ
೧೨. ಉಷಾ : ಹವಳ ಹಾರಿದ ಹೊತ್ತು

ಕಾದಂಬರಿ

ಪಠ್ಯ : ಕರ್ವಾಲೊ : ಕೆ.ಪಿ. ಪೂರ್ಣಚಂದ್ರ ತೇಜಸ್ವಿ

ಪಠ್ಯ ಮೂಲ : (ಕವಿತೆಗಳು)

೧. ಶಿಶುನಾಳ ಶರೀಫರ ಗೀತೆಗಳು :ಸಂ.ಡಾ. ಶಿವಾನಂದ ಗುಬ್ಬಣ್ಣನವರ, ಕನ್ನಡ ಮತ್ತು ಸಂಸ್ಕೃತಿ ನಿರ್ದೇಶನಾಲಯ, ಬೆಂ:೧೯೮೫

೨. ಶತಮಾನಗಳ ಬಾಯಾರಿಕೆ : ಸಂ.ಚೆ.ಶ್ರೀನಿವಾಸರಾಜು ಇತರರು, ನವಕರ್ನಾಟಕ ಪ್ರಕಾಶನ ಬೆಂ:೧೯೮೬

೩. ಕುವೆಂಪು ಸಮಗ್ರ ಕಾವ್ಯ ಸಂಪುಟ-೧ : ರಾಷ್ಟ್ರಕವಿ ಕುವೆಂಪು ಪ್ರತಿಷ್ಠಾನ (ರಿ), ಕುಪ್ಪಳ್ಳಿ,೨೦೧೩

೪. ಬೆಳೆಗೆರೆ ಜಾನಕಮ್ಮ ಬದುಕು-ಬರಹ : ಸಂ.ನೇಮಿಚಂದ್ರ, ಕರ್ನಾಟಕ ಲೇಖಕಿಯರ ಸಂಘ, ಬೆಂಗಳೂರು :೧೯೮೮

೫. ಮಲ್ಲಿಗೆಯ ಮಾಲೆ :

೬. ಹೊಸಗನ್ನಡ ಕವಿತೆ : ಸಂ.ಜಿ.ಎಚ್.ನಾಯಕ, ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪರಿಷತ್ತು, ಬೆಂಗಳೂರು : ೧೯೮೫

೭. ಅದೇ

೮. ಸುವರ್ಣ ಕಾವ್ಯ :ಸಂ ಬಿ.ಎ. ಸನದಿ, ಕನ್ನಡ ಸಂಸ್ಕೃತಿ ಇಲಾಖೆ, ಬೆಂ:೨೦೦೬

೯. ಬಂಡಾಯ ಕಾವ್ಯ : ಸಂ.ಬರಗೂರು ರಾಮಚಂದ್ರಪ್ಪ, ಕನ್ನಡ ಮತ್ತು ಸಂಸ್ಕೃತಿ ನಿರ್ದೇಶನಾಲಯ, ಬೆಂ :೧೯೯೦

೧೦. ಸುವರ್ಣ ಕಾವ್ಯ :ಸಂ ಬಿ.ಎ. ಸನದಿ, ಕನ್ನಡ ಸಂಸ್ಕೃತಿ ಇಲಾಖೆ, ಬೆಂ:೨೦೦೬

೧೧. ಹೊಸಗನ್ನಡ ಕವಿತೆ : ಸಂ.ಜಿ.ಎಚ್.ನಾಯಕ, ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪರಿಷತ್ತು, ಬೆಂಗಳೂರು:೧೯೮೫

೧೨. ಬಿಡುಗಡೆಯ ಬೆಳಕು :ಸಂ.ಚೆ.ಶ್ರೀನಿವಾಸರಾಜು ಇತರರು, ಸಾಹಿತ್ಯ ಅಕಾಡೆಮಿ, ಬೆಂ.೨೦೧೨

ಪರಾಮರ್ಶನ ಕೃತಿಗಳು:

೧. ೨೦ನೇ ಶತಮಾನದ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಘಟ್ಟಗಳು : ಡಾ. ಬಸವರಾಜ ಸಾದರ

೨. ಕರ್ನಾಟಕ ಸಾಹಿತ್ಯ ಅಕಾಡೆಮಿಯ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪುನರ್ ಮೌಲ್ಯೀಕರಣ ಮಾಲೆಯ ಸಂಪುಟಗಳು

೩. ಹಾಡೇ ಹಾದಿಯ ತೋರಿತು : ಎಚ್.ಎಸ್.ರಾಘವೇಂದ್ರರಾವ್

೪. ಇಹದ ಪರಿಮಳದ ಹಾದಿ : ನರಹಳ್ಳಿ ಬಾಲಸುಬ್ರಹ್ಮಣ್ಯಂ

೫. ಗಂಗೋತ್ರಿ : ಕುವೆಂಪು ಅಭಿನಂದನ ಗ್ರಂಥ

೬. ಶ್ರೀ ಕುವೆಂಪು : ಸಂ: ಜಿ.ಎಸ್.ಶಿವರುದ್ರಪ್ಪ

೭. ಕುವೆಂಪು ಕೃತಿ ವಿಮರ್ಶೆ : ಸಂ:ಅರವಿಂದ ಮಾಲಗತ್ತಿ, ಕುವೆಂಪು ಕನ್ನಡ ಅಧ್ಯಯನ ಸಂಸ್ಥೆ, ಮೈಸೂರು

೮. ಸಾಹಿತ್ಯ ಮತ್ತು ಯುಗಧರ್ಮ : ಕೀರ್ತಿನಾಥ ಕುರ್ತಕೋಟಿ

೯. ಹೊಸಗನ್ನಡ ಕಾವ್ಯದ ಎರಡು ಮಾರ್ಗಗಳು :ಸಂ.ಜಿ.ಎಸ್.ಶಿವರುದ್ರಪ್ಪ

(KND 020) <u>ಪತ್ರಿಕೆ: ೨ ಪಾಶ್ಚಾತ್ಯ ಕಾವ್ಯಮೀಮಾಂಸೆ</u> (೨:೦=೩ ಕ್ರೆಡಿಟ್)

೧. ಅರಿಸ್ಟಾಟಲ್, ಹೊರೇಸ್, ಲಾಂಜಿನಸ್

೨. ಬುಲ್ಲೋ : ಮಾನಸಿಕ ದೂರ

೩. (ಅ) ಟಿ.ಎಸ್. ಎಲಿಯಟ್ : ಪರಂಪರೆ ಮತ್ತು ವ್ಯಕ್ತಿ ಪ್ರತಿಭೆ

(ಆ) ಐ.ಎ. ರಿಚರ್ಡ್ಸ್ : ಮೌಲ್ಯ ಸಿದ್ಧಾಂತ ಮತ್ತು ಸಂವಹನ ಸಿದ್ಧಾಂತ

೪. ಜೊನಾಥನ್ ಕಲರ್ : ರಚನಾವಾದ ಮತ್ತು ಕಾವ್ಯ ಮೀಮಾಂಸೆ

ಪರಾಮರ್ಶನ ಕೃತಿಗಳು:

೧. ಅರಿಸ್ಟಾಟಲನ ಕಾವ್ಯಮೀಮಾಂಸೆ : ಎನ್. ಬಾಲಸುಬ್ರಮಣ್ಯ

೨. ಹೊರೇಸನ ಸಾಹಿತ್ಯ ವಿಮರ್ಶೆ : ಎನ್. ಬಾಲಸುಬ್ರಮಣ್ಯ

೩. ಔನ್ನತ್ಯ ವಿಚಾರ ಚರ್ಚೆ : ಎನ್.ಬಾಲಸುಬ್ರಮಣ್ಯ

೪. ತೌಲನಿಕ ಕಾವ್ಯಮೀಮಾಂಸೆ : ಎಚ್.ತಿಪ್ಪೇರುದ್ರಸ್ವಾಮಿ

೫. ಪಾಶ್ಚಾತ್ಯ ಕಾವ್ಯಮೀಮಾಂಸೆ : ವಿ.ಎಂ.ಇನಾಂದಾರ್

೬. ಇಂಗ್ಲಿಷ್ ಭಾಷೆಯಲ್ಲಿ ಆಧುನಿಕ ಸಾಹಿತ್ಯ ವಿಮರ್ಶೆ : ಎಲ್.ಎಸ್.ಶೇಷಗಿರಿರಾವ್

೭. ಕಾವ್ಯಾರ್ಥ ಚಿಂತನೆ : ಜಿ.ಎಸ್.ಶಿವರುದ್ರಪ್ಪ

೮. ಸಾಹಿತ್ಯ ವಿಮರ್ಶೆ : ಸಿ.ಎನ್.ರಾಮಚಂದ್ರನ್

೯. ಟಿ.ಎಸ್. ಎಲಿಯಟ್ ಕವಿಯ ವಿಮರ್ಶೆಯ ವಿಚಾರಗಳು : ಎಚ್.ಬಿ. ಮಿಣಜಗಿ

೧೦. Structuralist Poetics : Jonathan Culler

೧೧. On Deconstruction : Jonathan Culler

೧೨. The Pursuit of Signs : Jonathan Culler

೧೩. Linguistics and Poetics : Roman Jacobson

೧೪. Principles of litatray Critisism : I A Richards

KND 040: ಪತ್ರಿಕೆ : ೩ ಸಮೂಹ ಮಾಧ್ಯಮ (೨:೦=೩ ಕ್ರೆಡಿಟ್)

೧. **ಸಮೂಹ ಮಾಧ್ಯಮದ ಪರಿಕಲ್ಪನೆ :** ವ್ಯಾಖ್ಯಾನಗಳು, ಸ್ವರೂಪ, ಮಹತ್ವ, ಪ್ರಕಾರಗಳು : ಜಾನಪದ ಮತ್ತು ಆಧುನಿಕ ಪ್ರಕಾರಗಳು; ಕಾರ್ಯಗಳು, ಅಭಿವೃದ್ಧಿ ಮತ್ತು ಸಂವಹನ ಹಾಗೂ ಸಾಮಾಜಿಕ ಬದಲಾವಣೆ, ಲಿಂಗತ್ವ ಸೂಕ್ಷ್ಮತೆ

೨. **ಪತ್ರಿಕೆ ಹಾಗೂ ಪುಸ್ತಕ ಮಾಧ್ಯಮ :** ಪತ್ರಿಕೆಗಳ ಮತ್ತು ಪುಸ್ತಕಗಳ ಸ್ವರೂಪ, ಮಹತ್ವ, ಪ್ರಕಾರಗಳು, ಕಾರ್ಯಗಳು, ಸಂಹಿತೆಗಳು, ಹುಟ್ಟು ಮತ್ತು ಬೆಳವಣಿಗೆ; ಪತ್ರಿಕೆ ಮತ್ತು ಪುಸ್ತಕ ಕ್ಷೇತ್ರದ ಕಾರ್ಯಕರ್ತರು-ಗುಣಗಳು ಮತ್ತು ಇತಿಮಿತಿ, ಬರಹ, ಭಾಷೆ, ಸಾಹಿತ್ಯ, ವಿಮರ್ಶೆ, ವರದಿ, ಸುದ್ದಿ, ಲೇಖನ, ಸಂಪಾದಕೀಯ, ಅವಲೋಕನ, ಅಂಕಣ, ಪುರವಣಿಗಳು, ಜಾಹಿರಾತು; ಮುದ್ರಣದ ಹಿನ್ನೆಲೆ ಮತ್ತು ವಿಕಾಸ-ಪ್ರಸಾರ ಹಾಗೂ ಮಾರಾಟ

೩. **ಆಕಾಶವಾಣಿ- ದೂರದರ್ಶನ – ಚಲನಚಿತ್ರ** : ಸ್ವರೂಪ, ಮಹತ್ವ, ಸಂಹಿತೆ, ಹುಟ್ಟು ಮತ್ತು ಬೆಳವಣಿಗೆ, ಇತಿಮಿತಿಗಳು, ಕ್ಷೇತ್ರದ ಕಾರ್ಯಕರ್ತಗರು, ಆಡಳಿತ ವ್ಯವಸ್ಥೆ, ಬರಹ, ಭಾಷೆ,

ಸಾಹಿತ್ಯ, ವಿಮರ್ಶೆ (ಸಂಭಾಷಣೆ, ನಿರೂಪಣೆ, ವಾರ್ತೆ, ವರದಿ, ಕಾರ್ಯಕ್ರಮಗಳು) ಧ್ವನಿ, ಉಚ್ಚಾರಣೆ, ಸ್ಪಷ್ಟತೆ, ಉಡುಪು, ವಿನ್ಯಾಸ, ನಿರ್ಮಾಣದ ಕಲೆ, ಸಂಗೀತ, ಸಂಪಾದನೆ, ಕಲೆಗಳು

೪. ಸಂವಹನ ಮಾಧ್ಯಮಗಳು ಮತ್ತು ಭಾಷಾಂತರ : ಭಾಷಾಂತರದ ಮಹತ್ವ, ವಿವಿಧ ಕ್ಷೇತ್ರಗಳಲ್ಲಿ ಅದರ ಅಗತ್ಯತೆ ಮತ್ತು ಪ್ರಯೋಜನ ಹಾಗೂ ಸಮಸ್ಯೆಗಳು (ಟ್ಯುಟೋರಿಯಲ್‌ನಲ್ಲಿ ಪ್ರಾಯೋಗಿಕ ಮಾದರಿಗಳ ಅಭ್ಯಾಸ ಮಾಡಿಸಬೇಕು)

ಪರಾಮರ್ಶನ ಕೃತಿಗಳು

೧. ಪತ್ರಿಕೆ/ ಸಾಹಿತ್ಯ : ಸರಜೂ ಕಾಟ್ಕರ್, ಅನ್ವೇಷಣೆ ಪ್ರಕಾಶನ, ಬೆಂಗಳೂರು

೨. ಭಾರತೀಯ ಪತ್ರಿಕೋದ್ಯಮ : ನಾಡಿಗ ಕೃಷ್ಣಮೂರ್ತಿ, ಪ್ರಸಾರಾಂಗ, ಬೆಂಗಳೂರು

ಆಧುನಿಕ ಭಾರತದಲ್ಲಿ ಪತ್ರಿಕೋದ್ಯಮ : ರೋಲೆಂಟ್ ಇ ಉಲ್‌ಸ್ಲೀ (ಮೂಲ) ಶ್ರೀಕರ ಎಲ್. ಭಂಡಾರ್‌ಕರ್ (ಅನು) ಪ್ರಸಾರಾಂಗ. ಮೈಸೂರು ವಿ.ವಿ

೩. ಭಾರತದಲ್ಲಿ ಪುಸ್ತಕಗಳ ಬೆಳವಣಿಗೆ : ಅಬ್ದುಲ್ ಹಸನ್ (ಮೂಲ) ಜಿ.ಪಿ. ಶಿವರಾಂ (ಅನು), ಮೈ.ವಿ.ವಿ

೪. ಪ್ರಾಯೋಗಿಕ ಪತ್ರಿಕೋದ್ಯಮ : (ಸಂ) ಬಿ.ವಿ. ವೈಕುಂಠರಾಜು, ಬೆಂಗಳೂರು ವಿ.ವಿ

೫. ಸಮೂಹ ಮಾಧ್ಯಮಗಳು : ಡಿ.ಬಿ. ನಾಯಕ, ಗುಲಬರ್ಗಾ ವಿ.ವಿ

೬. ಬ್ರಿಟಿಷ್ ಪತ್ರಿಕೋದ್ಯಮ : ನಾಡಿಗ ಕೃಷ್ಣಮೂರ್ತಿ, ಮೈವಿವಿ

೭. ಫ್ರೀಲಾನ್ಸ್ ಪತ್ರಿಕೋದ್ಯಮ : ನಿರಂಜನ ವಾನಳ್ಳಿ, ಮೈವಿವಿ

೮. ಸಮೂಹ ಮಾಧ್ಯಮಗಳು ಮತ್ತು ರಾಷ್ಟ್ರೀಯ ಅಭಿವೃದ್ಧಿ : ಎ.ಎಸ್. ಬಾಲಸುಬ್ರಹ್ಮಣ್ಯ, ಕರ್ನಾಟಕ ವಿವಿ

೯. ಪತ್ರಿಕೋದ್ಯಮ : ಎಂ.ಚಲಪತಿರಾವ್ (ಮೂಲ) ನಾಡಿಗ ಕೃಷ್ಣಮೂರ್ತಿ (ಅನು)

೧೦. ಗ್ರಂಥೋದ್ಯಮ : ಸಂ.ಅರವಿಂದ ಮಾಲಗತ್ತಿ, ಪ್ರಸಾರಾಂಗ, ಮೈವಿವಿ

೧೧. ಕನ್ನಡ ಪತ್ರಿಕಾಸೂಚಿ : ಸಂ.ಶ್ರೀನಿವಾಸ ಹಾವನೂರ, ಪ್ರಸಾರಾಂಗ ಮೈವಿವಿ

೧೨. ಜಾನಪದ ಮತ್ತು ಸಮೂಹ ಮಾಧ್ಯಮ : ಕರ್ನಾಟಕ ಜಾನಪದ ಯಕ್ಷಗಾನ ಅಕಾಡೆಮಿ, ಬೆಂಗಳೂರು

೧೩. ಸಂವಹನ ಮಾಧ್ಯಮ : ಎಸ್.ಎಂ.ಹಿರೇಮಠ ಮತ್ತು ಡಿ.ಬಿ. ನಾಯಕ

೧೪. ಕರ್ನಾಟಕ ಸಂಗಾತಿ : ಕನ್ನಡ ಅಬಿವೃದ್ಧಿ ಪ್ರಾಧಿಕಾರ ಪ್ರಕಟಣೆ

KND 040: ಪತ್ರಿಕೆ:೪ ಅವಧಿಕ ಕಾರ್ಯ/ಮೈನರ್ ಪ್ರಾಜೆಕ್ಟ್ (೧:೨=೩ ಕ್ರೆಡಿಟ್)

ಕ್ಷೇತ್ರಕಾರ್ಯ, ಮಾಹಿತಿ ಸಂಗ್ರಹ ಮತ್ತು ವರದಿ

ಘಟಕ ೧: ಅ) ಅವಧಿಕ ಪ್ರಗತಿ ಮತ್ತು ವರದಿ

ಆ) ವಿಚಾರಗೋಷ್ಠಿ / ಚರ್ಚೆ/ ಪ್ರದರ್ಶನ

ಘಟಕ ೨ ಅ) ಕರಡು ವರದಿ

ಆ) ಫಲಿತಾಂಶಗಳು ಹಾಗೂ ಅಂತಿಮ ವರದಿ

ಘಟಕ ೩: ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದಲ್ಲಿ ವರದಿಯ ಮೌಲ್ಯಮಾಪನ ಮತ್ತು ಮೌಖಿಕ ಪರೀಕ್ಷೆಯನ್ನು ಒಬ್ಬ ಆಂತರಿಕ ಹಾಗೂ ಒಬ್ಬ ಬಾಹ್ಯ ಪರೀಕ್ಷಕರನ್ನೊಳಗೊಂಡಂತೆ ಸಮಿತಿ ನಡೆಸುತ್ತದೆ – ೭೦ ಅಂಕಗಳಿಗೆ

ಉಪಪ್ರಧಾನ ವಿಷಯಗಳು (**Soft core**)

KND 210: ಪತ್ರಿಕೆ: ೫.೧

ಭಾಷಾವಿಜ್ಞಾನ ಅಧ್ಯಯನ : ಕನ್ನಡ ಭಾಷಾಸ್ವರೂಪ : ಆಯ್ದ ಪಠ್ಯಗಳು

(೩:೧=೪ ಕ್ರೆಡಿಟ್)

೧. ಶಂ.ಬಾ.ಜೋಷಿ	: ಕಂನುಡಿಯ ಒಳ್ಗುಂಪು
೨. ಎ.ಆರ್.ಕೃಷ್ಣಶಾಸ್ತ್ರಿ	: ಇಂದಿನ ಜನಜೀವನದಲ್ಲಿ ಕನ್ನಡ
೩. ಡಿ.ಎಲ್.ಎನ್	: ಪದಗಳ ಹುಟ್ಟು ಸಾವು
೪. ಕುವೆಂಪು	: ಸಂಸ್ಕೃತಿ ಕರ್ನಾಟಕ
೫. ಜಿ.ಎಸ್.ಎಸ್.ಶಿವರುದ್ರಪ್ಪ	: ಕನ್ನಡ ಸಾಹಿತಿ ಮತ್ತು ಕನ್ನಡ
೬. ಜಿ. ವೆಂಕಟಸುಬ್ಬಯ್ಯ	: ಇಗೋ ಕನ್ನಡ
೭. ಯು.ಆರ್.ಅನಂತಮೂರ್ತಿ	: ಕನ್ನಡದ ಮೂರು ಹಸಿವುಗಳು
೮. ಕೆ.ವಿ.ನಾರಾಯಣ	: ತಂತ್ರಜ್ಞಾನ ಮತ್ತು ಕನ್ನಡ
೯. ತಿರುಮಲೇಶ್	: ಕನ್ನಡತನ ನನ್ನ ದೃಷ್ಟಿಯಲ್ಲಿ
೧೦.ಬರಗೂರು ರಾಮಚಂದ್ರಪ್ಪ	: ಕನ್ನಡಾಭಿಮಾನ

ಪಠ್ಯ ಮೂಲ :

೧. ಶಂ.ಬಾ.ಜೋಷಿ : ಕಂನುಡಿಯ ಹುಟ್ಟು, ಸಮಾಜ ಪುಸ್ತಕಾಲಯ, ಧಾರವಾಡ :೧೯೪೫

೨. ಎ.ಎರ್.ಕೃಷ್ಣಶಾಸ್ತ್ರಿ : ಭಾಷಣಗಳು ಲೇಖನಗಳು, ಶಾರದಾ ಮಂದಿರ, ಮೈಸೂರು

೩. ಡಿಎಲ್ಎನ್ : ಪೀಠಿಕೆಗಳು ಲೇಖನಗಳು

೪. (ಸಂ) ಶಿವಾರೆಡ್ಡಿ : ಕುವೆಂಪು ಸಮಗ್ರ ಗದ್ಯ, ಕನ್ನಡ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಹಂಪಿ

೫. ಸಂ.ರಹಮತ್ ತರೀಕೆರೆ : ಮಾತು ತಲೆಯೆತ್ತುವ ಬಗೆ, ಸಂಪುಟಗಳು ೧, ಕವಿವಿ, ಹಂಪಿ ೨೦೧೧

೬. ಸಂ. ಎನ್.ಎಸ್. ತಾರಾನಾಥ : ಶತಮಾನದ ಸಂಶೋಧನೆ, ಕರ್ನಾಟಕ ಸಾಹಿತ್ಯ ಅಕಾಡೆಮಿ, ಬೆಂ

೭. ಯು.ಆರ್. ಅನಂತಮೂರ್ತಿ : ವಾಲ್ಮೀಕಿಯ ನೆಪದಲ್ಲಿ

೮. ಕೆ.ವಿ. ನಾರಾಯಣ : ಕನ್ನಡ ಜಗತ್ತು :ಅರ್ಧಶತಮಾನ, ಕನ್ನಡ ವಿವಿ

೯. ಕೆ.ವಿ. ತಿರುಮಲೇಶ್ : ನಮ್ಮ ಕನ್ನಡ

೧೦. ಹಚ್.ಎಸ್.ಬಿಳಿಗಿರಿ : ಮೂರು ದತ್ತಿ ಉಪನ್ಯಾಸಗಳು

KND 210:ಪತ್ರಿಕೆ: ಪತ್ರಿಕೆ:೫.೨

ಜಾನಪದ ಅಧ್ಯಯನ : ಕನ್ನಡದ ಜನಪದ ಸಾಹಿತ್ಯ (ಆಯ್ದ ಪಠ್ಯಗಳು)

(೩:೧=೪ ಕ್ರೆಡಿಟ್)

೧. ತಾತ್ವಿಕ : ಜಾನಪದ ಸಾಹಿತ್ಯ ಪ್ರಕಾರಗಳ ಕುರಿತು ಈವರೆಗೆ ನಡೆದ ಅಧ್ಯಯನದ ಸ್ವರೂಪ, ಪ್ರತಿಯೊಂದು ಸಾಹಿತ್ಯ ಪ್ರಕಾರದಲ್ಲಿ ಅದ್ಯಯನ ಮಾಡಿದ ಪ್ರಮುಕ ವಿದ್ವಾಂಸರ ಪರಿಚಯ

ಪಠ್ಯಗಳು:

೨. ಅ) ಕನ್ನಡ ಜನಪದ ಕತೆಗಳು : ಜೀ.ಶಂ.. ಪರಮಶಿವಯ್ಯ (ಪ್ರತಿ ಗುಂಪಿನ ಮೊದಲ ಎರಡು ಕತೆಗಳು)

ಆ) ಗರತಿಯ ಹಾಡು : ಹಲಸಂಗಿ ಗೆಳೆಯರು

೩. ಅ) ಗರಿಗೆದರಿದ ನವಿಲು : (ಸಂ) ಕಾಳೇಗೌಡ ನಾಗವಾರ – ಜಿ,ವಿ. ಆನಂದಮೂರ್ತಿ

ನಿಗದಿತ ಭಾಗ ಪುಟ ೧ ರಿಂದ ೧೦೬ ಮತ್ತು ೨೫೧ ರಿಂದ ೩೦೦ ರವರೆಗೆ)

೪. ಅ) ನಮ್ಮ ಸುತ್ತಿನ ಗಾದೆಗಳು : ಸುಧಾಕರ

ಆ) ಸಾವಿರದ ಒಗಟುಗಳು : ಸೋಮಶೇಖರ ಇಮ್ರಾಪುರ

KND 210:ಪತ್ರಿಕೆ:೫.೩

ಚಾರಿತ್ರಿಕ ಅಧ್ಯಯನ: ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ: ಆಯ್ದ ಪಠ್ಯಗಳು

೧. ಕವಿರಾಜಮಾರ್ಗ೦ : ನಾಡು-ನುಡಿ ವರ್ಣನೆ

(ಆಶ್ವಾಸ–೧, ಪದ್ಯಗಳು ೧ ರಿಂದ ೪೩, ಆಶ್ವಾಸ –೨೨ ಪದ್ಯ ೨೮)

೨. ವಡ್ಡಾರಾಧನೆ : ಭದ್ರಬಾಹು ಭಟಾರರ ಕಥೆ

೩. ಅಜಿತಪುರಾಣ : ಅತ್ತಿಮಬ್ಬೆ ವೃತ್ತಾಂತ

(ಆಸ್ವಾಸ–೧, ಪದ್ಯಗಳು ೨೦ ರಿಂದ ೭೫)

೪. ಬಸವಣ್ಣನವರ ನಿಗದಿತ ೧೨ ವಚನಗಳು

೧. ಸಗಣಿಯ ಬೆನಕನ ಮಾಡಿ

೨. ಲೋಕದ ಡೊಂಕ ನೀವೇಕೆ

೩. ಹಬ್ಬಕ್ಕೆ ತಂದ ಹರಕೆಯ ಕುರಿ

೪. ಹಾವು ತಿಂದವರ ನುಡಿಸಬಹುದು

೫. ದೇವಲೋಕ ಮರ್ತ್ಯಲೋಕವೆಂಬುದು

೬. ಮರ್ತ್ಯಲೋಕವೆಂಬುದು ಕರ್ತಾರನ ಕಮ್ಮಟವಯ್ಯ

೭. ವ್ಯಾಧನೊಂದು ಮೊಲನ ತಂದರೆ

೮. ಕಲ್ಲನಾಗರ

೯. ವೇದಕ್ಕೆ ಒರೆಯನಿಕ್ಕುವೆ

೧೦. ಅಪ್ಪನು ಡೋಹರ ಕಕ್ಕಯ್ಯ

೧೧. ಉತ್ತಮ ಕುಲದಲಿ ಹುಟ್ಟಿದನೆಂಬ

೧೨.ಅರಸರ ಮನೆಯಲ್ಲಿ ಅರಸಿಯಾಗಿಪ್ಪುದರಿಂದ

೧. ಕೇಶಿರಾಜ ದಣ್ಣಾಯಕರ ರಗಳೆ (ಹರಿಹರ)

೨. ಸಿದ್ಧರಾಮ ಚಾರಿತ್ರ್ಯ : ನಾಲ್ಕನೆಯ ಸಂಧಿ

೩. ಬಸವಪುರಾಣ : ಸುಗ್ಗಲದೇವಿ ಹಾಗೂ ದಾಸಿಮಯ್ಯನ ಕತೆ (ಸಂಧಿ ೫೧)

೪ ರಾಮಧಾನ್ಯ ಚರಿತೆ : ಕನಕದಾಸ

೫. ರಾಮನಾಥ ಚರಿತೆ : ಶೂಲದಹಬ್ಬ (ಆಶ್ವಾಸ ೬, ಸಂಧಿ ೨, ಪದ್ಯ ೧ ರಿಂದ ೧೦೪)

೪. ರಾಜಾವಳಿ ಕಥಾಸಾರ : ನವಮಾಧಿಕಾರ

೭. ಪ್ಲೀಟರು ಸಂಗ್ರಹಿಸಿದ ಐದು ಐತಿಹಾಸಿಕ ಲಾವಣಿಗಳು : ಹಲಗಲಿಯ ಬೇಡರು

೮. ಕೈಫಿಯತ್ತು : ಉಪ್ಪಲಿ ಬಣಜಿಗರ ಕೈಫಿಯತ್ತು

ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನ: (೩೦ ಅಂಕಗಳು)

ಪ್ರತಿ ಚತುರ್ಮಾಸ ವಿದ್ಯಾರ್ಥಿಗಳ ಇಡೀ ತಂಡಕ್ಕೆ ಒಂದೇ ರೀತಿಯ ಮೌಲ್ಯಮಾಪನ ಚಟುವಟಿಕೆಗಳು ಮತ್ತು ಮಾನದಂಡಗಳನ್ನು ಅನುಸರಿಸಬೇಕು

ಟೆಸ್ಟ್	ಅವಧಿ	ಅಂಕಗಳು
ಟೆಸ್ಟ್–1	ಪ್ರತಿ ಚತುರ್ಮಾಸ 2ನೆ ತಿಂಗಳ ಅಂತ್ಯದಲ್ಲಿ (ಒಂದು ಗಂಟೆ)	**10**
ಟೆಸ್ಟ್–2	ಪ್ರತಿ ಚತುರ್ಮಾಸ 4ನೆ ತಿಂಗಳ ಅಂತ್ಯದಲ್ಲಿ (ಒಂದು ಗಂಟೆ)	**10**
	ಪ್ರತಿ ಚತುರ್ಮಾಸ ಆರಂಭದ ಎರಡು ತಿಂಗಳ ಅವಿರತ ಮೌಲ್ಯಮಾಪನ (ಟ್ಯುಟೋರಿಯಲ್)	**05**
	ಪ್ರತಿ ಚತುರ್ಮಾಸ ಅಂತಿಮ ಎರಡು ತಿಂಗಳ ಅವಿರತ ಮೌಲ್ಯಮಾಪನ (ಟ್ಯುಟೋರಿಯಲ್)	**05**
	ಒಟ್ಟು	**30**

3 ವಿಚಾರಗೋಷ್ಠಿ / ಚರ್ಚಾಗೋಷ್ಠಿ / ಪ್ರದರ್ಶನ - ಇಂತಹ ಸದೃಶ ಚಟುವಟಿಕೆಗೆಗಳು ವಿಷಯ ಸಂಗ್ರಹಣೆ, ಪ್ರಬಂಧ ರಚನೆ, ಮಂಡನೆ ಮತ್ತು ಚರ್ಚೆಯಲ್ಲಿ ಭಾಗವಹಿಸುವಿಕೆ - ಗರಿಷ್ಠ 5 ಅಂಕಗಳು

1. ಮೌಲ್ಯಮಾಪನ ಘಟಕ : 3 : ವಿಶ್ವವಿದ್ಯಾನಿಲಯ ಚತುರ್ಮಾಸ ಅಂತ್ಯದಲ್ಲಿ ಮೂರು ಗಂಟೆ ಅವದಿಯ ಗರಿಷ್ಠ 70 ಅಂಕಗಳ ಪರೀಕ್ಷೆ ನಡೆಸುತ್ತದೆ.
2. ಅ) ಅವಧಿಕ ಕಾರ್ಯ / ಮೈನರ್ ಪ್ರಾಜೆಕ್ಟ್ (4 ಕ್ರೆಡಿಟ್ಗಳು) ಮೌಲ್ಯಮಾಪನ ಕ್ಷೇತ್ರಕಾರ್ಯ, ಮಾಹಿತಿ ಸಂಗ್ರಹಣೆ ಮತ್ತು ವರದಿ

ಘಟಕ 1: **ಅ) ಅವಧಿಕ ಪ್ರಗತಿ ಮತ್ತು ವರದಿ** – 7.5 ಅಂಕಗಳು
ಆ) ವಿಚಾರಗೋಷ್ಠಿ / ಚರ್ಚೆ / ಪ್ರದರ್ಶನ – 7.5 ಅಂಕಗಳು

ಘಟಕ 2: **ಅ) ಕರಡು ವರದಿ** – 7.5 ಅಂಕಗಳು

ಆ) ಫಲಿತಾಂಶಗಳು ಹಾಗೂ ಅಂತಿಮ ವರದಿ – 7.5 ಅಂಕಗಳು

ಘಟಕ 3: ಚತುರ್ಮಾಸ ಅಂತ್ಯದಲ್ಲಿ ವರದಿಯ ಮೌಲ್ಯಮಾಪನ ಮತ್ತು ಮೌಖಿಕ ಪರೀಕ್ಷೆಯನ್ನು ಒಬ್ಬ ಆಂತರಿಕ ಹಾಗೂ ಒಬ್ಬ ಬಾಹ್ಯ ಪರೀಕ್ಷಕರನ್ನೊಳಗೊಂಡಂತೆ ಸಮಿತಿ ನಡೆಸುತ್ತದೆ-70 ಅಂಕಗಳಿಗೆ

ಘಟಕ 4: ವಿದ್ಯಾರ್ಥಿಯು ಮೂರನೆಯ ಚತುರ್ಮಾಸದಲ್ಲಿ ಚತುರ್ಮಾಸದಲ್ಲಿ ವಿಭಾಗದ ಅಧ್ಯಾಪಕರೊಂದಿಗೆ ಚರ್ಚಿಸಿ ವಿಷಯ ಆಯ್ಕೆ ಮಾಡಿಕೊಂಡು ನಾಲ್ಕನೆಯ ಚತುರ್ಮಾಸ ಅಂತ್ಯದಲ್ಲಿ ವಿಭಾಗಕ್ಕೆ ಸಲ್ಲಿಸಬೇಕು. ಎ-4 ಅಳತೆಯ ಕಾಗದದಲ್ಲಿ 12 ಪಾಯಿಂಟ್ ಅಕ್ಷರಗಳಲ್ಲಿ 50 ಪುಟಗಳಿಗೆ ಕಡಿಮೆ ಇಲ್ಲದಂತೆ ಮತ್ತು 80 ಪುಟಗಳಿಗೆ ಮೀರದಂತೆ ಅವಧಿಕ ಕಾರ್ಯವಿರಬೇಕು

ಘಟಕ 5: ಚತುರ್ಮಾಸ ಅಂತ್ಯದಲ್ಲಿ ವರದಿಯ ಮೌಲ್ಯಮಾಪನ ಮತ್ತು ಮೌಖಿಕ ಪರೀಕ್ಷೆಯನ್ನು ಅಧ್ಯಯನ ಮಂಡಳಿ / ಅಧ್ಯಯನ ವಿಭಾಗ / ಪರೀಕ್ಷಾ ಮಂಡಳಿ ಅಧ್ಯಕ್ಷರು ಅಥವಾ ಅವರ ನಾಮಾಂಕಿತರು ಮೇಲ್ವಿಚಾರಕರು ಹಾಗೂ ಇತರ ವಿಶ್ವವಿದ್ಯಾಲಯ / ಉದ್ಯಮ / ಸಮಾಜ / ಸಮುದಾಯದಿಂದ ಆಹ್ವಾನಿತರಾದ ಒಬ್ಬ ಬಾಹ್ಯ ಪರೀಕ್ಷಕರನ್ನೊಳಗೊಂಡ ಸಮಿತಿ ನಡೆಸುತ್ತದೆ.– 10 ಅಂಕಗಳು (60+10=70)

4ನೇ ಚತುರ್ಮಾಸದ ವಿಚಯವಾದ 'ಅವಧಿಕ ಕಾರ್ಯ' ಬರಹದ ಮೌಲ್ಯಮಾಪನವನ್ನು 60 ಅಂಕಗಳಿಗೆ ನಡೆಸಲಾಗುವುದು. 10 ಅಂಕಗಳಿಗೆ ಮೌಖಿಕ ಪರೀಕ್ಷೆಯನ್ನು ನಡೆಸಲಾಗುವುದು.

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ಮಾದರಿ ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ

2020–21ನೇ ಸಾಲಿನ ಸ್ನಾತಕೋತ್ತರ ಎಂ.ಎ ಕನ್ನಡ ಚತುರ್ಮಾಸ ಪರೀಕ್ಷೆಗಳು

(ಸಿಬಿಸಿಎಸ್-ಸಿಎಜಿಪಿ ಮಾದರಿ)

ಪತ್ರಿಕೆಯ ಶೀರ್ಷಿಕೆ:

ಸಮಯ: 3 ಗಂಟೆಗಳು ಅಂಕಗಳು: 70

ಸೂಚನೆ : ಎಲ್ಲಾ ಪ್ರಧಾನ ಪ್ರಶ್ನೆಗಳು ಕಡ್ಡಾಯ

(ಎ) ಅಥವಾ (ಬಿ) ಅಂಕಗಳು : 14

(ಸಿ) ಅಥವಾ (ಡಿ) ಅಂಕಗಳು : 14

(ಇ) ಅಥವಾ (ಎಫ್) ಅಂಕಗಳು: 14

(ಜಿ) ಅಥವಾ (ಎಚ್) ಅಂಕಗಳು : 14

ಯಾವುದಾದರೂ ಏಳು ಪ್ರಶ್ನೆಗಳಿಗೆ ಉತ್ತರಿಸಿ ಅಂಕಗಳು :7X2=14

(ಐ) (ಒ)

(ಜೆ) (ಪಿ)

(ಕ) (ಕ್ಯೂ)

(ಎಲ್) (ಆರ್)

(ಎಮ್) (ಎಸ್)

(ಎನ್) (ಟಿ)

ಪ್ರಶ್ನೆಗಳನ್ನು ಪಠ್ಯಕ್ರಮದ ಎಲ್ಲಾ ಘಟಕಗಳನ್ನು ಒಳಗೊಂಡಂತೆ ತಯಾರಿಸುವುದು.

JSS MAHAVIDYAPEETA

JSS COLLEGE OF ARTS, COMMERCE & SCIENCE

(Affiliated to University of Mysore)

Autonomous, NAAC 'A' grade and College with Potential for Excellence

B N Road, Mysuru – 570025

PROPOSED SCHEME of INSTRUCTION

and

SYLLABI

for

M.Sc. MATHEMATICS

under

CHOICE BASED CREDIT SYSTEM (CBCS)

PG DEPARTMENT OF MATHEMATICS

2017 – 18

1. **Scheme of Admission**:
   - 50% seats of the total intake for M.Sc. Mathematics Programme of the College will be filled by the University of Mysore through Centralized Admission Cell as per University regulations.
   - Remaining 50% seats will be filled by the College under College Quota.

2. **Eligibility**: B.Sc. degree with Mathematics as Major/Optional subject with 45% or B.Sc.Ed., degree of Regional Institute of Education with Mathematics as a special subject.

3. **Scheme of Examination**:
   (i) Theory paper of 03 hours duration (C_3 component) : **70** marks
   (ii) Internal Assessment: **30** marks
   (C_1 Component: 15 marks, C_2 Component: 15 marks)

4. **Pattern of Question Paper**: **Theory paper**: There are 5 questions. All questions must be answered. Each question carries 14 marks.

5. Minimum Marks for Securing Credits: 40% (with minimum of 30% in C_1 and C_2 and minimum of 30% in C_3).

6. Minimum Credits for getting the M.Sc. Mathematics degree: 76 credits.

7. Scheme of study for Masters:

Total No. of credits to be earned	76 credits
Minimum No. of credits to be earned from Hard Core papers	44 credits
Minimum No. of credits to be earned from Soft Core papers	28 credits
Minimum No. of credits to be earned from Open elective papers	4 credits

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PG DEPARTMENT OF MATHEMATICS

CBCS - M.Sc. Mathematics

List of courses with credit pattern

Sl. No.	Code	Type of the paper	Title of the Paper	Credit pattern in L:T:P	Credit Value	No. of hrs
			FIRST SEMESTER			
1	MAA 010	HC	Algebra I	3 : 1 : 0	4	5
2	MAA 020	HC	Real Analysis I	3 : 1 : 0	4	5
3	MAA 030	HC	Real Analysis II	3 : 1 : 0	4	5
4	MAA 040	HC	Complex Analysis I	3 : 1 : 0	4	5
5	MAA 210	SC	Linear Algebra	3 : 1 : 0	4	5
			SECOND SEMESTER			
6	MAB 010	HC	Algebra II	3 : 1 : 0	4	5
7	MAB 020	HC	Real Analysis III	3 : 1 : 0	4	5
8	MAB 030	HC	Complex Analysis II	3 : 1 : 0	4	5
9	MAB 210	SC	Ordinary and Partial Differential Equations	3 : 1 : 0	4	5
10	MAB 230	SC	Graph Theory	3 : 1 : 0	4	5
			THIRD SEMESTER			
11	MAC 010	HC	Elements of Functional Analysis	3 : 1 : 0	4	5
12	MAC 020	HC	Topology I	3 : 1 : 0	4	5
13	MAC 210	SC	Commutative Algebra	3 : 1 : 0	4	5
14	MAC 220	SC	Theory of Numbers	3 : 1 : 0	4	5
15	CSC/MCC/ZOC/ BTC/BOC/BCC 580	OE (For others)	Basic Mathematics	3 : 1 : 0	4	5
			FORTH SEMESTER			
16	MAD 010	HC	Measure and Integration	3 : 1 : 0	4	5
17	MAD 020	HC	Topology-II	3 : 1 : 0	4	5
18	MAD 220	SC	Theory of Partitions	3 : 1 : 0	4	5
19	MAD 230	SC	Differential Geometry	3 : 1 : 0	4	5
			Total Credits		76	

Program Outcomes

PO1 : Apply the underlying unifying structures of mathematics (i.e. sets, relations and functions, logical structure) and the relationships among them

PO2 : To include methods of facilitating learning such as projects, group work and participative learning.

PO3 : To Innovate, invent and solve complex mathematical problems using the knowledge of pure and applied mathematics.

PO4 : To impart knowledge of some basic concepts and principles of the discipline.

PO5 : To establish inter-disciplinarily between mathematics and other subjects from Humanities and the Social Sciences.

PO6 : To encourage collaborative learning through group activities and hands-on learning.

PO7 : To provide in-service training for school teachers. To learn to apply mathematics to real life situations and help in problem solving

Program Specific Outcomes

PSO1 : Explain the importance of mathematics and its techniques to solve real life problems and provide the limitations of such techniques and the validity of the results

PSO2 : Propose new mathematical and statistical questions and suggest possible software packages and/or computer programming to find solutions to these questions

PSO3 : Continue to acquire mathematical and statistical knowledge and skills appropriate to professional activities and demonstrate highest standards of ethical issues in mathematics

PSO4 : Ability to use computer calculations as a tool to carry out scientific investigations and develop new variants of the acquired methods, if required by the problem at hand.

PSO5 : Crack lectureship and fellowship exams approved by UGC like CSIR – NET and SLET.

PSO6 : Apply knowledge of Mathematics, in all the fields of learning including higher research and its extensions.

First Semester

Course Code MAA 010	Algebra I

Course Outcome

Students are able to

CO1 Define and interpret the concepts of divisibility, congruence, greatest common divisor, prime, and prime-factorization

CO2 Apply the Law of Quadratic Reciprocity and other methods to classify numbers as primitive roots, quadratic residues, and quadratic non-residues

CO3 Assess properties implied by the definitions of groups.

CO4 Analyze Permutation groups

CO5 Uses various canonical types of groups and canonical types of rings

CO6 Analyze and demonstrate examples of subgroups, normal subgroups and quotient groups.

CO7 Use the concepts of isomorphism and homomorphism for groups

CO8 Demonstrate knowledge of conjugates, the Class Equation and Sylow theorems.

COURSE CONTENT

Unit I

Number theory - Congruences, residue classes, theorems of Fermat, Euler and Wilson, linear congruences, elementary arithmetical functions, primitive roots, quadratic residues and the law of quadratic reciprocity.

Unit II

Groups - Lagrange's Theorem, homomorphism and isomorphism, normal subgroups and factor groups.

Unit III

The fundamental theorem of homomorphism, two laws of isomorphism.

Unit IV

Permutation groups and Cayley's theorem, Sylow's theorems.

Books for Reference:

1. D. M. Burton – Elementary Number Theory, Tata McGraw-Hill, New Delhi, 6th Ed.,

2. I. Niven, H. S. Zuckerman and H. L. Montgomery – An Introduction to the Theory of Numbers, New York, John Wiley and Sons, Inc., 2004, 5th Ed.,

3. G. A. Jones and J. M. Jones – Elementary Number Theory, Springer, 1998.

4. Thomas W. Hungerford – Algebra, Springer International Edition, New York.

5. Michael Artin – Algebra, Prentice-Hall of India, New Delhi.

6. J. A. Gallian – Contemporary Abstract Algebra, Narosa Publishing House, 4th Ed.,

7. D. S. Dummit and R. M. Foote – Abstract Algebra, John Wiley and Sons, 1999.

8. I. N. Herstein – Topics in Algebra, Vikas Publishing House, New Delhi.

9. J. B. Fraleigh – A First course in Abstract Algebra, Addison-Wesley,

10. N. S. Gopalakrishnan – University Algebra, New Age International, 2nd Ed.

Course code MAA020	**Real Analysis I**

Course Outcome

Students are able to

CO1 Describe fundamental properties of the real numbers that lead to the formal development of real analysis

CO2 Describe the real line as a complete ordered field

CO3 Acquire knowledge extended real number system, the n-dimensional Euclidean space

CO4 Study the types of mean inequalities and application

CO5 Use the definitions of convergence as they apply to sequences, series, and functions

CO6 Use the definitions of convergence as they apply to re-arrangements. Double series, infinite products

COURSE CONTENT

Unit I

The extended real number system, the n-dimensional Euclidean space, the binomial inequality, the inequality of the arithmetic and geometric means, the inequality of the power means, Cauchy's, Holder's inequality and Minkowski's inequality.

Unit II

Numerical sequences, convergent sequences, Cauchy sequences, upper and lower limits.

Unit III

Series of real numbers series of non-negative terms, the number `e', tests of convergence.

Unit IV

Multiplications of series, re-arrangements. Double series, infinite products.

Books for Reference:

1. W. Rudin – Principles of Mathematical Analysis, International Student edition, McGraw Hill, 3rd Ed.

2. T. M. Apostal – Mathematical Analysis, Addison Wesley, Narosa, New Delhi, 2nd Ed.

3. R. R. Goldberg – Methods of real Analysis, Oxford and IBH, New Delhi.

4. Torence Tao – Analysis I, Hindustan Book Agency, India, 2006.

5. Torence Tao – Analysis II, Hindustan Book Agency, India, 2006.

6. Kenneth A. Ross – Elementary Analysis: The Theory of Calculus, Springer International Edition, 2004.

Course code MAA 030	**Real Analysis II**

Course Outcome

Students are able to

CO1 Determine the basic topological properties of subsets of the real numbers

CO2 Analyze Sets and functions , distinguish between finite, countable and uncountable sets

CO3 Determine the Riemann integrability and the Riemann-Stieltjes integrability of a bounded function and prove a related of theorems concerning integration

CO4 Apply the Mean Value Theorem and the Fundamental Theorem of Calculus to

problems in the context of real analysis

CO5 Prove Taylor's theorem, determine maxima and minima, study the Functions of bounded variation

CO6 Produce rigorous proofs of results that arise in the context of real analysis.

COURSE CONTENT

Unit I

Finite, countable and uncountable sets, the topology of the real line.

Unit II

Continuity, uniform continuity, properties of continuous functions, discontinuities, monotonic functions.

Unit III

Differentiability**, mean value theorems**, L' Hospital rule, Taylor's theorem, maxima and minima, Functions of bounded variation.

Unit IV

The Riemann-Stieltje's integral, criterion for integrability. Properties of the integral, classes of integrable functions. The integral as the limit of a sum. First and second mean value theorems. Integration and differentiation.

Books for Reference:

1. W. Rudin – Principles of Mathematical Analysis, International Student edition, McGraw-Hill, 3rd Ed..

2. Torence Tao – Analysis I, Hindustan Book Agency, India, 2006.

3. Torence Tao – Analysis II, Hindustan Book Agency, India, 2006.

4. T. M. Apostal – Mathematical Analysis, Addison Wesley, Narosa, 2nd Ed.,

5. R. R. Goldberg – Methods of real Analysis, Oxford and IBH Publishing Company, New Delhi.

6. Kenneth A. Ross – Elementary Analysis: The Theory of Calculus, Springer International Edition, 2004.

Course code MAA 040	Complex Analysis I

Course Outcome

Students are able to

CO1 Represent complex numbers algebraically and geometrically,

CO2 Define and analyze limits and continuity for complex functions as well as consequences of continuity

CO3 Apply the concept and consequences of analyticity and the Cauchy-Riemann equations and of results on harmonic and entire functions including the fundamental theorem of algebra

CO4 Analyze sequences and series of analytic functions and types of convergence.

CO5 Apply Cauchy's theorem for disk and the integral formula.

CO6 Understand Local properties of Analytic functions

COURSE CONTENT

Unit I

Algebra of complex numbers, geometric representation of complex numbers. Riemann sphere and Stereographic projection, Lines, Circles. Limits and Continuity.

Unit II

Analytic functions, Cauchy-Riemann equations, Harmonic functions, Polynomials and Rational functions. Elementary theory of power series - sequences, series, uniform convergence of power series, Abel's limit theorem, The elementary functions.

Unit III

Topology of the complex plane. Linear fractional transformations, Cross-ratio, Symmetry, Elementary conformal mappings. Complex integration – Line integrals, Rectifiable arcs.

Unit IV

Cauchy's theorem for a rectangle. Cauchy's theorem in a Circular disk, Cauchy's integral formula. Local properties of analytic functions.

Books for Reference:

1. L. V. Ahlfors – Complex Analysis, McGraw-Hill, Kogakusha, 1979.

2. J. B. Conway – Functions of one complex variable, Narosa, New Delhi.

3. R. P. Boas – Invitation to Complex Analysis, The Random House, 1987

4. B. C. Palka – An Introduction to Complex Function Theory, Springer, 1991.

5. S. Ponnusamy – Foundations of Complex Analysis, Narosa, 1995.

Course code MAA 210	**Linear Algebra**

Course Outcome

Students are able to

CO1 Solve systems of linear equations,

CO2 Analyze vectors in R^n geometrically and algebraically,

CO3 Recognize the concepts of the terms span, linear independence, basis, and dimension, and apply these concepts to various vector spaces and subspaces,

CO4 Use matrix algebra and the related matrices to linear transformations,

CO5 Compute and use determinants, and use eigenvectors and eigenvalues,

CO6 Determine and use orthogonality, have thorough understanding of the Linear Transformations

CO7 Study Inner Products and Norms, The Gram-Schmidt Orthogonalization Process and Orthogonal Complements.

CO8 Analyze the elementary canonical forms, rational and Jordan forms, Apply the inner product space

COURSE CONTENT

Unit I

Vector Spaces, Subspaces, Linear Combinations and Systems of Linear Equations, Linear Dependence and Linear Independence, Bases and Dimension, Maximal Linearly Independent Subsets; Linear Transformations, Null Spaces, and Ranges, The Matrix Representation of a Linear Transformation, Composition of Linear Transformations and Matrix Multiplication, Invertibility and Isomorphisms, The Change of Coordinate Matrix, The Dual Space; Elementary Matrix Operations and Elementary Matrices, The Rank of a Matrix and Matrix Inverses, Systems of Linear Equations.

Unit II

Properties of Determinants, Cofactor Expansions, Elementary Operations and Cramer's Rule, Eigenvalues and Eigenvectors, Diagonalizability, Invariant Subspaces and the Cayley-Hamilton Theorem;Inner Products and Norms, The Gram-Schmidt Orthogonalization Process and Orthogonal Complements.

Unit III

The Adjoint of a Linear Operator, Normal and Self-Adjoint Operators, Unitary and Orthogonal Operators and Their Matrices, Orthogonal Projections and the Spectral Theorem; Bilinear and Quadratic Forms;

Unit IV

The Diagonal form, The Triangular form; The Jordan Canonical Form; The Minimal Polynomial; The Rational Canonical Form.

Books for Reference:

1. S. Friedberg, A. Insel, and L. Spence - Linear Algebra, Fourth Edition, PHI, 2009.
2. Jimmie Gilbert and Linda Gilbert – Linear Algebra and Matrix Theory, Academic Press, An imprint of Elsevier.

3. I. N. Herstein – Topics in Algebra, Vikas Publishing House, New Delhi.

4. Hoffman and Kunze – Linear Algebra, Prentice-Hall of India, 1978, 2nd Ed.,

5. P. R. Halmos – Finite Dimensional Vector Space, D. Van Nostrand, 1958.

6. S. Kumeresan – Linear Algebra, A Geometric approach, Prentice Hall India, 2000.

SECOND SEMESTER

Course code MAB 010	**Algebra II**

Course Outcome

Students are able to

CO1 Assess properties implied by the definitions of rings.

CO2 Analyze and demonstrate examples and properties of ideals and quotient rings

CO3 Demonstrate knowledge of polynomial rings and associated properties

CO4 Derive and apply Gauss Lemma, Eisenstein criterion for irreducibility of rationals

CO5 Demonstrate the characteristic of a field and the prime subfield.

COURSE CONTENT

Unit I

Rings, Integral domains and Fields, Homomorphisms, Ideals and Quotient Rings, Prime and Maximal ideals.

Unit II

Euclidean and principal ideal rings, Polynomials, Zeros of a polynomial, Factorization, Irreducibility criterion.

Unit III

Adjunction of roots, algebraic and transcendental extensions, Finite fields.

Unit IV

Separable and inseparable extensions, Perfect and imperfect fields. Theorem on the primitive element.

Books for Reference:

1. Thomas W. Hungerford – Algebra, Springer International Edition, New York.

2. Michael Artin – Algebra, Prentice-Hall of India, New Delhi.

3. Joseph A. Gallian – Contemporary Abstract Algebra, Narosa, 4th Ed.,

4. D. S. Dummit and R. M. Foote – Abstract Algebra, John Wiley and Sons,1999, 2nd Ed.,

5. I. N. Herstein – Topics in Algebra, Vikas Publishing House, New Delhi.

6. J. B. Fraleigh – A First course in Abstract Algebra, Addison-Wesley,

7. N. S. Gopalakrishnan – University Algebra, New Age International, 2nd ed.,

Course code MAB 020	Real Analysis III

Course Outcome

Students are able to

CO1 Understand the concept of sequences and series with respect to the real numbers system and establish whether a given series/ sequences is convergent/ divergent at a specified point or interval

CO2 Recognize the difference between pointwise and uniform convergence of a sequence/series of functions

CO3 Illustrate the effect of uniform convergence on the limit function with respect to continuity, differentiability, and integrability

CO4 Derive and apply properties of convergence of power series.

CO5 Analyze Functions of several variables, partial derivatives, continuity and differentiability

CO6 Uunderstand the importance of the Implicit function theorem, Taylor's theorem, the Maxima and Minima, Lagrange's multipliers

COURSE CONTENT

Unit I

Sequences and series of functions, Uniform convergence, Uniform convergence and continuity, Uniform convergence and integration, Uniform convergence and differentiation.

Unit II

Power series, The exponential and logarithmic functions, The trigonometric functions. Improper integrals and their convergence.

Unit III

Functions of several variables, partial derivatives, continuity and differentiability, the chain rule, Jacobians.

Unit IV

The Implicit function theorem, Taylor's theorem, the Maxima and Minima, Lagrange's multipliers.

Books for Reference:

1. W. Rudin – Principles of Mathematical Analysis, International Student edition, McGraw-Hill, 3rd Ed.,

2. T.M. Apostal – Mathematical Analysis, Addison Wesley, Narosa, 2nd Ed.,

3. R.R. Goldberg – Methods of Real Analysis, Oxford and IBH, New Delhi.

4. D.V. Widder – Advanced Calculus, Prentice Hall of India, New Delhi, 2nd Ed.,

5. Torence Tao – Analysis I, Hindustan Book Agency, India, 2006.

6. Torence Tao – Analysis II, Hindustan Book Agency, India, 2006.

7. Kenneth A. Ross – Elementary Analysis: The Theory of Calculus, Springer International Edition, 2004.

Course code MAB 030	**Complex Analysis II**

Course Outcome

Students are able to

CO1 Classify singularities and poles, find residues and evaluate complex integrals using the residue theorem.

CO2 Apply the Cauchy integral theorem in its various versions, and the Cauchy integral formulas

CO3 Evaluate complex contour integrals directly and by the fundamental theorem

CO4 Study Residue theorem and the argument principle

CO5 State and prove the Cauchy Riemann Equation and use it to show that a function is Analytic

CO6 Represent functions as Taylor, power and Laurent series

CO7 Study properties of Partial fractions, Infinite products, Canonical products, The Gamma and Beta functions

COURSE CONTENT

Unit I

The Calculus of Residues – The residue theorem, argument principle, Evaluation of definite integrals.

Unit II

Harmonic functions – Definition and basic properties, mean value property, Poisson's formula, Schwarz's theorem, reflection principle.

Unit III

Power series expansions – The Weierstrass theorem, The Taylor series, The Laurent series.

Unit IV

Partial fractions and factorization – Partial fractions, Mittag - Leffer's theorem, Infinite products, Canonical products, The Gamma and Beta functions, Sterling's formula. Entire functions – Jensen's formula, Hadamard's theorem.

Books for Reference:

1. L. V. Ahlfors – Complex Analysis, McGraw-Hill, Kogakusha, 1979.

2. J. B. Conway – Functions of one complex variable, Narosa, New Delhi.

3. R. P. Boas – Invitation to Complex Analysis, The Random House, 1987.

4. B. C. Palka – An Introduction to the Complex Function Theory, Springer, 1991.

5. S. Ponnusamy – Foundations of Complex Analysis, Narosa, 1995.

Course code MAB 210	**Ordinary and Partial Differential Equations**

Course Outcome

Students are able to

CO1 Solve problems in ordinary differential equations, dynamical systems, stability theory, and a number of applications to scientific and engineering problems

CO2 Study of Differential focuses on the existence and uniqueness of solutions also emphansizes the rigorous justification of methods for approximating solutions in pure and applied mathematics.

CO3 Implement solution methods using appropriate technology

CO4 Investigate the qualitative behavior of solutions of systems of differential equations

CO5 Recognize the major classification of PDEs and the qualitative differences between the classes of equations

CO6 Solve linear PDEs using classical solution methods.

CO7 Solve differential equations widely used in formulating many fundamental laws of physics and chemistry.

COURSE CONTENT

Unit I

Linear Second Order Equations - Initial value problem, Existence and Uniqueness by Picard's Theorem, Wronskian, separation and comparison theorems, Poincare phase plane, variation of parameters.

Unit II

Power series solutions - Solution near ordinary and regular singular point. Convergence of the formal power series, applications to Legendre, Bessel, Hermite, Laguerre and hypergeometric differential equations with their properties.

Unit III

Partial differential equations - Cauchy problems and characteristics, Classification of Second order PDE's, reduction to canonical forms, derivation of the equations of mathematical physics and their solutions by separation of variables.

Unit IV

Boundary value problems - Transforming Boundary value problem of PDE and ODE, Sturm - Liouvile system, eigen values and eigen functions, simple properties, expansion in eigen functions, Parseval's identity, Green's function method.

Books for Reference:

1. E. A. Coddington and N. Levinson – Theory of Ordinary Differential equations, Tata McGraw-Hill, New Delhi.

2. R. Courant and D. Hilbert – Methods of Mathermatical Physics, Vol. I. & II, Tata McGraw-Hill, New Delhi, 1975.

3. G. F. Simmons – Differential Equations with applications and Historical Notes, Tata McGraw-Hill, New Delhi,
1991.

4. I. N. Sneddon – Theory of Partial differential equations, McGraw-Hill, International Student Edition.

5. S. G. Deo and V. Raghavendra – Ordinary Differential Equations and Stability Theory, Tata McGraw-Hill, New Delhi.

Course code MAB 230	**Graph Theory**

Course Outcome

Students are able to

CO1 Construct examples and proofs pertaining to the basic theorems.

CO2 Understand the definitions of cut vertex, bridge, blocks and Automorphism group of a graph.

CO3 Study the properties of trees and connectivity

CO4 Discuss and understand the importance of the concepts Matchings and Menger's theorem

COURSE CONTENT

Unit I

Types of Graphs, Walk and connectedness, degrees, Extremal graphs, Intersection graph, Operations on graphs.

Unit II

Cutpoints, Bridges and Blocks, Block graphs and cutpoints.

Unit III

Characterization of trees, Centers and Centroids, Spanning Tree .

Unit IV

Connectivity and line connectivity, Menger's theorem, Coverings Independence, Critical points and lines.

Books for Reference:

1. F. Harary – Graph Theory, Addition Wesley Reading Mass, 1969.

2. N. Deo – Graph Theory With Applications to Engineering and Computer Science, Prentice Hall of India, 1987.

3. K. R. Parthasarathy – Basic Graph Theory, Tata McGraw-Hill, New Delhi, 1994.

4. G. Chartand and L. Lesniak – Graphs and Diagraphs, Qwadsworth and Brooks, 2nd Ed.,

5. Clark and D. A. Holton – A First Look at Graph Theory, Allied publishers.

6. D. B. West – Introduction to Graph Theory, Pearson Education Inc., 2001, 2nd Ed.,

7. J. A. Bondy and U. S. R. Murthy – Graph Theory with applications, Elsevier, 1976.

THIRD SEMESTER

Course code MAC 010	Elements of Functional Analysis

Course Outcome

Students are able to

CO1 Explain the fundamental concepts of functional analysis.

CO2 Understand the approximation of continuous functions.

CO3 Understand concepts of Hilbert and Banach spaces

CO4 Understand the definitions of linear functional and prove the Hahn-Banach theorem, open mapping theorem, uniform boundedness theorem, etc.

CO5 Define linear operators, self adjoint, isometric and unitary operators on Hilbert spaces.

COURSE CONTENT

Unit I

Metric completion. Banach's contraction mapping theorem and applications, Baire' category theorem, Ascoli - Arzela theorem.

Unit II

Linear spaces and linear operators, Norm of a bounded operator, The Hahn – Banach extension theorem, Stone - Weirstrass theorem.

Unit III

Open mapping and Closed Graph theorems. The Banach - Steinhaus Principle of Uniform Boundedness.

Unit IV

Hilbert spaces- The orthogonal projection, Nearly orthogonal elements, Riesz's lemma, Riesz's representation theorem.

Books for Reference:

1. G. F. Simmons – Introduction to Topology and Modern Analysis, Tata McGraw-Hill, New Delhi.

2. A. E. Taylor – Introduction to Functional Analysis, Wiley, New York, 1958.

3. A. Page and A. L. Brown – Elements of Functional Analysis.

4. George Bachman and Lawrence Narici – Functional Analysis, Dover Publications, Inc., Mineola, New York.

5. J. B. Conway – A Course in Functional Analysis, GTM, Vol. 96., Springer, 1985.

Course code MAC 020	**Topology I**

Course Outcome

Students are able to

CO1 Define and illustrate the concept of topological spaces and continuous functions

CO2 Provide precise definitions and appropriate examples and counter examples of fundamental concepts in topology.

CO3 Define and illustrate the concept of product topology, metric and quotient topology

CO4 Prove a selection of theorems concerning topological spaces, continuous functions product topologies, and quotient topologies

CO5 Define connectedness and compactness, and prove a selection of related theorems

COURSE CONTENT

Unit I

Set theoretic preliminaries. Topological spaces and continuous maps - topological spaces, basis for a topology, the order topology, the product topology on X x X, the subspace topology.

Unit II

Closed sets and limit points, continuous functions, the product topology, the metric topology, the quotient topology.

Unit III

Connectedness - connected spaces, connected sets on the real line, path connectedness.

Unit IV

Compactness - compact spaces, compact sets on the line, limit point compactness, local compactness.

Books for Reference:

1. J. R. Munkres – A First Course in Topology, Prentice Hall India, 2000, 2nd Ed.,

2. G. F. Simmons – Introduction to Topology and Modern Analysis, McGraw-Hill, Kogakusha, 1968.

3. S. Willard – General Topology, Addison Wesley, New York, 1968.

4. J. Dugundji – Topology, Allyn and Bacon, Boston, 1966.

5. J. L. Kelley – General Topology, Van Nostrand and Reinhold Co., New York, 1955.

Course code MAC 210	**Commutative Algebra**

Course Outcome

Students are able to

CO1 Know the basic definition of commutative rings, local rings, prime and maximal Ideals over commutative rings

CO2 Explain basic concepts of The prime spectrum of a ring, the nil radical and Jacobson radical

CO3 Study the operation on ideals and extension and contraction

CO4 Be Familiar with the notions of Noetherian and Artinian modules

CO5 Discuss and understand the Free modules Finitely generated modules, Simple modules, Exact sequences of modules

CO6 Know how to localize rings and modules, and familiar with important applications of localization

CO7 Know basic theory of Noetherian rings and study the Hilbert basis theorem .

COURSE CONTENT

Unit I

Rings and ideals - Rings and ring homomorphisms, Ideals, Quotient rings, zero-divisors, nilpotent elements, units, prime ideals and maximal ideals.

Unit II

The prime spectrum of a ring, the nil radical and Jacobson radical, operation on ideals, extension and contraction.

Unit III

Modules - Modules and modules homomorphisms, submodules and quotient modules, Direct sums, Free modules Finitely generated modules, Nakayama Lemma, Simple modules, Exact sequences of modules.

Unit IV

Modules with chain conditions - Artinian and Noetherian modules, modules of finite length, Artnian rings, Noetherian rings, Hilbert basis theorem.

Books for Reference:

1. M. F. Atiyah and I. G. Macdonald – Introduction to Commutative Algebra, Addison-Wesley.

2. C. Musili – Introduction to Rings and Modules, Narosa Publishing House.

3. Miles Reid – Under-graduate Commutative Algebra, Cambridge University Press.

4. N. S. Gopalakrishnan, Commutative Algebra, Oxonian Press.

Course code MAC 220	**Theory of Numbers**

Course Outcome

Students are able to

CO1 Define and interpret the concepts of divisibility, congruence, greatest common

divisor, prime, and prime-factorization

CO2 Apply the Law of Quadratic Reciprocity and other methods to classify numbers as primitive roots, quadratic residues, and quadratic non-residues

CO3 Produce rigorous arguments (proofs) centered on the material of number theory, most notably in the use of Mathematical Induction and/or the Well Ordering Principal in the proof of theorems

CO4 Know the diophantine equations, irrational numbers, continued fractions

COURSE CONTENT

Unit I

Prime numbers, The Fundamental theorem of Arithmetic, The series of Reciprocals of primes, The Euclidean Algorithm. Fermat and Mersenne numbers. Farey series, Farey dissection of the continuum, Irrational numbers-Irrationality of m^{th} root of N, e and π.

Unit II

Arithmetical Functions – The Mobius function, The Euler' function and Sigma function, The Dirichlet product of Arithmetical functions, Multiplicative functions. Averages of Arithmetical functions – Euler summation formula, Some elementary asymptotic formulas, The average orders of d(n), $\sigma(n)$, $\varphi(n)$, $\mu(n)$. An application to the distribution of lattice points visible from the origin.

Unit III

Approximation Irrational numbers, Hurwitz's Theorem, Representation of a number by two or four squares, Definition g(k) and G(k), Proof of $g(4)<50$, Perfect numbers. The series of Fibonacci and Lucas.

Unit IV

Continued fractions - Finite continued fractions, Convergent of a continued fraction, Continued fractions with positive quotients. Simple continued fractions, The representation of an irreducible rational fraction by a simple continued fraction. The continued fraction algorithm and Euclid's algorithm. The difference between the fraction and its convergents, Infinite simple continued fractions, the representation of an irrational number by an infinite continued fraction, Equivalent numbers and periodic continued fractions, some special quadratic surds.

Books for Reference:

1. G. H. Hardy and E. M. Wright – An Introduction to Theory of Numbers, Oxford University Press, 1979, 5th Ed.,

2. I. Niven, H. S. Zuckerman and H. L. Montgomery – An Introduction to the Theory of Numbers, New York, John Wiley and Sons, Inc., 2004, 5th Ed.,

3. Bruce C. Berndt – Ramanujan's Note Books Volume-1 to 5, Springer.

4. G. E. Andrews – Number Theory, Dover Books, 1995.

5. T. M. Apostol – Introduction to Analytic Number Theory, Narosa Publishing House, New Delhi.

OPEN ELECTIVE (For others)

Coursecode MCC/BCC/BTC/BOC/ZOC/CSC 580	**Basic Mathematics**

Course Outcome

Students are able to

CO1 Write an argument using logical notation and determine if the argument is or is not valid

CO2 Identify sets as well defined collections, represents sets in roster and set builder form, conversion from set builder form to roster form and vice versa.

CO3 Understand the meaning of equal and equivalent sets and differentiate between equal and equivalent sets.

CO4 Identify the subsets of the given sets, find the complement of a subset of a given Set, within a given universe. Represent venn diagram using sets.

CO5 Use the simple method to solve small linear programming models by hands, given a basic feasible point

CO6 Solve a two dimensional linear programming problem graphically

CO7 Understand the definitions of graphs, path, connectedness, cut vertex, bridge, blocks of a graph.

CO8 Study the properties of trees and matrix of a graph

COURSE CONTENT

Unit I

Mathematical Logic: Connection – Normal Forms – Theory of Inferences –Predicate Calculus.

Unit II

Set Theory: Operations on Sets – Basic Set Identities – Relations and Orderings, Functions.

Unit III

Introduction: formulation of LP problems, Graphical solution of LP problems. Introduction to Simplex, revised simplex methods and Dual simplex, Game theory.

Unit IV

Graph Theory: Basic Concepts of Graph Theory- Paths – Connectedness – Matrix Representation of Graphs – Trees – List structures and Graphs

Books for Reference:

1. C. L. Liu – Elements of Discrete Mathematics, McGraw-Hill, 1986.

2. Kenneth H. Rosen – Discrete Mathematics and its Applications, McGraw-Hill, 2002.

3. F. Harary – Graph Theory, Addition Wesley Reading Mass, 1969.

4. N. Deo – Graph Theory With Applications to Engineering and Computer Science, Prentice Hall of India, 1987.

5. K. R. Parthasarathy – Basic Graph Theory, Tata McGraw-Hill, New Delhi, 1994.

6. G. Chartand and L. Lesniak – Graphs and Diagraphs, wadsworth and Brooks, 2nd Ed.,

7. Clark and D. A. Holton – A First Look at Graph Theory, Allied publishers.

8. D. B. West – Introduction to Graph Theory, Pearson Education Inc.,2001, 2nd Ed.,

9. J. A. Bondy and U. S. R. Murthy – Graph Theory with applications, Elsevier, 1976.

10. S. D Sharma- Operations Research.

Fourth Semester

Course code MAD 010	**Measure and Integration**

Course Outcome

Students are able to

CO1 Understand the fundamental concepts of Mathematical Analysis and the classical theorems in Advanced Real Analysis

CO2 Be familiar with measurable sets and functions

CO3 Discuss the Integration a measurable function

CO4 Discuss theorems on monotonic functions, functions of bounded variation, differentiation of an integral, absolute continuity

CO5 Understand the fundamentals of measure theory and be acquainted with the proofs of the fundamental theorems underlying the theory of integration.

CO6 Learn about measure theory of Signed measures, product measures

COURSE CONTENT

Unit I

Lebesgue measure - outer measure, measurable sets and Lebesgue measure, a nonmeasurable set, measurable functions.

Unit II

The Lebesgue integral – the Lebesgue Integral of a bounded function over as set of finite measure, the integral of a non-negative function, the general Lebesgue integral.

Unit III

Differentiation and integration - Differentiation of monotonic functions, functions of bounded variation, differentiation of an integral, absolute continuity.

Unit IV

Measure and integration - Measure spaces, Measurable functions, integration, Signed measures, the Radon - Nikodym theorem, Measure and outer measure, outer measure and measurability, the extension theorem, product measures.

Books for Reference:

1. H. L. Royden – Real Analysis, Prentice Hall, 3rd Ed.,

2. G. de Barra – Measure Theory and Integration, Wiley Eastern Limited.

3. Inder K. Rana – An Introduction to Measure and Integration, Narosa, 1997.

Course code MAD 020	**Topology II**

Course Outcome

Students are able to

CO1 Define and illustrate the concepts of the countability and separation axioms.

CO2 Appreciate the beauty of deep mathematical results like Uryzohn's lemma and Tietze's extension theorem and understand the dynamics of the proof techniques.

CO3 Discuss Tychonoff's theorem, locally compact spaces, Compactness of metric spaces

CO4 Study Stone-Weierstrass theorems

CO5 Describe different examples distinguishing general, geometric, and algebraic topology.

CO6 Construct of the fundamental group of a topological space and applications to covering spaces and homotopy theory.

COURSE CONTENT

Unit I

Countability and Separation axioms - the countability axioms, the separation axioms, normality of a compact Hausdorff space.

Unit II

Urysohn's lemma, Tietze's extension theorem, Urysohn's metrization theorem, Partitions of unity.

Unit III

Tychonoff's theorem on the product of compact spaces. Local finiteness, Paracompactness, Normality of a paracompact space.

Unit IV

The Fundamental group and the Fundamental group of a circle, The Fundamental group of the punctured plane, Essential and Inessential Maps, The Fundamental Theorem of Algebra.

Books for Reference:

1. James R. Munkres - A First Course in Topology , Prentice Hall India, 2000, 2nd Ed.,

2. G. F. Simmons – Introduction to Topology and Modern Analysis, McGraw-Hill, Kogakusha, 1968.

3. S. Willard – General Topology, Addison Wesley, New York, 1968.

4. J. Dugundji – Topology, Allyn and Bacon, Boston, 1966.

5. J. L. Kelley – General Topology, Van Nostrand and Reinhold Co., New York, 1955.

Course code MAD 230	**Differential Geometry**

Course Outcome

Students are able to

CO1 Define and analyze the basic concepts of space curves and plane curves

CO2 Introduce the fundamentals of differential geometry primarily by focusing on the theory of curves and surfaces in three space.

CO3 Compute quantities of geometric interest such as curvature, as well as develop a facility to compute in various specialized systems

CO4 Understand the global properties of curves such as the four vertex theorem.

CO5 Know the theory of surfaces introduces the fundamental quadratic forms of a surface, intrinsic and extrinsic geometry of surfaces, and the Gauss theorem.

CO6 Introduce the method of the moving frame and over determined systems of differential equations as they arise in surface theory.

COURSE CONTENT

Unit I

Plane curves and Space curves – Frenet-Serret Formulae. Global properties of curves – Simple closed curves, The isoperimetric inequality, The Four Vertex theorem. Surfaces in three dimensions – Smooth surfaces, Tangents, Normals and Orientability, Quadric surfaces.

Unit II

The First Fundamental form – The lengths of curves on surfaces, Isometries of surfaces, Conformal mappings of surfaces, Surface area, Equiareal Maps and a theorem of Archimedes.

Unit III

Curvature of surfaces – The Second Fundamental form, The Curvature of curves on a surface, Normal and Principal Curvatures.

Unit IV

Gaussian Curvature and The Gauss' Map – The Gaussian and The mean Curvatures, The Pseudo sphere, Flat surfaces, Surfaces of Constant Mean Curvature, Gaussian Curvature of Compact surfaces, The Gauss' Map.

Books for Reference:

1. A. Pressley – Elementary Differential Geometry, Under-graduate Mathematics Series, Springer.

2. T. J. Willmore – An Introduction to Differential Geometry, Oxford University Press.

3. D. Somasundaram – Differential Geometry: A First Course, Narosa, 2005.

Course code MAD 220	**Theory of Partitions**

Course Outcome

Students are able to

CO1 Know the definitions of partitions

CO2 Apply the q-binomial theorem and Ramanujan ${}_1\psi_1$ - summation formula

CO3 Know the congruence of partition

CO4 Apply the q-series

COURSE CONTENT

Unit I

Partitions - partitions of numbers, the generating function of p(n), other generating functions, two theorems of Euler, Jacobi's triple product identity and its applications.

Unit II

${}_1\psi_1$ - summation formula and its applications, combinatorial proofs of Euler's identity, Euler's pentagonal number theorem, Franklin's combinatorial proof.

Unit III

Congruence properties of partition function, the Rogers - Ramanujan Identities.

Unit IV

Elementary series - product identities, Euler's, Gauss', Heine's, Jacobi's identities. Restricted Partitions – Gaussian, Frobinius partitions.

Books for Reference:

1. G. H. Hardy and E. M. Wright – An Introduction to Theory of Numbers, Oxford University Press, 1979, 5th Ed.,

2. I. Niven, H. S. Zuckerman and H. L. Montgomery – An Introduction to the Theory of Numbers, New York, John Wiley and Sons, Inc., 2004, 5th Ed.,

3. Bruce C. Berndt – Ramanujan's Note Books Volumes-1 to 5.

4. G. E. Andrews – The Theory of Partitions, Addison Wesley, 1976.

5. A. K. Agarwal, Padmavathamma, M. V. Subbarao – Partition Theory, Atma Ram & Sons, Chandigarh, 2005.

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE
(An autonomous College of University of Mysuru)
Re-accredited by NAAC with 'A' grade
Ooty road, Mysuru-570 025, Karnataka

ESTD-1964

DEPARTMENT OF MICROBIOLOGY

SYLLABUS

NATIONAL EDUCATION POLICY
FOR
B.Sc. PROGRAMME
Microbiology & Biotechnology

Microbiology & Biochemistry

AND

CHOICE BASED CREDIT SYSTEM

FOR
B.Sc. PROGRAMME
Biochemistry, Microbiology & Biotechnology

Botany, Biochemistry & Microbiology

(W. E. F. 2021 – 2022)

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSURU-25
DEPARTMENT OF MICROBIOLOGY
PROFORMA OF INSTRUCTIONS AND EXAMINATION FOR B.Sc. PROGRAMME IN MICROBIOLOGY (NEP)
DURATION OF THE COURSE: 4YEARS (8SEMESTER)
PROGRAMME: BSc Microbiology & Biotechnology
(2021-22)

BSc Microbiology (Basic / Hons.)

Year	Semester	Course code	Core course		Title of the paper	No. of credits			Total credits	Total hours		Maximum Marks in exam/Assessment			
						L	T	P		Th	Pr		IA(Theory)		Total
													C-1	C-2	
I B.Sc	I	FSA500	DSC-I :Theory	General Microbiology	04	4: 0 : 0			06	56		60	Total -20Marks 10- IA test 10-Assignment	Total -20Marks 10- IA test 10-Seminar	100
		FSA500	DSC-I: Pract-I	General Microbiology	04	0: 0: 2					60	25	10- Pract- IA test	10- Pract- IA test +5 (record)	50
		FSA980	OE-I	Microbial Technology for human welfare	03	3: 0: 0			03	42	-	-	Total -20Marks 10- IA test 10-Assignment	Total -20Marks 10- IA test 10-Seminar	100
			SEC-1	Microbiological methods and Analytical Techniques	01	1 : 0: 0			01	14					100
	II	FSB500	DSC-II: Theory	Microbial biochemistry and physiology	04	4: 0 : 0			06	56		60	Total -20Marks 10- IA test 10-Assignment	Total -20Marks 10- IA test 10-Seminar	100
		FSB500	DSC-II: Pract-II	Microbial biochemistry and physiology	04	0: 0: 2					60	25	10- Pract- IA test	10- Pract- IA test +5 (record)	50
		FSB980	OE-II	Environmental and sanitary Microbiology	03	3: 0: 0			03	42			Total -20Marks 10- IA test 10-Assignment	Total -20Marks 10- IA test 10-Seminar	100

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSURU-25
DEPARTMENT OF MICROBIOLOGY
PROFORMA OF INSTRUCTIONS AND EXAMINATION FOR B.Sc. PROGRAMME IN MICROBIOLOGY (NEP)
DURATION OF THE COURSE: 4YEARS (8SEMESTER)
PROGRAMME: BSc Microbiology & Biochemistry
(2021-22)

BSc Microbiology (Basic / Hons.)

Year	Semester	Course code	Core course		Title of the paper	No. of credits			Total credits	Total hours		Maximum Marks in exam/Assessment			
						L	T	P		Th	Pr		IA(Theory) C-1	IA(Theory) C-2	Total
I B.Sc	I	FSA500	DSC-I :Theory	General Microbiology	04	4: 0 : 0			06	56		60	Total -20Marks 10- IA test 10-Assignment	Total -20Marks 10- IA test 10-Seminar	100
		FSA500	DSC-I: Pract-I	General Microbiology	04	0: 0: 2					60	25	10- Pract- IA test	10- Pract- IA test +5 (record)	50
		FSA980	OE-I	Microbial Technology for human welfare	03	3: 0: 0			03	42	-	-	Total -20Marks 10- IA test 10-Assignment	Total -20Marks 10- IA test 10-Seminar	100
			SEC-1	Microbiological methods and Analytical Techniques	01	1 : 0: 0			01	14					100
	II	FSB500	DSC-II:Theory	Microbial biochemistry and physiology	04	4: 0 : 0			06	56		60	Total -20Marks 10- IA test 10-Assignment	Total -20Marks 10- IA test 10-Seminar	100
		FSB500	DSC-II: Pract-II	Microbial biochemistry and physiology	04	0: 0: 2					60	25	10- Pract- IA test	10- Pract- IA test +5 (record)	50
		FSB980	OE-II	Environmental and sanitary Microbiology	03	3: 0: 0			03	42			Total -20Marks 10- IA test 10-Assignment	Total -20Marks 10- IA test 10-Seminar	100

DEPARTMENT OF MICROBIOLOGY
PROGRAMME: B.Sc., Microbiology & Biotechnology
B.Sc., Microbiology & Biochemistry
PROGRAM OUTCOMES

Competencies need to be acquired by the candidate securing B.Sc (Basic) or B.Sc (Hons)

By the end of the program the students will be able to:

PO1	Knowledge and understanding of concepts of microbiology and its application in pharma, food, agriculture, beverages, nutraceutical industries.
PO2	Understand the distribution, morphology and physiology of microorganisms and demonstrate the skills in aseptic handling of microbes including isolation, identification and maintenance.
PO3	Competent to apply the knowledge gained for conserving the environment and resolving the environmental related issues.
PO4	Learning and practicing professional skills in handling microbes and contaminants in laboratories and production sectors.
PO5	Exploring the microbial world and analyzing the specific benefits and challenges.
PO6	Applying the knowledge acquired to undertake studies and identify specific remedial measures for the challenges in health, agriculture, and food sectors.
PO7	Thorough knowledge and application of good laboratory and good manufacturing practices in microbial quality control.
PO8	Understanding biochemical and physiological aspects of microbes and developing broader perspective to identify innovative solutions for present and future challenges posed by microbes
PO9	Understanding and application of microbial principles in forensic and working knowledge about clinical microbiology.
PO10	Demonstrate the ability to identify ethical issues related to recombinant DNA technology, GMOs, intellectual property rights, biosafety and biohazards.
PO11	Demonstrate the ability to identify key questions in microbiological research, optimize research methods, and analyze outcomes by adopting scientific methods, thereby improving the employability.
PO12	Enhance and demonstrate analytical skills and apply basic computational and statistical techniques in the field of microbiology.

PROGRAMME SPECIFIC OUTCOME

After completing the graduation in the Bachelor of Science the students are able to:

PSO 1	Demonstrate effectively the applications of biochemical and biological sciences
PSO2	Inculcating proficiency in all experimental techniques and methods of analysis
PSO3	Acquire, articulate, retain and demonstrate laboratory safety skills applicable to microbiological research or clinical methods, including accurately reporting observations and analysis
PSO4	Communicate scientific information effectively, especially relating to microbes and their role in ecosystem and health related issues
PSO5	Be knowledgeable in proper procedures and regulations in handling and disposal of chemicals
PSO6	Gain and understanding of biochemical and molecular processes that occur in and between cells to expand understanding of biology

ASSESSMENT

Weight age for assessments (in percentage)

Type of Course	Formative Assessment / IA	Summative Assessment
Theory	**40%**	**60%**
Practical	**50%**	**50%**
Projects	**40%**	**60%**
Experiential Learning (Internships/MOOC/ Swayam etc.)	**40%**	**60%**

Formative Assessment : 40%	
Assessment Occasion/ type	**Weightage in Marks**
C1 = IA -1 + Assignments / Visits	10% + 10% = 20% : 20 Marks
C2 = IA -2 + Seminars / Group Discussion	10% + 10 = 20% : 20 Marks
Total	40% : 40 Marks

Total Marks for each course = 100%
Formative Assesment (C1+C2) = 40%
Semester end examination (C3) = 60%

BSc Microbiology (Basic / Hons.)
Semester 1

Course Title: DSC-1T, MBL 101, General Microbiology	
Total Contact Hours: **56**	Course Credits: **4+2**
Formative Assessment Marks: **40%**	Duration of ESA/Exam: **3 Hrs**
Model Syllabus Authors: **Curriculum Committee**	Summative Assessment Marks: **60%**

Course Outcomes (COs):
At the end of the course the student should be able to:

1. **Thorough knowledge and understanding of concepts of microbiology.**
2. **Learning and practicing professional skills in handling microbes.**
3. **Thorough knowledge and application of good laboratory and good manufacturing practices in microbial quality control.**

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12
1. Thorough knowledge and understanding of concepts of microbiology	✓	✓		✓								
2. Learning and practicing professional skills in handling microbes		✓		✓			✓					
3. Thorough knowledge and application of good laboratory and good manufacturing practices in microbial quality control.		✓		✓			✓					

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark 'X' in the intersection cell if a course outcome addresses a particular program outcome.

BSc Microbiology (Basic / Hons.)

Semester 1

Title of the Courses:

Course 1: DSC-1T: General Microbiology
Course 2: OE 1T: Microbial Technology for Human Welfare
Course 3: SEC 1T: Microbiological Methods and Analytical Techniques

Course 1 : DSC-1T General Microbiology		**Course 2 : OE 1T Microbial Technology for Human Welfare**		**Course 3 : SEC 1T Microbiological Methods and Analytical Techniques**	
Number of Theory Credits	Number of lecture hours/semester	Number of Theory Credits	Number of lecture hours/semester	Number of Theory Credits	Number of lecture hours/semester
4	**56**	**3**	**42**	**1**	**14**

Content of Course 1: Theory: DSC-1T, MBL 101, General Microbiology	**56 Hrs**
Unit – 1: Historical development, major contributions, origin of microorganisms and microscopy	**14Hrs**
Historical development of microbiology -Theory of spontaneous generation, Biogenesis and Abiogenesis. Contributions of Anton Von Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister and Edward Jenner, Alexander Fleming, Martinus Beijirinic, Segei Winogrodsky, Elei Metechnikoff. Contributions of Indian scientists in the field of Microbiology. Fossil evidences of microorganisms. Origin of life, primitive cells and evolution of microorganisms. Microcopy- working principle, construction and operation of simple and compound microscopes.	
Unit – 2: Staining, sterilization and preservation of microorganisms	**14Hrs**
Staining: Nature of strains, principles, mechanism, methods and types of staining- Simple, Differential-Gram staining, Acid fast staining, staining of capsule, cell wall, endospore, inclusion bodies. Sterilization: Principles, types and techniques, Physical and chemical methods. Preservation of microorganisms: Methods of preservation of microorganisms; slant culture, stab culture, soil culture, mineral oil overlaying, glycerol preservation.	
Unit – 3: Types, structure, organisation and reproduction of prokaryotic microorganism	**14Hrs**
Overview of Prokaryotic Cell Structure: Size, shape, arrangement. Diagram of Prokaryotic cell organisation, cell wall structure of Gram positive and negative bacteria, cell membrane; Bacterial and Archaeal, Cytoplasmic matrix- Cytoskeleton, ribosome, inclusion granules: Composition and function. Nuclear Materials – Bacterial chromosomes structure (its differences with the Eukaryotic chromosome); Extra Chromosomal materials. Components external to cell wall- capsule, slime, s- layer, pilli, fimbriae, flagella; structure, motility, chemotaxis. Bacterial Endospore - Examples of spore forming organisms, habitats, function, formation and germination. Reproduction in bacteria and bacterial cell cycle.	

Unit – 4: Types, structure, organisation and reproduction of eukaryotic microorganisms	14Hrs
Over view of eukaryotic cell structure: General structure and types of cells; External cell coverings and cell membrane. Structure and function of Cytoplasmic matrix- cytoskeleton: Structure and function; single Membrane organelles- Endoplasmic reticulum, Golgi complex, Lysosomes, Vesicles and Ribosomes; Double Membrane organelles- Nucleus, Mitochondrion and Chloroplast: Structure and Functions; Peroxisomes; Organelles of motility- Structure and movement of flagella and cilia.	

Course 1: Practical: DSC-1P : General Microbiology

1. Microbiological laboratory standards and safety protocols.
2. Standard aseptic conditions of Microbiological laboratory.
3. Operation and working principles of Light/ Compound microscope.
4. Working principles and operations of basic equipments of microbiological laboratory (Autoclave, Oven, Incubator, pH meter, Spectrophotometer, Colorimeter, Vortex, Magnetic stirrer).
5. Applications of basic microbiological tools (Pipettes, Micropipette, Bunsen burner, Inoculation loop, Spreader).
6. Demonstration and observations of microorganisms from natural sources under light microscope (Algae, Yeast and Protozoa).
7. Demonstration of bacterial motility by hanging drop method.
8. Simple staining.
9. Negative staining.
10. Differential staining - Gram staining.
11. Acid fast staining.
12. Structural staining - Flagella and Capsule.
13. Bacterial endospore staining.
14. Staining of reserved food materials.
15. Staining of fungi by Lactophenol cotton blue.

Text Books / References

1. General Microbiology 1st Edition, 2020 , Linda Bruslind, Oregon State University
2. Prescott, Harley, Klein's Microbiology, J.M. Willey, L.M. Sherwood, C.J. Woolverton, 7th International, edition 2008, McGraw Hill.
3. Foundations in Microbiology, K. P. Talaro, 7th International edition 2009, McGraw Hill.
4. A Textbook of Microbiology, R. C. Dubey and D. K. Maheshwari, 1st edition, 1999, S. Chand & Company Ltd.
5. Brock Biology of Microorganisms, M.T.Madigan, J.M.Martinko, P. V. Dunlap, D. P. Clark- 12th edition, Pearson International edition 2009, Pearson Benjamin Cummings.
6. Microbiology – An Introduction, G. J.Tortora, B. R.Funke, C. L. Case, 10th ed. 2008,Pearson Education.
7. General Microbiology, Stanier, Ingraham et al, 4th and 5th edition 1987, Macmillan education limited.
8. Microbiology- Concepts and Applications, Pelczar Jr,Chan, Krieg, International ed, McGraw Hill.
9. Alexopoulos, C.J., Mims, C.W., and Blackwell, M. 2002. Introductory Mycology. John Wiley and Sons (Asia) Pvt. Ltd. Singapore. 869 pp.
10. Atlas, R.M. 1984. Basic and practical microbiology. Mac Millan Publishers, USA. 987pp.
11. Black, J.G. 2008. Microbiology principles and explorations. 7edn. John Wiley and Sons Inc., New Jersey 846 pp.
12. Pommerville, J.C. Alcamo's Fundamentals of Microbiology. Jones and Bartlett Pub..Sudburry, 835 pp.
13. Schlegel, H.G. 1995.General Microbiology. Cambridge University Press, Cambridge, 655 pp.
14. Toratora, G.J., Funke, B.R. and Case, C.L. 2007. Microbiology 9th ed. Pearson Education Pte. Ltd., San Francisco. 958pp.

COURSE 2: THEORY: OE 1T: MICROBIAL TECHNOLOGY FOR HUMAN WELFARE

Course 2 : OE 1T: Microbial Technology for Human Welfare	**42Hrs**
Unit – 1: Food and Fermentation Microbial Technology	14Hrs
Fermented Foods – Types, Nutritional Values, Advantages and Health Benefits Prebiotics, Probiotics, Synbiotics and Nutraceutical Foods Fermented Products – Alcoholic and nonalcoholic beverages, fermented dairy products, Fruit fermented drinks,	
Unit – 2: Agricultural Microbial Technology	14Hrs
Microbial Fertilizers, Microbial Pesticides, Mushroom Cultivation, Biogas Production	
Unit – 3: Pharmaceutical Microbial Technology	14Hrs
Microbial Drugs – Types and Development of Drug resistance Antibiotics – Types, Functions and Antibiotic Therapy Vaccines – Types, Properties, Functions and Schedules	

COURSE 3: THERORY: SEC 1T

TITLE: MICROBIOLOGICAL METHODS AND ANALYTICAL TECHNIQUES

LEARNING OUTCOMES

- Demonstrate skills as per National Occupational Standards (NOS) of "Lab Technician/ Assistant" Qualification Pack issued by Life Sciences Sector Skill Development Council - LFS/Q0509, Level 3.
- Perform microbiology and analytical techniques. Knowledge about environment, health, and safety (EHS), good laboratory practices (GLP), good manufacturing practices (GMP) and standard operating procedures (SOP)
- Demonstrate professional skills at work, such as decision making, planning, and organizing, Problem solving, analytical thinking, critical thinking, and documentation.

1. Principles which underlies sterilization of culture media, glassware and plastic ware to be used for microbiological work.
2. Principles of a number of analytical instruments which the students have to use during the study and also later as microbiologists for performing various laboratory manipulations.
3. Handling and use of microscopes for the study of microorganisms which are among the basic skills expected from a practicing microbiologist. They also get introduced a variety of modifications in the microscopes for specialized viewing.
4. Several separation techniques which may be required to be handled later as microbiologists.

COURSE 3: THEORY: SEC 1T

SEC 1T : MICROBIOLOGICAL METHODS AND ANALYTICAL TECHNIQUES	14Hrs

DIGITAL SKILLS:

The components of digital skills provided by KSHEC, will be followed accordingly.

Microbiological Skills

Microbiological culture media: Types, Composition, Preparation, Application and storage**;** Ingredients of media, natural and synthetic media, chemically defined media, complex media, selective, differential, indicator, enriched and enrichment media.

Isolation and cultivation of microorganisms: Collection of samples, processing of samples, serial dilution, technique, inoculation of samples, incubation and observations of microbial colonies. Morphological characterization of microorganisms - Colony characteristics, Microscopic characters, biochemical/physiological tests or properties and identification. Subculturing of microorganisms and pure culture techniques. Preservation of microorganisms.

Advanced Microscopic Skills: Different types of microscopes - Phase contrast, Bright Field, Dark Field, Fluorescent, Confocal, Scanning and Transmission Electron Microscopy.

Analytical Skills

Centrifugation, Chromatography and Spectroscopy: Principles, Types, Instrumentation, Operation and applications.

Course 3: Practicals: SEC 1P: Microbiological Methods and Analytical Techniques

1. Preparation of different microbiological culture media
2. Isolation and cultivation of bacteria, actinobacteria, fungi and algae
3. Characterization and identification of bacteria, actinobacteria, fungi and algae – colony characters and microscopic characters
4. Biochemical and physiological tests for identification of bacteria
5. Methods and practices in microbiology lab: MSDS (Material Safety Data Sheet), Good clinical Practices (GCP), Standard Operating Procedure (SOP), Good Laboratory Practices (GLP), Good Manufacturing Practices**.**
6. Usage and maintenance of basic equipment of microbiology lab: Principles, calibrations, and SOPs of balances (Types), pH meter (Types), Autoclaves (Types), Laminar flows and biosafety cabinets, basic Microscopes, homogenizers, stirrers.
7. Procedures for documentation, lab maintenance, repair reporting
8. Separation of mixtures of biomolecules by paper / thin layer chromatography.
9. Demonstration of column packing in column chromatography.

Pedagogy :

The general pedagogy to be followed for theory and practicals are as under. Lecturing, Tutorials, Group/Individual Discussions, Seminars, Assignments, Counseling, Remedial Coaching. Field/Institution/Industrial visits, Hands on training, Case observations, Models/charts preparations, Problem solving mechanism, Demonstrations, Project presentations, Experiential documentation and Innovative methods.

Active learning as per LSSSDC (NSDC) LFS/Q0509 guidelines, at skill training Level 3. Case studies about application of microbial biomolecules in various industries. Seminar on topics of microbial biochemistry

Formative Assessment : 40%	
Assessment Occasion/ type	**Weightage in Marks**
C1 = IA -1 + Assignments / Visits	10% + 10% = 20% : 20 Marks
C2 = IA -2 + Seminars / Group Discussion	10% + 10 = 20% : 20 Marks
Total	40% : 40 Marks

BSc Microbiology (Basic / Hons.)
Semester 2

Title of the Courses:

Course 1: DSC-2T: Microbial Biochemistry and Physiology Course 2: OE- 2T: Environmental and Sanitary Microbiology

Course 1: DSC-2T, MBL 102, Microbial Biochemistry and Physiology		**Course 2: OE- 2T, MBL 302, Environmental and Sanitary Microbiology**	
Number of Theory Credits	Number of lecture hours/semester	Number of Theory Credits	Number of lecture hours/semester
4	**56**	**3**	**42**

Content of Course: DSC-2T: Microbial Biochemistry and Physiology	**56 Hrs**
Unit - 1 Biochemical Concepts	**14Hrs**
Basic Biochemical Concepts: Major elements of life and their primary characteristics, atomic bonds and molecules – bonding properties of carbon, chemical bonds- covalent and non covalent, Hydrogen bonds and Vander Waal Forces. Biological Solvents: Structure and properties of water molecule, Water as an universal solvent, polarity, hydrophilic and hydrophobic interactions, properties of water, Acids, bases, electrolytes, hydrogen ion concentration, pH, buffers and physiological buffer system, Handerson – Hasselbatch equation.	
Unit - 2 Macromolecules – Types, Structure and Properties	**14Hrs**
Carbohydrates: Definition, classification, structure and properties. Amino acids and proteins: Definition, structure, classification and properties of amino acids, Structure and classification of proteins. Lipids and Fats: Definition, classification, structure, properties and importance of lipids. Porphyrins and Vitamins: Definition, structure, properties and importance of chlorophyll, cytochrome and hemoglobin.	
Unit – 3 Microbial Physiology	**14Hrs**
Microbial Growth: Definition of growth, Mathematical expression, Growth curve, phases of growth, calculation of generation time and specific growth rate. Synchronous growth, Continuous growth (chemostat and turbidostat), Diauxic growth. Measurement of Growth: Direct Microscopic count - Haemocytometer; Viable count, Membrane filtration; Electronic Counting; Measurement of cell mass; Turbidity measurements-Nephelometer and spectrophotometer techniques;Measurements of cell constituents. Growth Yield (definition of terms). Influence of environmental factors on growth. Microbial growth in natural environments. viable non-culturable organisms. Quorum sensing. **Microbial Nutrition**: Microbial nutrients, Classification of organisms based on carbon source, energy source and electron source, Macro and micronutrients. **Membrane Transport**: Structure and organization of biological membranes, Types of Cellular transport, Passive, Facilitated, Active, Group Translocation, Membrane bound and binding protein transport system, Carrier models, Liposomes, Ion transduction Na K^+, ATPase.	
Unit – 4: Microbial Physiology- Bioenergetics, Microbial Respiration, Microbial Photosynthesis	**14Hrs**

Bioenergetics: Free energy, Enthalpy, Entropy, Classification of high energy compounds, Oxidation reduction reactions, equilibrium constant, Redox potential, Law of thermodynamics. Microbial Respiration:Respiratory electron transport chain in bacteria, oxidation – reduction reactions, protein translocation, oxidative and substrate level phosphorylation – inhibitors and mechanism, chemiosmotic coupling. Fermentation reactions (homo and hetero) Microbial Photosynthesis: Light reaction:Light harvesting pigments Photophosphorylation, CO2 fixation pathways: Calvin cycle, CODH pathway, Reductive TCA pathway.	

Course 1: Practicals: DSC-2P: Microbial Biochemistry and Physiology

1. Preparation of Solution: Normal and Molar solutions
2. Calibration of pH meter and determination of pH of natural samples
3. Preparation of Buffer Solutions
4. Qualitative determination and identification of Carbohydrates
5. Qualitative determination and identification of Proteins
6. Qualitative determination and identification of Amino Acids
7. Qualitative determination and identification of Fatty Acids
8. Quantitative estimation of Reducing Sugur by DNS method
9. Quantitative estimation of Proteins by Biuret and Lowry's method
10. Determination of lipid saponification values of fats and iodine number of fatty acids
11. Determination of bacterial growth by spectrophotometric method & calculation of generation time
12. Effect of pH, temperature and Salt concentration on bacterial growth
13. Effect of Salt concentration on bacterial growth
14. Effect of Temperature on bacterial growth
15. Demonstration of aerobic and anaerobic respiration in microbes

Text Books / References

1. Cohen, Georges N, 2014, Microbial Biochemistry, Springer Netherlands.
2. Felix Franks, 1993; Protein Biotechnology, Humana Press, New Jersey.
3. Stryer L, 1995; Biochemistry, Freeman and Company, New York.
4. Voet & Voet, 1995; Biochemistry, John Wiley and Sons, New York.
5. Nelson and Cox, 2000; Lehninger Principles of Biochemistry, Elsevier Publ.
6. Harper, 1999; Biochemistry, McGraw Hill, New York.
7. Palmer T. (2001), Biochemistry, Biotechnology and Clinical Chemistry, Harwood Publication, Chichester.
8. Boyer R. (2002), Concepts in Biochemistry 2nd Edition, Brook/ Cole, Australia.
9. Moat A. G., Foster J.W. Spector. (2004), Microbial Physiology 4th Edition Panama Book Distributors.
10. Caldwell, D. R. (1995) – Microbial Physiology and Metabolism. Brown Publishers.
11. Lodish H, T. Baltimore, A. Berck B.L. Zipursky, P. Mastsydaire and J. Darnell. (2004) – Molecular Cell Biology, Scientific American Books, Inc. Newyork.

Course 2: Theory: OE- 2T: Environmental and Sanitary Microbiology

Course 2 :Theory: OE- 2T:Environmental and Sanitary Microbiology	**42 Hrs**
Unit – 1: Soil and Air Microbiology	**14 Hrs**
Soil and Air as a major component of environment. Types, properties and uses of soil and air. Distribution of microorganisms in soil and air. Major types of beneficial microorganisms in soil. Major types of harmful microorganisms in soil	
Unit – 2: Water Microbiology	**14 Hrs**
Water as a major component of environment. Types, properties and uses of water. Microorganisms of different water bodies. Standard qualities of drinking water	
Unit – 3: Sanitary Microbiology	**14 Hrs**
Public health hygiene and communicable diseases. Survey and surveillance of microbial infections. Airborne microbial infections, waterborne microbial infections, Food borne microbial infections. Epidemiology of microbial infections, their detection and control.	

Text Books / References

1. Diana Marco, 2019, Microbial Ecology: Current advances from Genomics, Metagenomics and other omics, Caister Academic Press.
2. Prescott, Harley, Klein's Microbiology, J.M. Willey, L.M. Sherwood, C.J. Woolverton, 7th International, edition 2008, McGraw Hill.
3. Foundations in Microbiology, K. P. Talaro, 7th International edition 2009, McGraw Hill.
4. A Textbook of Microbiology, R. C. Dubey and D. K. Maheshwari, 1st edition, 1999, S. Chand & Company Ltd.
5. Brock Biology of Microorganisms, M.T.Madigan, J.M.Martinko, P. V. Dunlap, D. P. Clark- 12th edition, Pearson International edition 2009, Pearson Benjamin Cummings.
6. Microbiology – An Introduction, G. J.Tortora, B. R.Funke, C. L. Case, 10th ed. 2008,Pearson Education.
7. General Microbiology, Stanier, Ingraham et al, 4th and 5th edition 1987, Macmillan education limited.
8. Microbiology- Concepts and Applications, Pelczar Jr,Chan, Krieg, International ed, McGraw Hill.
9. Alexopoulos, C.J., Mims, C.W., and Blackwell, M. 2002. Introductory Mycology. John Wiley and Sons (Asia) Pvt. Ltd. Singapore. 869 pp.
10. Atlas, R.M. 1984. Basic and practical microbiology. Mac Millan Publishers, USA. 987pp.
11. Black, J.G. 2008. Microbiology principles and explorations. 7edn. John Wiley and Sons Inc., New Jersey 846 pp.
12. Pommerville, J.C. Alcamo's Fundamentals of Microbiology. Jones and Bartlett Pub..Sudburry, 835 pp.
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The general pedagogy to be followed for theory and practicals are as under.
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Formative Assessment : 40%	
Assessment Occasion/ type	**Weightage in Marks**
C1 = IA -1 + Assignments / Visits	10% + 10% = 20% : 20 Marks
C2 = IA -2 + Seminars / Group Discussion	10% + 10 = 20% : 20 Marks
Total	40% : 40 Marks

GENERAL PATTERN OF THEORY EXAMINATION

B.Sc MICROBIOLOGY

Duration: 3 Hours **Maximum: 60 Marks**

Note: *All questions are compulsory*
Draw neat labeled diagrams wherever necessary

QNo. I Answer any EIGHT of the following: **2X8=16**

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

QNo. II Answer any SIX of the following: **4X6=24**

11.
12.
13.
14.
15.
16.
17.
18.

QNo. III Answer any TWO of the following : **10X2=20**

19.
20.
21.
22.

PATTERN OF PRACTICAL EXAMINATION

Practical examination – B. Sc MICROBIOLOGY

Duration: 3 hours **Max. Marks: 25**

Q. 1	Major question	08 Marks
Q. 2	Minor question	05 Marks
Q. 3	Identify and comment	2X4 = 08Marks
Q. 4	Viva-voce	04 Marks

PATTERN OF FORMATIVE ASSESMENT - PRACTICALS

Max. Marks: 25

1	IA 1	05 Marks
2	IA 2	05 Marks
3	Assignment/ Field Visit Reports	10Marks
4	Record	05 Marks

SCHEME OF THEORY EXAMINATION

I B.Sc., I SEMESTER

DSC-I: GENERAL MICROBIOLOGY

Times:3hrs **Max Marks:60**

Question Paper to be set for total of 92 marks including choices

UNITS	2 mark questions	4mark questions	10 mark questions	Total Marks
Unit – 1: Historical development, major contributions, origin of microorganisms and microscopy	2	2	1	22
Unit – 2: Staining, sterilization and preservation of microorganisms	2	2	1	22
Unit – 3: Types, structure, organisation and reproduction of prokaryotic microorganism	3	2	1	24
Unit – 4: Types, structure, organisation and reproduction of eukaryotic microorganisms	3	2	1	24

I Main: 2x10=20Marks
II Main: 4x8= 32Marks
III Main: 4x10=40Marks

SCHEME OF PRACTICAL EXAMINATION

I B.Sc., I SEMESTER

PRACTICAL-I: GENERAL MICROBIOLOGY

Time: 3hours **Max marks: 25**

I. Stain the given material **A** by…….method. Write the principle, procedure and leave the preparation for evaluation
(Simple staining/Negative staining/Gram-staining/Cell wall/ Endospore)
(Preparation-4 marks; Principle-2 ,Procedure-1& result-1 marks) 08

II. Prepare a temporary slide **B** by …… method. Write the principle, procedure and leave the preparation for evaluation
(Wet mounting of Fungi/Hanging drop/Microbes from natural sources)
(Preparation-2 marks; Principle-1 ,Procedure- 1& result-1 marks) 05

III. Identify the materials **C, D, E** and F with labelled diagrams and reasons 2X4=08
(Microscopes/ Basic equipments / Basic Microbiological tools as per syllabus)
(Identification -1mark; diagram and reasons-1mark)

IV. Viva-voce 05

SCHEME OF THEORY EXAMINATION

I B.Sc., II SEMESTER

DSC-I: MICROBIAL BIOCHEMISTRY AND PHYSIOLOGY

Times:3hrs **Max Marks:60**

Question Paper to be set for total of 92 marks including choices

UNITS	2 mark questions	4mark questions	10 mark questions	Total Marks
Unit – 1 : Biochemical concepts	2	2	1	22
Unit – 2: Macromolecules-Types, Structure and properties	2	2	1	22
Unit – 3: Microbial physiology	3	2	1	24
Unit – 4: Microbial physiology-Bioenergitics,Microbialrespiration Microbial photosynthesis	3	2	1	24

I Main: 2x10=20Marks
II Main: 4x8= 32Marks
III Main: 4x10=40Marks

SCHEME OF PRACTICAL EXAMINATION

I B.Sc., I SEMESTER

PRACTICAL-I: GENERAL MICROBIOLOGY

Time: 3hours **Max marks: 25**

I. Demonstrate the experiment **A**, giving principle and procedure. Record the results.
(Effect of temperature on growth of microorganisms/Effect of pH on the growth of microorganisms /Effect of salt concentration on growth of microorganism)
(Demonstration-4marks; principle -2mark; procedure -1marks; result-1mark) 08

II. Perform/conduct the experiment **B,** giving principle and procedure. Record the results. 05
(Demonstration-2marks; principle -1mark; procedure -1marks; result-1mark)

III. Identify the materials **C, D, E** and F with labelled diagrams and reasons 2X4=08
(Normal /Molar solutions,pH meter,Spectrophotometer/Demonstration of aerobic and anaerobic Respiration, Effect of temperature on growth of microorganisms/Effect of pH on the growth of microorganisms /Effect of salt concentration on growth of microorganism)
(Identification -1mark; diagram and reasons-1mark)

IV. Viva-voce 05

SCHEME OF THEORY EXAMINATION

I B.Sc., II SEMESTER

OE-I: MICROBIAL TECHNOLOGY FOR HUMAN WELFARE

Times:3hrs **Max Marks:60**

Question Paper to be set for total of 92 marks including choices

UNITS	2 mark questions	4mark questions	10 mark questions	Total Marks
Unit – 1 : Food and Fermentation Microbial technology	3	2	2	34
Unit – 2: Agricultural Microbial technology	3	3	1	28
Unit – 3: Pharmaceutical Microbial Technology	4	3	1	30

I Main: 2x10=20Marks
II Main: 4x8= 32Marks
III Main: 4x10=40Marks

SCHEME OF THEORY EXAMINATION

I B.Sc., II SEMESTER

OE-II: ENVIRONMENTAL AND SANITARY MICROBIOLOGY

Times: 3hrs **Max Marks:60**

Question Paper to be set for total of 92 marks including choices

UNITS	2 mark questions	4mark questions	10 mark questions	Total Marks
Unit – 1 : Soil and Air Microbiology	3	2	2	34
Unit – 2: Water Microbiology	3	3	1	28
Unit – 3: Sanitary Microbiology	4	3	1	30

I Main: 2x10=20Marks
II Main: 4x8= 32Marks
III Main: 4x10=40Marks

Approved list of Paper setters and Valuers

Sl No.	Name	College address
1	Dr..M .Seema	Chairperson, Dept. of Microbiology JSS College, Ooty road, Mysore
2	H.P.Spoorthy	Assistant prof. Dept. of Microbiology JSS College, Ooty road, Mysore
3	Dr.S.Mahadevamurthy	Associate Prof & HOD Dept. of Microbiology Yuvaraja's college Mysore.
4	Dr.Syeda Kauser Fathima	Associate Prof. of Microbiology Maharani's Science College for women JLB road Mysore.
5	Dr. H.S. Jayanth.	Asso.Prof.of Microbiology Dept. of Microbiology Yuvaraja's college Mysore.
6	Dr.Uma Maheshwari	Assistant prof. JSS University, JSSAHER, Mysuru
7	Sri. M. Girish	Assistant prof. Dept. of Microbiology JSS College for Women Saraswathipuram,Mysore
8	Dr. P.K.Maheshwar	Assistant Prof. Dept. of Microbiology Yuvaraja's college,Mysore.
9	Smt. M.S.Shobha	Assistant Prof, Dept. of Microbiology Maharani's Science College Mysore
10	Sri. R.A. Manjunath	Assistant Prof. Dept. of Microbiology Saradavilas College,Mysore
11	Dr.M.P. Ragavendra	Assistant Prof. Dept. of Microbiology Maharani's Science College,Mysore
12	Dr.K.Girish	Assistant Prof. Dept. of Microbiology Maharani's Science College, Mysore
13	Sri. G.S. Siddegowda	Assistant Prof. Dept. of Microbiology

		Maharani's Science College Mysore
14	Dr.N.S.Devaki	Assistant Prof. Dept. of Molecular Biology Yuvaraja's College , Mysore
15	Syeda Farahna Parveen	Assistant Prof. Dept. of Microbiology St.Philomina's College, Mysore
16	Smt. Vanitha	Assistant Prof. Dept. of Microbiology Maharani's Science College,Mysore
17	Smt. Revanamba	Assistant Prof. Dept. of Microbiology Maharani's Science College,Mysore
18	Mahadevaprasad	Assistant prof. Dept. of Microbiology JSS College for Women Saraswathipuram,Mysore
19	Dr.Nagalambika	Assistant prof. JSS University, JSSAHER, Mysuru
20	RajaRajeshwari.R	Assistant prof. Dept. of Microbiology SDM College JLB Road,Mysuru
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22	Shruthi Prakash	Assistant Prof. Dept. of Microbiology Mahajana's Science College,Mysuru
23	Athiya sultan	Assistant prof. Dept. of Microbiology SDM College JLB Road,Mysuru
24	C.Poornima Devi	Assistant Prof. Dept. of Microbiology Yuvaraja's college,Mysore
25	Dr.Rakshith	Assistant Prof. Dept. of Microbiology Yuvaraja's college,Mysore
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27	Niveditha Prakash	Assistant prof. Dept. of Microbiology JSS College for Women Saraswathipuram,Mysore
28	Dr.K.Sumana	Assistant prof. JSS University, JSSAHER ,Mysuru
	Samjna.S.R	Assistant Prof.

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSURU-25
DEPARTMENT OF MICROBIOLOGY
PROFORMA OF INSTRUCTIONS AND EXAMINATION FOR B.Sc. PROGRAMME IN MICROBIOLOGY (CBCS)
DURATION OF THE COURSE: 3YEARS (6SEMESTER)
PROGRAMME:BScBMBt, PROGRAMME CODE:BSc06 (2019-20)

Year	Semester	Course code & Core course	Title of the paper	Lecture + Practicals hours per week	No. of credits			Total credits	Maximum Marks in exam/Assessment					Exam Duration
					L	T	P		Total hours	Max. Marks	IA(Theory)		Total	
											C-1	C-2		
II B.Sc	III	DSC-III:Theory	Microbial Physiology and Metabolism	04	4	0	0	06	60	70	15	15	100	3h
		DSC-III: PractIII	Microbial Physiology and Metabolism Based on theory	04	0	0	2		60	35	7.5	7.5	50	3h
	IV	DSC-IV: Theory	Microbial Genetics and Genetic Engineering	04	4	0	0	06	60	70	15	15	100	3h
		DSC-IV: Pract-IV	Microbial Genetics and Genetic Engineering Based on theory	04	0	0	2		60	35	7.5	7.5	50	3h
III B.Sc.	V	DSE: Theory	No. of courses:1 DSE- A: Environmental Microbiology DSE-B: Agricultural Microbiology	04	4	0	0	06	60	70	15	15	100	3h
		DSE Pract-V	Based on theory	04	0	0	2		60	35	7.5	7.5	50	3h
	VI	DSE : Theory	No. of courses:1 DSE-A:Industrial ,Food and Medical Microbiology DSE -B : Microbial biotechnology and Bioinformatics	04	4	0	0	06	60	70	15	15	100	3h
		DSE Pract-VI	Based on theory	04	0	0	2		60	35	7.5	7.5	50	3h
		SEC	No. of courses:1 SEC-A : Microbial diagnosis in health clinics SEC-B: Microbial analysis of Air and water	02	2	0	0	02	30	35	7.5	7.5	50	2h

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSURU-25
DEPARTMENT OF MICROBIOLOGY
PROFORMA OF INSTRUCTIONS AND EXAMINATION FOR B.Sc. PROGRAMME IN MICROBIOLOGY (CBCS)
DURATION OF THE COURSE: 3YEARS (6SEMESTER)
PROGRAMME:BScBBM, PROGRAMME CODE:BSc07 (2019-20)

Year	Semester	Course code & Core course	Title of the paper	Lecture + Practicals hours per week	No. of credits			Total credits	Maximum Marks in exam/Assessment					Exam Duration
					L	T	P		Total hours	Max. Marks	IA(Theory)		Total	
											C-1	C-2		
II B.Sc	III	DSC-III:Theory	Microbial Physiology and Metabolism	04	4	0	0	06	60	70	15	15	100	3h
		DSC-III: PractIII	Microbial Physiology and Metabolism Based on theory	04	0	0	2		60	35	7.5	7.5	50	3h
	IV	DSC-IV: Theory	Microbial Genetics and Genetic Engineering	04	4	0	0	06	60	70	15	15	100	3h
		DSC-IV: Pract-IV	Microbial Genetics and Genetic Engineering Based on theory	04	0	0	2		60	35	7.5	7.5	50	3h
III B.Sc.	V	DSE: Theory	No. of courses:1 DSE- A: Environmental Microbiology DSE-B: Agricultural Microbiology	04	4	0	0	06	60	70	15	15	100	3h
		DSE Pract-V	Based on theory	04	0	0	2		60	35	7.5	7.5	50	3h
	VI	DSE : Theory	No. of courses:1 DSE-A:Industrial ,Food and Medical Microbiology DSE -B : Microbial biotechnology and Bioinformatics	04	4	0	0	06	60	70	15	15	100	3h
		DSE Pract-VI	Based on theory	04	0	0	2		60	35	7.5	7.5	50	3h
		SEC	No. of courses:1 SEC-A : Microbial diagnosis in health clinics SEC-B: Microbial analysis of Air and water	02	2	0	0	02	30	35	7.5	7.5	50	2h

DEPARTMENT OF MICROBIOLOGY
PROGRAMME: BSc BMBT
PROGRAMME CODE: BSC06

PROGRAMME OUTCOMES: B.Sc., BMBT

After completing the graduation in the Bachelor of Science the students are able to:

PO1. Demonstrate the ability to justify and explain their thinking and/or approach, both written and oral

PO2. Develop state-of-the-art laboratory skills and professional communication skills

PO3. Apply the scientific method to design, execute, and analyze an experiment, to explain their scientific procedures and their experimental observations

PO4. Demonstrate an understanding of fundamental biochemical principles, structure and biological function

PO5. Work as a laboratory technician, biochemists or medical scientist

PO6. Describe/ explain the processes used by microorganisms for their replication, survival, and interaction with their environment and host populations

PO8. Explain the theoretical basis of the tools, technologies and methods common to microbiology

PO9. Design and develop solution to Biotechnology problems by applying appropriate tools while keeping in mind safety factor for environment & society

PO11. Create, select, and apply appropriate techniques, resources, and modern tools with an Understanding of the limitations

PO12. Support biotechnology research activity with strong technical background knowledge

PROGRAMME SPECIFIC OUTCOME

After completing the graduation in the Bachelor of Science the students are able to;

PSO 1: Gain and understand biochemical and molecular processes that occur in and between cells to expand understanding of biology

PSO2: Communicate scientific information effectively, especially relating to microbes and their role in ecosystem and health related issues

PSO3: Acquire, articulate, retain and demonstrate laboratory safety skills applicable to microbiological research or clinical methods

PSO4: Demonstrate effectively the applications of biochemical and biological sciences

PSO5: Decide and apply appropriate tools and techniques in biotechnological manipulation

PSO6: Justify societal, health, safety and legal issues and understand his or her responsibilities in biotechnological practices

PROGRAMME: BSc BBM
PROGRAMME CODE: BSC07
PROGRAMME OUTCOMES: B.Sc., BBM

After completing the graduation in the Bachelor of Science the students are able to:

PO1. Identify the taxonomic position of plants using principles and methods of nomenclature and classification in Botany

PO2. Understand the impact of the plant diversity in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

PO3. Use interdisciplinary approaches with quantitative skills to work on biological problems

PO4. Demonstrate the ability to justify and explain their thinking and/or approach, both written and oral

PO5. Develop state-of-the-art laboratory and professional communication skills

PO6. Apply the scientific method to design, execute, and analyze an experiment and also to explain their scientific procedures as well as their experimental observations

PO7. Demonstrate an understanding of fundamental biochemical principles, structure and biological function

PO8. Work as a laboratory technician, biochemists or medical scientist

PO10. Describe/ explain the processes used by microorganisms for their replication, survival, and interaction with their environment, hosts, and host populations

PO11. Explain the theoretical basis of the tools, technologies and methods common to microbiology

PROGRAMME SPECIFIC OUTCOME

After completing the graduation in the Bachelor of Science the students are able to;

PSO 1: Demonstrate effectively the applications of biochemical and biological sciences

PSO2: Inculcating proficiency in all experimental techniques and methods of analysis

PSO3: Acquire, articulate, retain and demonstrate laboratory safety skills applicable to microbiological research or clinical methods, including accurately reporting observations and analysis

PSO4: Communicate scientific information effectively, especially relating to microbes and their role in ecosystem and health related issues

PSO5: Be knowledgeable in proper procedures and regulations in handling and disposal of chemicals

PSO6: Gain and understanding of biochemical and molecular processes that occur in and between cells to expand understanding of biology

II B.Sc., III SEMESTER

DSC-III: MICROBIAL PHYSIOLOGY AND METABOLISM

TOTAL HOURS: 60hrs (4hrs/week) **CREDITS: 4**

COURSE OUTCOME:

After successful completion of the course students are able to:

CO1. Inculcate the knowledge regarding microbial growth, functions, physiology and metabolism

CO2. Know the microbial growth in response to environmental factors

CO3. Get equipped with various methods of bacterial growth measurement

CO4. Know about the biological nitrogen fixation

CO5. Knowledge of properties, structure, function of enzymes, enzyme kinetics and their regulation

UNIT I **No. of Hours: 15**

MICROBIAL NUTRITION

A. Classification of microorganisms based on energy- Phototroph and Chemotroph, Electron- Lithotroph and Organotroph and Carbon source- Autotroph and Heterotroph
Major nutritional type of Microorganisms: Chemolithoautotroph, Chemolithoheterotroph, Chemoheterotroph, Chemolithotroph, Photolithoautotroph and Photoorganoheterotroph.

B. Nutritional requirements of Microorganisms. Elementary nutrients: Carbon, nitrogen, phosphorous, sulphur, oxygen and energy sources. Trace elements: Vitamins and Growth factors.

C. **Uptake of nutrients: Diffusion- Simple and Facilitated, Active transport (use of Proton**
Motive force, ATP: ABC transporter), Group translocation, Iron uptake**.**

MICROBIAL GROWTH

A. Definition, Growth rate and generation time. The growth curve in batch culture - Phases of growth and their significance. Diauxic growth.

B. Microbial growth in response to environment -Temperature (psychrophiles, mesophiles, thermophiles, extremophiles, thermodurics, psychrotrophs), pH (acidophiles, alkaliphiles, neutophiles), solute and water activity (halophiles, xerophiles, osmophilic), Oxygen (aerobic, anaerobic, microaerophilic, facultative aerobe, facultative anaerobe) and barophilic.

D. Measurement of growth by cell number (Haemocytometer) and cell mass (Turbidometer).

E. Batch culture and continuous culture of microorganisms – Chemostat, Turbidostat. Synchronization of cell division.

UNIT II **No. of Hours: 15**

METABOLISM

A. Microbial Enzymes: Definition, Nomenclature, Classification, Properties, Mode and Mechanism of enzyme action, Factors effecting enzyme action, Enzyme regulation, Inhibition: Competitive and Noncompetitive and Allosteric enzymes, their importance. Cofactors and Coenzymes.

B. Nitrogen metabolism: Biological N_2 Fixation-Symbiotic and asymbiotic N_2 Fixation, nodule formation, bacteroids, Leg haemoglobin in Nitrogen fixation, Mechanism and

Biochemistry of Nitrogen fixation, Role of Nitrogenase and Hydrogenase in Nitrogen fixation. Nitrogen assimilation**.**

C. Lipid metabolism: Breakdown of lipids by microorganisms, beta-oxidation of fatty acids.

UNIT III No. of Hours: 15

CHEMOHETEROTROPHIC METABOLISM

A. Aerobic respiration: Concept of respiration: aerobic, anaerobic respiration and Fermentation. Ultra structure of Mitochondrion, Sugar degradation pathways i.e. EMP, ED, Pentose phosphate pathway, Formation of acetyl CoA from pyruvate, TCA cycle, Electron transport system and Oxidative phosphorylation**.**

B. Anaerobic respiration and Fermentation

Anaerobic respiration with special reference to dissimilatory nitrate reduction (Denitrification; nitrate /nitrite and nitrate/ammonia respiration; fermentative nitrate reduction). Fermentation - Alcohol fermentation and Pasteur effect. Lactate fermentation (homofermentative and heterofermentative pathways).

UNIT IV No. of Hours: 15

CHEMOLITHOTROPHIC AND PHOTOTROPHIC METABOLISM

A. Introduction to aerobic and anaerobic chemolithotrophy with an example each. Hydrogen oxidation (definition and reaction) and methanogenesis (definition and reaction)

B. Photosynthesis: Definition, Photosynthetic microorganisms, Anoxygenic and Oxygenic photosynthesis, Light as a source of energy, Pigments of photosynthetic bacteria and photosynthetic apparatus in prokaryotes and eukaryotes. Mechanism of photosynthesis in bacteria. Comparison of photosynthesis in bacteria and eukaryotes.

II B.Sc., III SEMESTER

DSC-III: MICROBIAL PHYSIOLOGY AND METABOLISM

PRACTICAL

TOTAL HOURS: 60hrs (4hrs/week) **CREDITS: 2**

1. Effect of temperature on growth of microorganisms.
2. Effect of pH on growth of microorganisms.
3. Effect of carbon and nitrogen sources on growth of *E.coli*
4. Effect of salt on growth of *E. coli*
5. Study and plot the growth curve of *E. coli* by turbidometric method
6. Measurement of growth by cell number using Haemocytometer.
7. Study of bacteroids from root nodules.
8. Production of ammonia from organic compounds- Ammonification.
9. Acid and gas production from carbohydrates- Demonstration of fermentation of lactose
10. Starch hydrolysis.
11. Gelatin hydrolysis.
12. Detection of Catalase production by microorganisms.
13. Urease test
14. Isolation and culturing of photosynthetic bacteria
15. Demonstration of fermentation of glucose using Kuhne's fermentation vessel.

REFERENCES:

1. Becker WM, Kleinsmith LJ, Hardin J and Bertoni GP (2009) The World of the Cell, 7th edition, Pearson Benjamin Cummings Publishing, San Francisco
2. Brock T. D. and Madigan M.T., Biology of Microoragnisms, Prentice hall of India Pvt. Ltd, New Delhi.
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4. Gardner EJ, Simmons MJ, Snustad DP (2008). Principles of Genetics. 8th Ed. Wiley-India
5. Gottschalk G. (1986). Bacterial Metabolism. 2nd edition. Springer Verlag
6. Karp G (2010). Cell and Molecular Biology: Concepts and Experiments, 6th edition, John Wiley & Sons. Inc.
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8. Lansing M. Prescott,John P.Harley,Donald A.klein, Microbiology,5th ed. WCB Mc Graw Hill, New york.
9. Madigan MT, and Martinko JM (2014). Brock Biology of Microorganisms. 14th edition. Prentice Hall International Inc.
10. Moat AG and Foster JW. (2002). Microbial Physiology. 4th edition. John Wiley & Sons
11. Nelson David L and Cox Michael M., Lehninger, Principles of Biochemistry, Macmillan Press, Worth Publishers, New Delhi.
12. Reddy SR and Reddy SM. (2005). Microbial Physiology. Scientific Publishers India
13. Sambrook J and Russell DW. (2001). Molecular Cloning: A Laboratory Manual. 4th Edition, Cold Spring Harbour Laboratory press.
14. Stanier RY, Ingrahm JI, Wheelis ML and Painter PR. (1987). General Microbiology. 5th edition, McMillan Press.
15. Willey JM, Sherwood LM, and Woolverton CJ. (2013). Prescott's Microbiology. 9th edition. McGraw Hill Higher Education.

II B.Sc., IV SEMESTER

DSC-IV: MICROBIAL GENETICS AND GENETIC ENGINEERING

TOTAL HOURS: 60hrs (4hrs/week) **CREDITS: 4**

COURSE OUTCOME:

After successful completion of the course students are able to:

CO1. Know genetics of microorganisms and recombinant DNA technology used in microbiological research

CO2. Know the terms and terminologies related to molecular biology and microbial genetics

CO3. Understand the properties, structure and function of genes in microorganisms

CO4. Conceptualize knowledge about DNA and RNA as a genetic material, enzymology, and replication strategies

CO5. Know the importance of genetic code and Recombination

CO6. The concept of recombination and gene transfer mechanisms

CO7. Understand techniques, social and ethical issues concerning genetic engineering

CO8. Applications of genetic engineering in various fields

UNIT: I **No. of Hours: 15**

MICROBIAL GENETICS

A. History and development of genetics. Chromosomes: Chromosome number, Morphology, Karyotype and Idiogram. Chemical composition. Prokaryotic and Eukaryotic chromosomal organization

Cell division: Mitosis, Meiosis and Cell cycle in brief.

B. a. Recombination in bacteria: Transformation, Transduction (types) and Conjugation process.

b. Extra-chromosomal genetic elements and their importance. Types of plasmids – F plasmid, R Plasmids, colicinogenic plasmids, Ti plasmids, linear plasmids, yeast- 2 µ plasmid.

c. Prokaryotic and Eukaryotic transposable elements. Transposition

d. Chemical basis of heredity: Evidence for DNA (Griffith experiment and Hershey and chase experiment) and RNA as genetic material (Fraenkel-Conrat's experiment).

e. DNA Structure: Miescher to Watson and Crick- historic perspective, Chemistry of nucleic acids. Watson and Crick model of DNA, Types of DNA, denaturation and renaturation . Organization of DNA: Prokaryotes, Eukaryotes and Viruses. RNA Structure and function. Organelle DNA -- mitochondria and chloroplast DNA.

UNIT-II **No. of Hours: 15**

MOLECULAR GENETICS

A. DNA Replication –Types, Modes and mechanism of DNA replication by semiconservative method, Replication in Prokaryotes (Cairn's model). Mechanism of

DNA replication: Enzymes and proteins involved in DNA replication –DNA polymerases, DNA ligase, primase, telomerase – for replication of linear ends .

B. Genetic code – features, Wobble hypothesis and evolution of genetic code.
Protein synthesis – Transcription and Translation in prokaryotes.
Regulation of gene expression in prokaryotes (Lac operon concept).

C. Gene mutation: Types of mutations. Mutagenic agents: Physical and chemical mutagens. Significance of mutations.
DNA damage and repair: Photo reactivation and SOS repair

UNIT -III **No. of Hours: 15**

GENETIC ENGINEERING

A. a. Genetic engineering: Milestones in genetic engineering and biotechnology. Cloning tools; restriction modification systems: types I,II and III. mode of action, nomenclature, applications of type II restriction enzymes in genetic engineering
b. DNA modifying enzymes and their applications: DNA polymerases, terminal deoxynucleotidyl transferase, kinases and phosphatases, and DNA ligases
c. Cloning vectors –1. Cloning plasmids (pBR 322 and pUC 18). 2. Viruses as cloning vehicles (Lambda DNA, M13). 3. Hybrid vectors (Cosmid, YAC).
d. Cloning host (*E. coli*) **.**

B. Methods in Molecular cloning: Transformation of DNA-Calcium chloride method. Gene delivery-Microinjection, Electroporation, Biolistic method (gene gun), *Agrobacterium*- mediated delivery.

C. Screening and detection of transformants: Blue white selection, replica plate technique and antibiotic resistance.

UNIT –IV **No. of Hours: 15**

TECHNIQUES IN GENETIC ENGINEERING

A. a. Gene cloning: DNA isolation (Phenol-Chloroform method). DNA separation by Gel electrophoresis: Agarose gel – principle and method, Transformation methods.
b. DNA libraries: Brief account of genomic library -application
c. Blotting – Southern and Western.
d. Gene screening and Isolation – Nucleic acid hybridization method (DNA) – Colony and Plaque hybridization.
e. DNA sequencing: Brief account of Sanger's dideoxynucleotide synthetic method.
f. DNA amplification – Principle of PCR.
g. DNA fingerprinting- Restriction Fragment Length Polymorphism (RFLP)

B. Applications of Genetic Engineering:
a. Medical Application.
b. Industrial Application.
c. Agricultural Application.
d. Environmental Application.

C. Social and ethical issues concerning Genetic Engineering.

II B.SC., IV SEMESTER

DSCIV: MICROBIAL GENETICS AND GENETIC ENGINEERING PRACTICALS

TOTAL HOURS: 60hrs (4hrs/week) **CREDITS: 2**

1. Study of mitosis in onion root.
2. Demonstration of meiosis from flower buds of onion / *Chlorophytum / Tradescantia*.
3. Demonstration of Bacterial Conjugation
4. Demonstration of bacterial transformation and transduction

5-6. Preparation of Master and Replica Plates

7. Isolation of streptomycin resistant strain of *E.coli* by gradient plate method.
8. Isolation and Quantification of Nucleic acids (DNA) from *E.coli* or Yeast.
9. Demonstration of AMES test
10. Demonstration of Amplification of DNA by PCR
11. Demonstration of Southern blotting
12. Study survival curve of bacteria after exposure to ultraviolet (UV) light
13. Isolation of Plasmid DNA from *E.coli*

14-15. Demonstration of the following models or photographs of – DNA, t-RNA, mRNA, Transformation, Conjugation and Transduction, Transcription, Translation and DNA replication.

REFERENCES:

1. Brown TA. (2010). Gene Cloning and DNA Analysis. 6th edition. Blackwell Publishing, Oxford, U.K.
2. Clark DP and Pazdernik NJ. (2009). Biotechnology: Applying the Genetic Revolution. Elsevier Academic Press, USA
3. Gardner EJ, Simmons MJ, Snustad DP (2008). Principles of Genetics. 8th Ed. Wiley-India
4. Klug WS, Cummings MR, Spencer, C, Palladino, M (2011). Concepts of Genetics, 10th Ed., Benjamin Cummings
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6. Maloy SR, Cronan JE and Friefelder D(2004) Microbial Genetics 2nd EDITION., Jones and Barlett Pub.
7. Pierce BA (2011) Genetics: A Conceptual Approach, 4th Ed., Macmillan Higher Education Learning
8. Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7th edition. Blackwell Publishing, Oxford, U.K.
9. Primrose SB and Twyman RM. (2008). Genomics: Applications in human biology. Blackwell Publishing, Oxford, U.K.
10. Russell PJ. (2009). i Genetics- A Molecular Approach. 3rd Ed, Benjamin Cummings
11. Sambrook J and Russell D. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold Spring Harbor Laboratory Press
12. Sambrook J and Russell DW. (2001). Molecular Cloning: A Laboratory Manual. 4th Edition, Cold Spring Harbour Laboratory press.
13. Watson JD, Baker TA, Bell SP et al. (2008) Molecular Biology of the Gene, 6th Ed., Benjamin Cummings
14. Wiley JM, Sherwood LM and Woolverton CJ. (2008). Prescott, Harley and Klein's Microbiology. McGraw Hill Higher Education

V SEMESTER

DSE-A: ENVIRONMENTAL MICROBIOLOGY

TOTAL HOURS: 60hrs (4hrs/week) **CREDITS: 4**

COURSE OUTCOME:

After successful completion of the course students are able to:

CO1. Know the role of microorganisms in soil, air, water, waste water and bioremediation

CO2. Learn the occurrence, abundance and distribution of microorganisms in the environment and their role in the environment

CO3. Understand various biogeochemical cycles – Carbon, Nitrogen, Phosphorus cycles etc. and microbes involved in these cycles

CO4. Understand various plant microbes interactions and their applications.

CO5. Understand the basic principles of bioremediation

C**O6.** The various methods to determine the Sanitary quality of water and sewage treatment methods employed in waste water treatment

UNIT 1 **No. of Hours: 15**

SOIL MICROBIOLOGY

A. Introduction: Definition, Soil types, Soil profile and Physical characteristics of soil- Mineral particles, Organic residues, Water and Gases. Soil fertility. Role of microorganisms in soil formation (in brief).

B. Microbial flora of Soil: A brief account of Bacteria, Fungi, Algae, Actinomycetes, Protozoa and Viruses.

C. Biogeochemical cycles: Carbon cycle: Microbes involved in carbon cycle
Nitrogen cycle: Nitrogen fixation, ammonification, nitrification, denitrification and nitrate reduction
Phosphorus cycle: Phosphate immobilization and solubilisation.
Sulphur cycle: Microbes involved in sulphur cycle

D. Associated soil microorganisms with plants- the Rhizosphere and Rhizoplane microflora, Actinorrhizae, and Mycorrhizae (AM), Tripartite and Tetra partite association.

E. Interaction among soil microorganisms – Neutralism, Mutualism, Commensalism, Antagonism and Parasitism. (In brief).
Microbe-Plant interaction: Symbiotic and non symbiotic interactions
Microbe-animal interaction: Microbes in ruminants, nematophagus fungi and symbiotic luminescent bacteria

UNIT: II **No. of Hours: 15**

AEROBIOLOGY

A. Introduction: Definition, history and development, aim and scope of aerobiology.

B. Microbes and atmosphere: Atmospheric layers, sources of microorganisms, Air spora of indoor and outdoor environment. Factors affecting air spora. Significance of air borne microbes. Management of air-borne microbes. Human air borne diseases (Tuberculosis, Rhinitis and Aspergillosis).

B. Techniques of trapping air-borne microorganisms: Impactors- The slit sampler, Hirst spore trap, Andersen sampler, Rotorod sampler, Vertical cylinder spore trap, Burkard spore traps. Impingers and Filtration. Advantages and disadvantages of the techniques.

UNIT-III **No. of Hours: 15**

AQUATIC MICROBIOLOGY

A. Introduction: Natural waters- atmospheric water, surface water and ground water. Distribution of microorganisms in aquatic environment-Neuston, plankton (Phytoplankton, Zooplankton). Aquatic microorganisms-lakes, ponds, streams, rivers estuaries, and marine plankton. Lotic and benthic population.

B. Water pollution: Sources, water borne diseases- Viral (jaundice), Bacterial (cholera) and Protozoan (amoebic dysentery). Biological indicator of water pollution.

C. Determination of sanitary quality of water: SPC, Tests for coliforms, MPN, IMViC reactions and membrane filter.

D. Water purification in Municipal water supply, Parameters of potable water (According to WHO).

SEWAGE MICROBIOLOGY

A. Introduction: Sources of waste water- Domestic, Agricultural and Industrial. Physical, chemical and microbiological characteristics of waste water

B. Waste water treatment: Single dwelling unit-Septic tank. Municipal waste treatment – Primary (screening, coagulation and sedimentation), Secondary (trickling filter, activated sludge process, oxidation pond), Tertiary (reverse osmosis, ion exchange method and electro-dialysis in brief).

C. Solid waste recycling- Anaerobic digestion process, Biogas and Composting.

MICROBIAL BIOREMEDIATION

In situ –Intrinsic, engineered and *Ex situ* bioremediation- Solid phase system (composting, composting process), Slurry phase system (aerated lagoons, low shear air lift reactor). Bioremediation of hydrocarbons- use of genetically engineered bacterial strains. Bioremediation of xenobiotics, Microbial leaching.

UNIT: IV **No. of Hours: 15**

MICROBES IN AGRICULTURE

A. Introduction – Classification of plant diseases on the basis of spread and severity of infection

B. Microbes and Plant diseases - Entry of pathogens into host-prepenetration, penetration, post penetration.

C. Microbes in Agriculture: Biofertilizers: Definition and Types. Mass production of Bacterial inoculants (*Rhizobium , Azospirillum & Cyanobacteria)*. Biopesticides: Definition, Types – Bacterial, Viral, Fungal and Protozoan, Mode of action, Microbial herbicides.

E. Plant diseases: Study of Symptoms, Etiology, Epidemiology, Management of the following diseases – Bean Mosaic, Sandal spike, Citrus canker, Downy mildew of Bajra, Powdery mildew of mulberry, Rust of sorghum, Blast of paddy, Red rot of sugarcane, Tikka disease of groundnut.

V SEMESTER
DSE-A: ENVIRONMENTAL MICROBIOLOGY
PRATICALS

TOTAL HOURS: 30hrs (2hrs/week) **CREDITS: 1**

1. a. Isolation and identification of fungi from soil by serial dilution method.
   b. Isolation and enumeration of bacteria from soil by serial dilution method.
2. Study of AM fungi
3. Isolation of Nitrogen fixing bacteria- *Rhizobium*
4. Study of antagonism between microorganisms

5a. Gram's staining of citrus canker specimen
   b. Observation of specimens - Bean mosaic, Sandal spike, Citrus canker, Downy mildew of Bajra, Powdery mildew of mulberry, Rust of sorghum, Blast of paddy, Red rot of Sugarcane, Tikka disease of groundnut.

6. Isolation of airborne microorganisms (Bacteria and Fungi) by Petriplate exposure method.
7. Demonstration of air samplers: equipments / photographs of vertical cylindrical spore trap, Rotorod sampler, Hirst's spore trap, Andersen's sampler, Liquid impingement method (bead bubbler device) and Membrane filter.
8. Microscopic observation of different water samples for biological indicators of water pollution.
9. a. Standard analysis of water sample
   b. Determination of MPN.
10. a. IMViC reactions.
    b. Water quality test by Hydrogen sulphide strip test.
11. Display of photographs of water purification process (Baffles, Flocculator, Clarifier, Sand filter, Back wash, Chlorinometer and Chloroscope).
12. Determination of biological oxygen demand (BOD) of water.
13. a. Estimation of total solids in sewage.
    b. Display of photographs - Septic tank, Trickling filter, Activated sludge process, Oxidation ponds, Sedimentation tank, and anaerobic digester.
14.. Demonstration of composting
15. Display of photographs: composting, composting process, aerated lagoons, low shear air lift reactor and microbial leaching.

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NOTE: Visit to water treatment plant/ sewage treatment plant/ industrial effluent treatment plant/Agricultural research institute. Each student shall submit an independent report on the visit along with the practical record for the internal assessment.

REFERENCES:

1. Alexander A.M. 1987. Introduction to soil Microbiology, 5th ed., John Wiley and sons.
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3. Daniel Environmental Microbiology
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7. Michael. J.Pelczar, Jr.E.C.S. Chan, Moel: Microbiology, Mc Graw Hill Book Company, New york).
8. Mitchell R (1992), Introduction to Environmental Microbiology, Prentice Hall Inc, Englewood Cliffs.
9. Powar and Daginwala 1996 . General Microbiology, Vol 2. Himalaya Publishing House, Bombay
10. Powar and Daginwala 1996. General Microbiology, Vol 1. Himalaya Publishing House, Bombay.
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12. Rao, M.N. and Datta , A.K. (1987).Waste Water Treatment. Oxford and I.B.H.
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14. Subba Rao, N.S.(2002) Soil Microorganisms and Plant Growth 4th ed., Oxford and IBH Pub.Co.Pvt.ltd., New Delhi.
15. Subha Rao.N.S., 1988. Biofertilizers in Agricultural 2nd ed.Oxford and IBH Pub.Co., New Delhi.

V SEMESTER
DSE-B: AGRICULTURAL MICROBIOLOGY

TOTAL HOURS: 60hrs (4hrs/week) **CREDITS: 4**

COURSE OUTCOME:

After successful completion of the course students are able to:

CO1. Know microorganisms in agriculture, plant pathology and control of plant diseases and their significance
CO2. Understand the land mark in the field of Agricultural microbiology
CO3. Gain knowledge about biofertilizers and biopesticide in agriculture
CO4. Know the stages in disease development, epidemiology and host pathogen interaction
CO5. Know about principles and practices involved in the management of plant diseases

UNIT I **No. of Hours: 15**

INTRODUCTION AND HISTORY OF PLANT PATHOLOGY

A. Concept of plant disease- definitions of disease, disease cycle & pathogenicity, symptoms associated with microbial plant diseases, types of plant pathogens, Koch's postulates, economic losses and social impact of plant diseases.

B. Significant landmarks in the field of plant pathology- Contributions of Anton DeBary, Millardet, T J Burrill, E. Smith, Adolph Mayer, Dmitri Ivanowski, Diener, Stakman, H.H. Flor, Van Der Plank. Contributions of eminent Indian plant pathologists- E J Butler, B B Mundkar, K V Subbarao and M J Thirumalachar.

MICROORGANISMS IN AGRICULTURE

A. Biofertilizers: Definition, Types- Nitrogen fixing, Phosphate solubilizing and cellulolytic microbes. Mass production of Bacterial inoculants (*Rhizobium, Azospirillum, Azotobacter, Cyanobacteria*). Mode of application, Advantages and limitations.

B. Biopesticides: Definition, Types – Bacterial, Viral, Fungal and Protozoan, Mode of action, Microbial herbicides.

UNIT:II **No. of Hours: 15**

PHYTOPATHOLOGY

A. Stages in development of a disease : Introduction – Classification of plant diseases on the basis of spread and severity of infection.

Microbes and Plant diseases: Entry of pathogens into host- prepenetration (Infection) penetration, post penetration (invasion, colonization, dissemination of pathogens and perennation).

B. Plant disease epidemiology: Concepts of monocyclic, polycyclic and polyetic diseases, disease triangle & disease pyramid, forecasting of plant diseases.

C. Host Pathogen Interaction

a. Microbial Pathogenicity

Virulence factors of pathogen: Role of Enzymes-pectic enzymes, Toxins: Host specific (Tabtoxin) and host non-specific (Victorin and T toxin) and growth regulating substance in disease development- Auxins and Gibberellins.

b. Defense Mechanisms in Plants

Defence mechanism in plants: Preexisting (fungitoxic exudates and phenolic compounds) Structural (formation of cork layers, abscission layer and tyloses) and Biochemical defense mechanism (simple phenolic compounds), Hypersensitivity (in brief).

UNIT: III No. of Hours: 15

CONTROL OF PLANT DISEASES

A. Principles & practices involved in the management of plant diseases by different methods, *viz.* regulatory - quarantine, crop certification, avoidance of pathogen, use of pathogen free propagative material : a. Cultural-Host eradication, crop rotation, sanitization, polythene traps and mulches(in brief).

B. Chemical- Inorganic chemicals: Copper compounds-Bordeaux mixture and Bordeaux paste, Organic chemicals- Organic sulfur compounds (Dithiocarbamates), Systemic fungicide, Heterocyclic compounds (Benomyl), antibiotics (Agrimycin).

C. Physical method-Soil sterilization by heat, soil solarization, hot water treatment of propagative organs and hot air treatment of storage organs (in brief)

D. Biological methods- suppressive soils, antagonism, antagonistic plants and trap plants (in brief).

E. IDM-Perennial Crop and annual crop (in brief).

UNIT:IV No. of Hours: 15

SPECIFIC PLANT DISEASES

Study of some important plant diseases giving emphasis on its etiological agent, symptoms, epidemiology and control

A. Important diseases caused by fungi

Late blight of potato - *Phytophthora infestans*
Powdery mildew of wheat - *Erysiphe graminis*
Ergot of rye - *Claviceps purpurea*
Loose smut of wheat - *Ustilago nuda*
Wilt of tomato - *Fusarium oxysporum* f.sp. *lycopersici*
Red rot of sugarcane - *Colletotrichum falcatum*
Blast of rice-*Magnaporthe grisea*

B. Important diseases caused by phytopathogenic bacteria: Bacterial leaf blight of rice, Bacterial cankers of citrus

C. Important diseases caused by phytoplasmas: Sandal spike

D. Important diseases caused by viruses: Papaya ring spot, Bunchy top of banana, Bean mosaic.

E. Important diseases caused by viroids: Potato spindle tuber.

V SEMESTER
DSE-B: AGRICULTURAL MICROBIOLOGY
PRACTICAL

TOTAL HOURS: 30hrs (2hrs/week) **CREDITS: 01**

1. Demonstration of Koch's postulates in fungal disease.
2-5. Study of important diseases of crop plants by cutting sections of infected plant material - Late blight of potato, Powdery mildew of wheat, Ergot of rye, Loose smut of wheat, Wilt of tomato, Red rot of sugarcane, Blast of rice
6. Gram's staining of citrus canker specimen
7-8. Mounting of fungal pathogen- *Phytophthora infestans, Fusarium, Colletotrichum* and *Magnaporthe grisea.*
9. Observation of specimens-Bean mosaic and sandal spike
10. Observation of root nodule formation in plants (*Trigonella/Crotolaria*)
11. Demonstration of Indole acetic acid (IAA) production by soil fungi
12. Plant disease control by fungicides
13. Chemical determination of IAA produced by soil fungi *in vitro*
14. Isolation of fungal pathogens from soil
15. Isolation of fungal pathogens from diseased parts of plant

NOTE: Visit to Agricultural research station. Each student shall submit an independent report on the visit along with the practical record for the internal assessment.

REFERENCES:

1. Rangaswamy.G and Bagyaraj, D.J.(2001), Agricultural Microbiology, 2nd ed. Prentice hall of India pvt.ltd., New Delhi.
2. Rao, M.N. and Datta , A.K. (1987).Waste Water Treatment. Oxford and I.B.H.
3. Rheinhermer, G.1986. Aquatic Microbiology Jhon Wiely and sons, New york.
4. Subha Rao.N.S., 1988. Biofertilizers in Agricultural 2nd ed.Oxford and IBH Pub.Co., New Delhi.
5. Agrios.2009. Agricultural Microbiology
6. Rangaswamy.G.(1996). Diseases of crop plants in India. 3 rd edition .Prentice- Hall of India Pvt Ltd. New Delhi.

VI SEMESTER

DSE-A: INDUSTRIAL, FOOD AND MEDICAL MICROBIOLOGY

TOTAL HOURS: 60hrs (4hrs/week) **CREDITS: 4**

COURSE OUTCOME:

After successful completion of the course students are able to:

CO1.Understand food related microorganisms, their contamination, spoilage and preservation

CO2. Understand the beneficial role of microorganisms in fermented dairy products

CO3. Understand how microbiology is applied in manufacture of industrial products

CO4. The underlying principles in downstream processing

CO5. Know the human immune response towards microbes, Know the relationship between microorganism and human disease, pathogenicity, Laboratory diagnosis, treatment and prophylaxis

CO6. Demonstrate an understanding of key concepts in immunology

UNIT: I **No of Hours: 15**

INDUSTRIAL MICROBIOLOGY

A. Introduction, Definition and scope

B. Microorganisms of industrial importance; Isolation, Screening and Preservation of Industrially important microbes.

C. Strain improvement of Microorganisms for industrial purposes.

D. A brief account of production medium, inoculum medium, raw materials-Molasses, corn steep liquor, sulphite waste liquor, yeast extract and whey. Buffers, Precursors, Inhibitors and Antifoam agents.

E. Fermenters and fermentation process: Design, types and basic function of fermenters, sterilization, devices for aeration and agitation (in brief).

Fermentation process – Surface, Submerged and Solid state fermentation. Types- Batch and Continuous fermentation.

Downstream processing: Steps in recovery and purification of products – Precipitation, Filtration, Centrifugation, Distillation, Cell disruption, Solvent recovery, Chromatography, Drying and Crystallization (in brief).

INDUSTRIAL PRODUCTION

A. a. Organic acids – Citric acid.

b. Antibiotics – Penicillin.

c. Enzymes –Pectinase

d. Alcohol – Ethanol.

e. Amino acid –Glutamatic acid.

B. Mushroom cultivation – Oyster mushroom (bag method). Nutritional value.

C. Role of microorganisms in the production and recovery of minerals and petroleum.

D. Single cell protein: *Spirulina*.

UNIT: II **No of Hours: 15**

FOOD MICROBIOLOGY

A. Introduction to Food Microbiology: Definition, Concept and Scope. Food as a substrate

for microorganisms, Factors influencing microbial growth in foods (intrinsic and extrinsic factors)**.**

B. Sources of contamination, Microbial spoilage of foods – fruits, vegetables, meat, poultry, canned foods, cereals and cereal products.

C. Methods of food preservation: Physical method – high temperature, low temperature, canning. Drying – solar drying, drum drying, spray drying and Radiation.
Chemical methods – chemical preservatives – (propionates, benzoate, sorbates, nitrates and nitrites, sugar and salt)

D. Food borne intoxication and infection:
Bacterial intoxication - Staphylococcal intoxication and Botulism.
Bacterial infection - Salmonellosis.
Mycotoxin –Types and importance of toxins with special reference to Aflatoxins.

E. Food safety and quality control. –A brief account on HACCP, FSSAI and Food safety and standard act 2006

DAIRY MICROBIOLOGY

A. Introduction to Dairy Microbiology: Source of milk contamination. Types of microorganisms in milk.

B. Methods to detect microbial spoilage by SPC, Reductase test.

C. Biochemical changes of milk - Souring, Gassy fermentation, Proteolysis, Lipolysis, and Ropiness.

D. Fermented dairy products (a brief account of characteristic and therapeutic value). Acidophilus milk, Yoghurt, Butter milk, Srikhand. Types of cheese. Probiotics and their benefits.

E. Preservation of milk and milk products – Pasteurization and Sterilization.

UNIT:III **No of Hours: 15**

MEDICAL MICROBIOLOGY

A. Introduction – History and development of medical microbiology. Normal microflora of the human body: normal microflora of skin, throat, gastrointestinal tract, urogenital tract

B. Infection and disease transmission – Signs, symptoms, syndrome. Types of Infection: opportunistic infection and Nosocomial infection, mode of transmission.

C. Host pathogen interaction –Pathogenicity, microbial virulence, microbial toxins, Opportunistic and true pathogens.

D. Antimicrobial chemotherapy – General characteristics and types of antibiotics.
Mode of action of -Penicillin, Aminoglycosides, Erythromycin and Chloramphenicol, Antifungal drugs- Griseofulvin and Nystatin. Antiviral drugs-Acyclovir. Multiple Drug Resistance (in brief).

HUMAN DISEASES

A. Pathogen –Morphology, Cultural and Biochemical characteristics,clinical symptoms, laboratory diagnosis, prophylaxis and treatment of the following diseases:

a. Air borne: Influenza, Diphtheria, Blastomycosis
b. Direct contact: Warts, Syphilis, Sporotrichosis

c. Vector borne: Dengue, Malaria

d. Water borne: Typhoid, Amoebic dysentry

UNIT IV **No. of Hours: 15**

IMMUNOLOGY: IMMUNE CELLS AND ORGANS

A. Historical account and introduction to immune system – Blood and Plasma system.

B. Types of immunity – Innate (non specific) and Adaptive immunity (specific). Hummoral and cell mediated immunity.

C. Structure, Functions and Properties of: Immune Cells –T cell, B cell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, Dendritic cell, Phagocytes and NK cells.

Cells and tissues of immune systems-Structure and role of primary lymphoid organs (bone marrow,thymus),secondary lymphoid organs (spleen, lymph nodes and tonsils).

IMMUNOLOGY: ANTIGENS AND ANTIBODIES

A. Antigens –Nature and types

B. Antibodies – Basic structure of immunoglobulin (Ig G). Biological properties of Immunoglobulin classes, monoclonal antibodies, antigen antibody reactions – salient features. Precipitation reaction, neutralization test, opsonisation, agglutination reaction, compliment fixation. Immunotechniques – RIA, ELISA and ELISPOT.

C. Hypersensitivity (Type I to V - in brief).

D. Immunoprophylaxis – Vaccine – Types – killed, Live and Attenuated (Bacterial and Viral) and Toxoid with an example each. National Immunization program (Tabular form).

VI SEMESTER
DSE-A: INDUSTRIAL, FOOD AND MEDICAL MICROBIOLOGY
PRACTICAL

TOTAL HOURS: 30hrs (2hrs/week) **CREDITS: 01**

1a. Isolation and enumeration of bacteria from utensils
b. Isolation and identification of fungi from food utensils
2a. Isolation and enumeration of bacteria from spoiled vegetables
b. Isolation and identification fungi from spoiled vegetables.
3a. Isolation and enumeration of bacteria from spoiled fruits.
b. Isolation and identification of fungi from spoiled fruits.
4. Isolation and identification of *Aspergillus* on groundnut by standard blotters Method (ISTA,1982).
5. Estimation of lactic acid in milk.
6a. Turbidity test to detect boiled and unboiled milk.
b. Methylene blue reductase test to determine the quality of milk.
7a. Preparation of wine from grapes.
b. Preparation of alcohol using jaggery or molasses.
8a. Estimation of percentage alcohol in a given sample by specific gravity method
b. Production of citric acid using *Aspergillus niger*
9. Determination of blood group and Rh factor.
10a. Enumerate RBC in given blood sample
b. Enumerate WBC in given blood sample
11. Demonstration of precipitation reaction-Double diffusion in two dimensions (Ouchterlony procedure).
12. Antibiotic sensitivity test.
13a. Determination of susceptibility to dental caries-Snydal test
b. Identification of dermatophytes from human skin.
14a. Detection of typhoid by Widal test
b. Rapid plasma reagin (RPR) card test for syphilis
15. Material/ microscopic observation/ display of photographs of human pathogens as per theory syllabus: Influenza virus, *Corynebacterium diphtheriae*, *Blastomyces dermatitidis*, Human papilloma virus, *Tryponema pallidum, Sporothrix schenckii, Plasmodium,* Dengue viruses (DENV), *Salmonella typhi* and *Entamoeba histolytica*

NOTE: Visit to food industries or food research laboratories, dairy industries, distilleries, pharmaceuticals and pathological laboratories. Each student shall submit an independent report on the visit along with the practical record for the internal assessment.

REFERENCES:

1. Adams M.R.and Moss M.O., 1995, Food Microbiology. Royal Society of Chemistry , Cambridge University Press.
2. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication
3. Anathanarayanan C and Paniker, C.K.J. Text Book of Microbiology, 9th ed. Orinet Longman ltd., Chennai.
4. Banwart, G.J. (1987). **Basic Food Microbiology**. CBS publishers and distributors, New Delhi.
5. Benson,H.J. **Microbiological applications- laboratory manual in general microbiology,** fifth edition.C.Brown publishers.
6. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication
7. Cappuccino,J.G., And Sherman,N. (1999). **Microbiology- A Laboratory Manual,** Fourth edition.
8. Casida,LE Jr 1968 Industrial Mirobiology. New Age International Publishers.
9. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology.11th edition WileyBlackwell Scientific Publication, Oxford.
10. Frazier & Westhoff, D.C.1995,Food Microbiology Tata McGraw Hill Pub. Company Ltd.,New Dehli.
11. Glodsby Richard A., Kindt Thomas J. And Osborne Barbara A., Kuby Immunology, W. H. Freeman and Company New York.
12. Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007) Mims' Medical Microbiology. 4th edition. Elsevier
13. Gupte S.M.D (1986). Short Text Book of Medical Microbiology. Jaypee Brothers, Medical Publishers, New Delhi.
14. Jagadish Chandra (1996). Text Book of Medical Mycology. Oreint Longman
15. Jawetz, Melnick, Adelberg, Medical Microbiolgy, Prentice Hall Inc, London.
16. Jay, J.M. (1985). Modern Food Microbiology.CBS Publishers and distributors, New Delhi.
17. Jayaram Panicker, C.K. 1993 Text Book of Medical Parsitology Jaypee Brothers, Medical Publishers, New Delhi.
18. Mackie and Mc catney, Medical Microbiolgy I and II. Charchill Livingston , 14th ed.
19. Madigan MT, Martinko JM, Dunlap PV and Clark DP. (2014). Brock Biology of Microorganisms. 14th edition. Pearson International Edition
20. Murphy K, Travers P, Walport M. (2008). Janeway's Immunobiology. 7th edition Garland Science Publishers, New York.
21. Nandhini Shetty 1993. Immunology: Inductory Text Book . New Age International Ltd.
22. Peakman M, and Vergani D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinberg.
23. R.P.Singh, Immunology and Medical Microbiology
24. Rajan. S. Medical Microbiology. MJP Publishers, Chennai. Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6th edition Saunders Publication, Philadelphia.
25. Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication

26. Roitt I.M., Essentials of Immunology, ELBS, Blackwell Scientific Publishers, London.
27. Stanbury P.T. and Whitaker 1984, Principles of Fermentation Technology, Pergamong Press, Newyork.
28. Tizard, I.R. 1998 . Immunology An Introduction, 2nd ed. W.B. Saunders, Philadelphia.
29. Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education

VI SEMESTER

DSE-B: MICROBIAL BIOTECHNOLOGY AND BIOINFORMATICS

TOTAL HOURS: 60hrs (4hrs/week) **CREDITS: 4**

COURSE OUTCOME:

After successful completion of the course students are able to:

CO1.Understand microbial biotechnology and its applications

CO2. Understand the microbial products and their recovery

CO3. Know about the applications of bioinformatics

CO4. The underlying principles of bioinformatics and biological databases

UNIT I

MICROBIAL BIOTECHNOLOGY AND ITS APPLICATIONS 15 hrs

Microbial biotechnology: Scope and its applications in human therapeutics, agriculture (Biofertilizers, PGPR, Mycorrhizae), environmental, and food technology. Use of prokaryotic and eukaryotic microorganisms in biotechnological applications. Genetically engineered microbes for industrial application: Bacteria and yeast.

Recombinant microbial production processes in pharmaceutical industries - Streptokinase, recombinant vaccines (Hepatitis B vaccine). Microbial polysaccharides and polyesters, Microbial production of bio-pesticides, bioplastics Microbial biosensors.

UNIT II

MICROBIAL PRODUCTS AND THEIR RECOVERY 15hrs

Microbial product purification: filtration, ion exchange & affinity chromatography techniques Immobilization methods and their application: Whole cell immobilization.

Microbes for Bio-energy and Environment: Bio-ethanol and bio-diesel production: commercial production from lignocellulosic waste and algal biomass, Biogas production: Methane and hydrogen production using microbial culture. Microorganisms in bioremediation: Degradation of xenobiotics, mineral recovery, removal of heavy metals from aqueous effluents.

UNIT III

INTRODUCTION TO BIOINFORMATICS 15hrs

Introduction to Computer Fundamentals: RDBMS - Definition of relational database Mode of data transfer (FTP, SFTP, SCP), advantage of encrypted data transfer.

Introduction to Bioinformatics and Biological Databases:Biological databases - nucleic acid, genome, protein sequence and structure, gene expression databases, Database of metabolic pathways, Mode of data storage - File formats - FASTA, Genbank and Uniprot, Data submission & retrieval from NCBI, EMBL, DDBJ, Uniprot, PDB.

UNIT IV

APPLICATIONS OF BIOINFORMATICS 15 hrs

Sequence Alignments, Phylogeny and Phylogenetic trees: Local and Global Sequence alignment, pairwise and multiple sequence alignment. Types of phylogenetic trees, Different approaches of phylogenetic tree construction - UPGMA, Neighbour joining, Maximum Parsomony, Maximum likelihood. Genome organization and analysis. Diversity of Genomes: prokaryotic & eukaryotic genomes Genome, transcriptome and proteome.

Protein Structure Predictions: Hierarchy of protein structure - primary, secondary and tertiary structures, modeling Structural Classes, Motifs, Folds and Domains. Protein structure prediction in presence and absence of structure template.

SEMESTER-V

MICROBIAL BIOTECHNOLOGY AND BIOINFORMATICS

PRACTICAL-V **(4hrs/week)**

1. Study yeast cell immobilization in calcium alginate gels
2. Study enzyme immobilization by sodium alginate method
3. Pigment production from fungi (Trichoderma / Aspergillus / Penicillium)
4. Isolation of xylanase or lipase producing bacteria
5. Study of algal Single Cell Proteins
6. Introduction to different operating systems - UNIX, LINUX and Windows
7. Introduction to bioinformatics databases (any three): NCBI/PDB/DDBJ, Uniprot, PDB
8. Sequence retrieval using BLAST
9. Sequence alignment & phylogenetic analysis using clustalW & phylip
10. Picking out a given gene from genomes using Genscan or other softwares (promoter region identification, repeat in genome, ORF prediction). Gene finding tools (Glimmer, GENSCAN), Primer designing, Genscan/Genetool
11. Protein structure prediction: primary structure analysis, secondary structure prediction using psipred, homology modeling using Swissmodel. Molecular visualization using jmol, Protein structure model evaluation (PROCHECK)
12. Prediction of different features of a functional gene

SUGGESTED READING

1. Glazer AN and Nikaido H (2007) Microbial Biotechnology, 2nd edition, Cambridge University Press
2. Glick BR, Pasternak JJ, and Patten CL (2010) Molecular Biotechnology 4th edition, ASM Press,
3. Gupta PK (2009) Elements of Biotechnology 2nd edition, Rastogi Publications,
4. Lesk M.A.(2008) Introduction to Bioinformatics . Oxford Publication, 3rd International Student Edition
5. Pradeep and Sinha Preeti (2007). Foundations of Computing, 4th ed., BPB Publications
6. Prescott, Harley and Klein's Microbiology by Willey JM, Sherwood LM, Woolverton CJ (2014), 9th edition, Mc Graw Hill Publishers.
7. Primrose and Twyman (2003) Principles of Genome Analysis & Genomics. Blackwell
8. Rastogi S.C., Mendiratta N. and Rastogi P. (2007) Bioinformatics: methods and applications, genomics, proteomics and drug discovery, 2nd ed. Prentice Hall India Publication
9. Ratledge, C and Kristiansen, B. (2001). Basic Biotechnology, 2nd Edition, Cambridge University Press.
10. Saxena Sanjay (2003) A First Course in Computers, Vikas Publishing House
11. Swartz, J. R. (2001). Advances in Escherichia coli production of therapeutic proteins. Current Opinion in Biotechnology, 12, 195–201.

SEMESTER – VI

SEC-A: MICROBIAL DIAGNOSIS IN HEALTH CLINICS

TOTAL HOURS: 30hrs (2hrs/week) **CREDITS: 2**

COURSE OUTCOME

After successful completion of the course students are able to:

CO1. Gain experience in health clinics such as examination, collection of clinical samples and diagnosis

CO2.Demonstrate scientific quantitative skills, the ability to evaluate experimental design, read graphs

CO3. Understand and use information from scientific papers/Journals

UNIT: I **No of Hours: 5**

IMPORTANCE OF DIAGNOSIS OF DISEASES

Bacterial, viral, fungal and protozoan diseases of various human body systems. Disease associated clinical samples for diagnosis.

UNIT: II **No of Hours: 5**

COLLECTION OF CLINICAL SAMPLES

Collection of clinical samples (oral cavity/sputum, throat, skin, blood, CSF, urine and faeces) and handling clinical specimens. Method of transport of clinical samples to laboratory and storage.

U**NIT: III** **No of Hours: 15**

DIRECT MICROSCOPIC EXAMINATION AND CULTURE

Examination of sample by staining - Gram stain, Ziehl-Neelson staining for tuberculosis, Giemsa stained, Thin blood film for malaria, Preparation and use of culture media – Blood agar, Chocolate agar, Lowenstein-Jensen medium, MacConkey agar, Distinct colony properties of various bacterial pathogens.

Serological and Molecular Methods

Serological Methods – Agglutination, Precipitation, ELISA and PCR.

Test for Typhoid, Dengue, HIV and Swine flu

Laboratory exposure to students: demonstration of staining.

UNIT: IV **No of Hours: 5**

TESTING FOR ANTIBIOTIC SENSITIVITY IN BACTERIA

Importance, Determination of resistance/sensitivity of bacteria using disc diffusion method, Determination of minimal inhibitory concentration (MIC) of an antibiotic by serial dilution method

REFERENCES:

1. Jagadish Chandra (1996). Text Book of Medical Mycology. Oreint Longman
2. Jawetz, Melnick, Adelberg, Medical Microbiolgy, Prentice Hall Inc, London.
3. Mackie and Mc catney, Medical Microbiolgy I and II. Charchill Livingston , 14th ed.
4. Nandhini Shetty 1993. Immunology: Inductory Text Book . New Age International Ltd.
5. R.P.Singh, Immunology and Medical Microbiology
6. Rajan. S. Medical Microbiology. MJP Publishers, Chennai.
7. Roitt I.M., Essentials of Immunology, ELBS, Blackwell Scientific Publishers, London.

SEMESTER – VI

SEC-II: MICROBIOLOGICAL ANALYSIS OF AIR AND WATER

TOTAL HOURS: 30hrs (2hrs/week) **CREDITS: 2**

COURSE OUTCOME:

After successful completion of the course students are able to:

CO1. Know about bioaerosols, airsample collection and analysis

CO2.Control measures of air microbes
CO3. Know about the water borne diseases and their management
CO4.To identify water borne pathogens

UNIT: I **No of Hours: 10**

AIR MICROBIOLOGY

Bioaerosols, Air borne microorganisms (bacteria, Viruses, fungi) and their impact on human health and environment, significance in food and pharma industries and operation theatres, allergens

Air Sample Collection and Analysis

Bioaerosol sampling, air samplers, methods of analysis, CFU, culture media for bacteria and fungi.

Control Measures

Fate of bioaerosols, inactivation mechanisms – UV light, HEPA filters, desiccation and Incineration

UNIT: II **No of Hours: 5**

WATER MICROBIOLOGY

Water borne diseases and their management: Cholera, Typhoid, Gastroenteritis and Traveller's diarrhoea.

UNIT: III **No of Hours: 5**

MICROBIOLOGICAL ANALYSIS OF WATER

Sample Collection, Treatment and safety of drinking (potable) water, methods to detect potability of water samples: (a) standard qualitative procedure: presumptive/MPN tests, confirmed and completed tests for faecal coliforms (b) Membrane filter technique.

UNIT: IV **No of Hours: 5**

LABORATORY SAFETY MEASURES

Precipitation, chemical disinfection, filtration, high temperature, UV light

Laboratory exposure to students: demonstration of air borne and water borne microbes.

REFERENCES:

1. da Silva N, Taniwaki MH, Junqueira VC, Silveira N, Nascimento MS, Gomes RAR (2012) Microbiological Examination Methods of Food and WaterA Laboratory Manual, CRC Press
2. Atlas RM and Bartha R. (2000). Microbial Ecology: Fundamentals & Applications. 4th edition. Benjamin/Cummings Science Publishing, USA
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PATTERN OF QUESTION PAPER (CBCS)
SUBJECT: MICROBIOLOGY
DSCI-DSCIV
(THEORY: I SEMESTER TO IV SEMESTER)

Time: 3hours Max marks: 70

I. Answer the following 1X5=05Marks

1
2
3
4
5

II Answer any five of the following: 3X5=15 Marks
(Seven questions to be given and four to be answered)-short answer type

6
7
8
9
10
11
12

III Answer any four of the following: 5X4=20
(Six questions to be given and four to be answered)-short answer type

13
14
15
16
17
18

III Answer any three of the following 10X3=30
(Five questions to be given and four to be answered- essay type questions)

19
20
21
22
23

C1+C2=30(15+15) Continuous assessment

PATTERN OF QUESTION PAPER (CBCS)
SUBJECT: MICROBIOLOGY
[THEORY: V SEMESTER (DSE (A/B)) TO VI SEMESTER (DSE(A/B))

Time: 3hours Max marks: 70

I. Answer the following 1X5=05Marks
1
2
3
4
5

II Answer any five of the following: 3X5=15 Marks
(Seven questions to be given and four to be answered)-short answer type
6
7
8
9
10
11
12

III Answer any four of the following: 5X4=20
(Six questions to be given and four to be answered)-short answer type

13
14
15
16
17
18

III Answer any three of the following 10X3=30
(Five questions to be given and four to be answered- essay type questions)

19
20
21
22
23

C1+C2=30(15+15) Continuous assessment

PATTERN OF QUESTION PAPER (CBCS)
SUBJECT: MICROBIOLOGY (SEI-SEII)
SEC (A) – SEC (B)
(THEORY: VI SEMESTER)

Time: 2 hours Max marks: 35

I. Answer the following 1X3=03
1
2
3

II Answer any four of the following: 3X4=12
(Six questions to be given and four to be answered)-short answer type
6
7
8
9
10
11

III Answer any two of the following: 10X2=20
(Four questions to be given and two to be answered)-short answer type

12
13
14
15

C1+C2=15 Continuous assessment

SCHEME OF THEORY EXAMINATION

I B.Sc., I SEMESTER

DSC-I: INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY

Times:3hrs **Max Marks:70**

Question Paper to be set for total of 106marks including choices

UNITS	1 mark questions	3 mark questions	5 mark questions	10 mark questions	Total Marks
UNITS: **1** **History of development of microbiology**	2	3	1	1	26
UNIT:2 **Microbial Diversity**	1	2	2	1	27
UNIT:3 **Fungi and Protozoa**	1	-----	1	2	26
UNIT:4 **Viruses**	1	2	2	1	27

I Main: 1x5=05Marks
II Main: 3x7=21Marks
III Main: 5x6=30Marks
IVMain: 10x5=50Marks

SCHEME OF PRACTICAL EXAMINATION

I B.Sc., I SEMESTER

PRACTICAL-I: INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY

Time: 3hours **Max marks: 35**

I. Identify the materials **A** and B with labelled diagrams and reasons 3X2=06
(1 material each from Algae and Fungi as per syllabus)
(Identification -1mark; diagram and reasons-1mark)

II. Write critical notes on C **, D** and E**.** **2**X3=06
(Photographs/materials of Bacteriophages /TMV/HIV/ Plaque assay/ prokaryotic and Eukaryotic cell/Microbiologists/Exposed plates to air)

III. Identify the slides F**, G** and **H** with labelled diagrams and reasons 3X3=09
(One slide each from Algae, Fungi and Protozoa as per the theory syllabus)
(Identification –1mark; labelled diagram with reasons-2mark)

IV. Stain the given material **I** by…….method. Write the principle, procedure and leave the preparation for evaluation 09
(Wet mounting of Algae/Fungi)
(Preparation-4 marks; Principle and Procedure-5 marks)

V. Record 05

Total marks: 35: [30(Practical Exam) + 5 (record)]

SCHEME OF THEORY EXAMINATION
I B.Sc.,II SEMESTER
DSC-II: BACTERIOLOGY

Times:3hrs **Max Marks:70**

Question Paper to be set for total of 106 marks including choices

UNITS	1 mark questions	3 mark questions	5 mark questions	10 mark questions	Total Marks
UNITS: **1** Bacterial cell organization	2	-	1	2	27
UNIT:2 Bacteriological techniques	1	2	2	1	27
UNIT:3 Microscopy	2	3	1	1	26
UNIT:4 Physical and chemical methods of Microbial control	-	2	2	1	26

I Main: 1x5=05Marks
II Main: 3x7=21Marks
III Main: 5x6=30Marks
IVMain: 10x5=50Marks

SCHEME OF PRACTICAL EXAMINATION
I B.Sc., II SEMESTER: PRACTICAL-II
PRACTICALS-II: BACTERIOLOGY

Time: 3hours **Max marks: 35**

I. Write critical notes on **A, B, C** and **D** 2X4=08
(Microscopes-Charts/Photographs/Instruments/Oil immersion objective/ Stains / Laboratory equipments/Chromicacid/Detergents/Microbiologists/Media/cultivation of microorganisms/pure cultures/maintenance of culture) as per the theory syllabus.

II. Measure the length/breadth/diameter of the given material **E** using Stage and Ocular Micrometer. Write the procedure and result. 08
(Procedure-4marks; calibration -2marks; Results-2marks)

III. Stain the given material **F** by…….method. Write the principle, procedure and leave the preparation for evaluation. 06
(Simple staining/Negative staining/Gram-staining/Cell wall/ Endospore)
(Preparation-3marks; Principle and Procedure-3 marks)

IV. Demonstrate/ Perform the experiment **G** giving the principle and procedure. Record the result. 08
(Demonstration- 4marks; principle-2mark; procedure-1marks; results-1marks)
(Serial dilution/ measurement of growth by cell number using Haemocytometer/ Pour plate/Spread plate/Streak plate/Point inoculation)

V. Record. 05

Total marks: 35: [30 (Practical Exam) + 5(record)]

SCHEME OF THEORY EXAMINATION

II B.Sc., III SEMESTER

DSC-III: MICROBIAL PHYSIOLOGY AND METABOLISM

Times: 3hrs **Max Marks: 70**

Question Paper to be set for total of 106marks including choices

UNITS	1 mark questions	3 mark questions	5 mark questions	10 mark questions	Total Marks
UNITS: **1** Mcrobial Growth & Microbial nutrition	2	-	1	2	27
UNIT:2 Metabolism	1	2	2	1	27
UNIT:3 Chemoheterotrophic metabolism	2	3	1	1	26
UNIT:4 Chemolithotrophic & phototrophic metabolism	-	2	2	1	26

I Main: 1x5=05Marks
II Main: 3x7=21Marks
III Main: 5x6=30Marks
IVMain: 10x5=50Marks

II B.Sc.-IIISEMESTER

SCHEME OF PRACTICAL EXAMINATION

PRACTICAL III: MICROBIAL PHYSIOLOGY AND METABOLISM

Time: 3hours **Max. marks :35**

I. Demonstrate the experiment **A**, giving principle and procedure. Record the results. 10
(Demonstration-5marks; principle -2mark; procedure -2marks; result-1mark)
(Ammonification /Effect of temperature on growth of microorganisms/Effect of pH on the growth of microorganisms /Effect of salt concentration on growth of microorganism/ Effect of carbon and nitrogen on growth of microorganism).

II. Perform/conduct the experiment **B,** giving principle and procedure. Record the results. 06
(Demonstration-3marks; principle -1mark; procedure -1marks; result-1mark)
(Fermentation of lactose / starch hydrolysis/gelatin hydrolysis / catalase activity/urease test)

III. Prepare a temporary slide of **C** and identify the microorganisms giving reasons. Leave the preparation for evaluation. 08
(Preparation of slide-5marks, identification- 1mark, reason-2mark, Material to be given is root nodules)

IV. Write critical notes on **D, E & F** 2X3=06
(Fermentation of lactose / glucose/Starch hydrolysis/Gelatin hydrolysis / Catalase Activity/Urease test/Haemocytometer/Turbidometer/fermentation of glucose by Kuhne's fermentation vessel)

V. Record 05

Total marks: 35: [30 (Practical Exam) + 5 (record)]

SCHEME OF THEORY EXAMINATION

II B.Sc.,IV SEMESTER

DSC-IV: MICROBIAL GENETICS AND GENETIC ENGINEERING

Times: 3hrs **Max Marks:70**

Question Paper to be set for total of 106marks including choices

UNITS	1 mark questions	3 mark questions	5 mark questions	10 mark questions	Total Marks
UNITS: **1** Microbial Genetics	2	-	1	2	27
UNIT:2 Molecular Genetics	1	2	2	1	27
UNIT:3 Genetic Engineering	2	3	1	1	26
UNIT:4 Tools of Genetic Engineering	-	2	2	1	26

I Main: 1x5=05Marks
II Main: 3x7=21Marks
III Main: 5x6=30Marks
IVMain: 10x5=50Marks

II B.Sc.-IV SEMESTER

SCHEME OF PRACTICAL EXAMINATION

PRACTICAL IV: MICROBIAL GENETICS AND GENETIC ENGINEERING

Time: 3hours **Max. marks :35**

I. Identify the materials **A, B**and **C** with labelled diagrams and reasons 2X3=06
(conjugation/transduction/ AMES test/Amplification of PCR/Southern blotting/Plasmid DNA/Streptomycin resistant mutant)
(Identification -1mark; diagram and reasons-1mark)

II. Write critical notes on **D, E** and **F.** **2** X3=06
(DNA model /Transcription and Translation model/DNA replication model/t-RNA/Plasmids /Episomes/ mRNA, transformation, conjugation and transduction)

III. Demonstrate the experiment **G,** giving principle and procedure. Record the results. 10
(Replica plating /Quantification of DNA/Conjugation/transformation/transduction, Isolation of streptomycin resistant strain of *E.coli* by gradient plate method)
(Demonstration-5marks; principle -2mark; procedure -2marks; result-1mark)

IV. Prepare the slide **H** giving the procedure and results. 08
(Preparation of slide-4marks, Procedure-2 reason-1mark, Diagram-1)
(onion root tip or flower buds mentioned in the practical syllabus)

V. Record 05

Total marks: 35: [25 (Practical Exam) + 10 (5 -record+ 5- viva)]

SCHEME OF THEORY EXAMINATION

III B.Sc.,V SEMESTER

DSE-A: ENVIRONMENTAL MICROBIOLOGY

Times: 3hrs **Max Marks:70**

Question Paper to be set for total of 106marks including choices

UNITS	1 mark questions	3 mark questions	5 mark questions	10 mark questions	Total Marks
UNITS: **1** Soil Microbiology	2	-	1	2	27
UNIT:2 Aerobiology	1	2	2	1	27
UNIT:3 Aquatic, sewage & bioremediation	2	3	1	1	26
UNIT:4 Microbes in Agriculture	-	2	2	1	26

I Main: 1x5=05Marks
II Main: 3x7=21Marks
III Main: 5x6=30Marks
IVMain: 10x5=50Marks

SCHEME OF THEORY EXAMINATION

III B.Sc.,V SEMESTER

DSE-B: AGRICULTURAL MICROBIOLOGY

Times: 3hrs **Max Marks:70**

Question Paper to be set for total of 106marks including choices

UNITS	1 mark questions	3 mark questions	5 mark questions	10 mark questions	Total Marks
UNITS: **1** Introduction & History of Plant pathology & Microorganism in Agriculture	-	2	2	1	26
UNIT:2 Phytopathology	1	2	2	1	27
UNIT:3 Control of Plant diseases	2	3	1	1	26
UNIT:4 Specific Plant disease	2	-	1	2	27

I Main: 1x5=05Marks
II Main: 3x7=21Marks
III Main: 5x6=30Marks
IVMain: 10x5=50Marks

DSE-A

III B.Sc.-VSEMESTER

SCHEME OF PRACTICAL EXAMINATION

PRACTICAL V: ENVIRONMENTAL MICROBIOLOGY

Time: 3hours **Max. marks :35**

I. Demonstrate /perform the experiment **A**, giving principle and procedure. Record and interpret the result. 08

(Demonstration-4marks; principle-2marks; procedure-1marks; results-1marks)

(Petriplate exposure method/standard analysis of water/ determination of MPN/ Isolation of Bacteria /Fungi from soil by serial dilution method/Antagonism between microorganisms).

II. Demonstrate /perform the experiment **B**, giving principle and procedure. Record and interpret the result. (Demonstration-2marks; principle-1mark; procedure & results-2marks) 05

(Demonstration of BOD of sewage/Estimation of total solids in sewage/IMViC/Hydrogen sulphide strip test).

III. Record the source and importance of microorganisms in the material **C** with Identification and label the diagrams. 06

(Source of the microorganisms and identification-3marks; labelled diagram- 1marks; importance-2marks).

(Pond water, agar plates exposed to air, biological indicators of water pollution/*Anabena* in Azolla).

IV. Write critical notes on **D, E** and **F** 2x3=06

(Identification -1mark; critical comments-4marks)

(Air samplers, Results of standatrd analysis of water, MPN, IMViC reactions,Hydrogen sulphide stip test, photograghs of baffles ,flocculator, clarifier,sand filter,back wash, chlorinometer,chloroscope,septic tank, Trickling filter, activated sludge process, oxidation pond, sedimentation tank, anaerobic digester, biogas plant, composting, composting process, aerated lagoons, low shear air lift reactor and microbial leaching/ Azolla/ VAM/Rhizosphere microflora/Plant diseases as per theory syllabus).

VI. Record+Report 05+05=10

DSE-B

III B.Sc.-V SEMESTER

SCHEME OF PRACTICAL EXAMINATION

PRACTICAL V: AGRICULTURAL MICROBIOLOGY

Time:3hours **Max. marks :35**

I. Demonstrate /perform the experiment **A**, giving principle and procedure. Record and Interpret the result. 10

(Demonstration-5marks; principle-2marks; procedure-2marks; results-1marks). (Isolation of Fungi from soil by serial dilution method/ from diseased parts of plants, chemical determination of IAA/plant disease control by fungicide).

II. Prepare a temporary stained slide of **B**. Identify with labeled sketch and reasons. Leave the preparation for evaluation. 09

(Identification -2mark; preparation-3marks; labeled diagram-2 and reasons-2marks).

(Plant diseases as per theory syllabus)

III. Identify the slides/materials **C, D, E** and **F** with labelled diagrams and reasons 2X3=06

(Identification-1mark; reasons & labeled sketch-1mark).

(Plant diseases as per theory syllabus/ Koch postulates)

IV. Record +Report 05+05=10

Total marks: 35: [25 (Practical Exam) + 10 (5 -record+ 5- viva)]

SCHEME OF THEORY EXAMINATION

III B.Sc.,VI SEMESTER

DSE-A: INDUSTRIAL, FOOD AND MEDICAL MICROBIOLOGY

Times: 3hrs **Max Marks: 70**

Question Paper to be set for total of 106marks including choices

UNITS	1 mark questions	3 mark questions	5 mark questions	10 mark questions	Total Marks
UNITS: **1** Industrial microbiology & Industrial production	2	-	1	2	27
UNIT:2 Food & Dairy Microbiology	2	3	1	1	26
UNIT:3 Medical Microbiology	1	2	2	1	27
UNIT:4 Immunology	-	2	2	1	26

I Main: 1x5=05Marks
II Main: 3x7=21Marks
III Main: 5x6=30Marks
IVMain: 10x5=50Marks

SCHEME OF THEORY EXAMINATION

III B.Sc.,VI SEMESTER

DSE-B: MICROBIAL BIOTECHNOLOGY AND BIOINFORMATICS

Times: 3hrs **Max Marks:70**

Question Paper to be set for total of 106marks including choices

UNITS	1 mark questions	3 mark questions	5 mark questions	10 mark questions	Total Marks
UNITS: **1** Microbial Biotechnology and its Applications	2	-	1	2	27
UNIT:2 Microbial Products and their Recovery	1	2	2	1	27
UNIT:3 Introduction to Bioinformatics	2	3	1	1	26
UNIT:4 **A**pplications of bioinformatics	-	2	2	1	26

I Main: 1x5=05Marks
II Main: 3x7=21Marks
III Main: 5x6=30Marks
IVMain: 10x5=50Marks

DSE-A

SCHEME OF PRACTICAL EXAMINATION

III B.Sc. – VI SEMESTER

TITLE: INDUSTRIAL, FOOD AND MEDICAL MICROBIOLOGY

Time: 3hours. **Max.marks:35**

I. Demonstrate / Perform the experiment **A**, giving principle and procedure. Record and interpret the result. 10

(Demonstration -5marks; principle-2marks; procedure-2marks; results and interpretation-1marks).

(Isolation of microorganisms from utensils/spoiled vegetables/spoiled fruits. Antibiotic sensitivity test/Determination of blood group and Rh factor/Demonstration of precipitation reaction-ODD).

II. Conduct the test for **B**. Write the principle and procedure. Record and interpret the results. 05

(Demonstration -2 marks; principle-1 marks; procedure-1 marks; results and interpretation- 1marks).

(Turbidity test, Phosphatase test, MBRT test, Estimation of % of alcohol in a given sample by specific gravity bottle method RPR/Urine bacteria by calibrated loop /Enumerate RBC in given blood sample/ Enumerate WBC in given blood sample/ Snyder test.).

III. Write critical notes on **C, D** and **E**. (Identification -1mark; critical comments-1marks). 2X3=06

(Cheese, Yoghurt, Srikhand, Bread, Molasses, Wine, Alcohol, *Aspergillus* on groundnut, Citric acid production/alcohol from jiggery. Antibiotic sensitivity test, Estimation of urine bacteria by calibrated loop/IMViC/TSI/Nitrate reduction/urease production/catalase/ Ouchterlony procedure, RPR, Widal test, Slides/Photographs of human pathogens as per theory syllabus).

IV .Prepare temporary stained slide of **F.** Identify with labelled sketch and reasons. 04

Leave the preparation for evaluation.

(Identification -1mark; preparation-2marks; reasons- 1marks).

(*Spirullina, Chlorella*, Aspergillus *niger* and Yeast/ Petri plates with Fungal colonies/Bacterial colonies.)

V. Record +Report 10

DSE-B

SCHEME OF PRACTICAL EXAMINATION

III B.Sc. – VI SEMESTER

TITLE: MICROBIAL BIOTECHNOLOGY AND BIOINFORMATICS

Time:3 hours **Max.marks:35**

I. Demonstrate / Perform the experiment **A**, giving principle and procedure. Record and interpret the result.

(Demonstration -5marks; principle-4marks; procedure-4marks;results and interpretation- 2). 10

(Study yeast cell immobilization in calcium alginate gels/Study enzyme immobilization by sodium alginate method)

II. Write critical notes on **B, C & D** 4x3=12

(Identification -1mark; critical comments-1marks)

(Single Cell Proteins/ BLAST / Protein structure prediction as per theory syllabus)

III. .Identify the given photographs **E,F,G &H** 2x4=08

(Genscan or other softwares (promoter region identification, repeat in genome, ORF prediction). Gene finding tools (Glimmer, GENSCAN), Primer designing, Genscan/Genetool)

IV. Record 05

Total marks: 35: [30 (Practical Exam) + 05 – (record)]

SCHEME OF THEORY EXAMINATION

III B.Sc.,V SEMESTER

SEC-A: MICROBIAL DIAGNOSIS IN HEALTH CLINICS

Times: 3hrs **Max Marks: 35**

Question Paper to be set for total of 59 marks including choices

UNITS	1 mark questions	3 mark questions	10 mark questions	Total Marks
UNITS: **1** Importance of diagnosis of diseases	1	1	1	14
UNIT:2 Collection of clinical samples	1	2	1	16
UNIT:3 Deirect microscopic examination and culture	--	1	1	13
UNIT:4 Testing for antibiotic sensitivity in bacteria	1	2	1	16

I Main: 1x3= 03Marks
II Main: 3x4= 12Marks
III Main: 10x2=20Marks

SCHEME OF THEORY EXAMINATION

III B.Sc.,V SEMESTER

SEC-B: MICROBIOLOGICAL ANALYSIS OF AIR AND WATER

Times: 3hrs **Max Marks: 35**

Question Paper to be set for total of 59marks including choices

UNITS	1 mark questions	3 mark questions	10 mark questions	Total Marks
UNITS: **1** Air microbiology	1	1	1	14
UNIT:2 Water microbiology	1	2	1	16
UNIT:3 Microbial analysis of water	--	1	1	13
UNIT:4 Control Measures	1	2	1	16

I Main: 1x3=03Marks
II Main: 3x6=18Marks
III Main: 10x2=20Marks

Approved list of Paper setters and Valuers

Sl No.	Name	College address
1	Dr..M .Seema	Chairperson, Dept. of Microbiology JSS College, Ooty road, Mysore
2	H.P.Spoorthy	Assistant prof. Dept. of Microbiology JSS College, Ooty road, Mysore
3	Dr.S.Mahadevamurthy	Associate Prof & HOD Dept. of Microbiology Yuvaraja's college Mysore.
4	Dr.Syeda Kauser Fathima	Associate Prof. of Microbiology Maharani's Science College for women JLB road Mysore.
5	Dr. H.S. Jayanth.	Asso.Prof.of Microbiology Dept. of Microbiology Yuvaraja's college Mysore.
6	Dr.Nagarathnamma	Asso. Prof. of Microbiology Government women college Mandya
7	Sri. M. Girish	Assistant prof. Dept. of Microbiology JSS College for Women Saraswathipuram,Mysore
8	Dr. P.K.Maheshwar	Assistant Prof. Dept. of Microbiology Yuvaraja's college,Mysore.
9	Smt. M.S.Shobha	Assistant Prof, Dept. of Microbiology Maharani's Science College Mysore
10	Sri. R.A. Manjunath	Assistant Prof. Dept. of Microbiology Saradavilas College,Mysore
11	Dr.M.P. Ragavendra	Assistant Prof. Dept. of Microbiology Maharani's Science College,Mysore
12	Dr.K.Girish	Assistant Prof. Dept. of Microbiology Maharani's Science College, Mysore
13	Sri. G.S. Siddegowda	Assistant Prof. Dept. of Microbiology Maharani's Science College Mysore

14	Dr.N.S.Devaki	Assistant Prof. Dept. of Molecular Biology Yuvaraja's College , Mysore
15	Syeda Farahna Parveen	Assistant Prof. Dept. of Microbiology St.Philomina's College, Mysore
16	Smt. Vanitha	Assistant Prof. Dept. of Microbiology Maharani's Science College,Mysore
17	Smt. Revanamba	Assistant Prof. Dept. of Microbiology Maharani's Science College,Mysore
18	Mahadevaprasad	Assistant prof. Dept. of Microbiology JSS College for Women Saraswathipuram,Mysore
19	Dr.Nagalambika	JSS University,Mysuru
20	RajaRajeshwari.R	Assistant prof. Dept. of Microbiology SDM College JLB Road,Mysuru
21	Uzma Bathool	Assistant Prof. Dept. of Microbiology St.Philomina's College, Mysore
22	Shruthi Prakash	Assistant Prof. Dept. of Microbiology Mahajana's Science College,Mysuru
23	Athiya sultan	Assistant prof. Dept. of Microbiology SDM College JLB Road,Mysuru
24	C.Poornima Devi	Assistant Prof. Dept. of Microbiology Yuvaraja's college,Mysore
25	Dr.Rakshith	Assistant Prof. Dept. of Microbiology Yuvaraja's college,Mysore
26	Vasundara Devi R	Assistant Prof. Dept. of Microbiology Maharani's Science College,Mysore
27	Niveditha Prakash	Assistant prof. Dept. of Microbiology JSS College for Women Saraswathipuram,Mysore
28	Dr.K.Sumana	JSS University,Mysuru
29	Samjna.S.R	Assistant Prof. Dept. of Microbiology Maharani's Science College,Mysore

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE

(Autonomous)

OOTY ROAD, MYSURU- 570 025

DEPARTMENT OF PHYSICS

Syllabus under

National Educational Policy

For B.Sc programmes

- ✓ **Physics, Chemistry**
- ✓ **Physics, Mathematics**
- ✓ **Physics, Computer Science**
- ✓ **Physics, Electronics**

Wef

2021-22

Sem	Course No	Course Code	Combination	Title of the course	Course type	Credit pattern L:T:P	Total credit	Teaching/week	Evaluation pattern			
									C1	C2	C3	Total Marks
I	C1/C2	FSA41031	PC	Mechanics & Properties of Matter	DSC	4:0:0	4	4hrs/week	20	20	60	100
		FSA41032	PM									
		FSA41033	PE									
		FSA41035	PCs	Practical - I		0:0:2	2	4hrs/week	10	15	25	50
II	C1/C2	FSB41031	PC	Electricity and Magnetism	DSC	4:0:0	4	4hrs/week	20	20	60	100
		FSB41032	**PM**									
		FSB41033	PE									
		FSB41035	PCs	Practical - II		0:0:2	2	4hrs/week	10	15	25	50
III	C1/C2	FSC41031	PC	Wave motion and optics	DSC	4:0:0	4	4hrs/week	20	20	60	100
		FSC41032	PM									
		FSC41033	PE									
		FSC41035	PCs	Practical-III		0:0:2	2	4hrs/week	10	15	25	50
IV	C1/C2	FSD41031	PC	Thermal Physics & Electronics	DSC	4:0:0	4	4hrs/week	20	20	60	100
		FSD41032	PM									
		FSD41033	PE									
		FSD41035	PCs	Practical-IV		0:0:2	2	4hrs/week	10	15	25	50

Scheme of Evaluation for OE (Open Elective papers)

(Open elective paper will be given to students in first four semesters)

Sem	Course No	Course Code	Combinations	Title of the course	Course type	Credit pattern L:T:P	Total credit	Teaching/week	Evaluation pattern			
									C1	C2	C3	Total Marks
I	C1/C2	FSA800	KG, HP, EG	Energy Sources	OE	2:1:0	3	3hrs/week	20	20	60	100
II	C1/C2	FSB800	KG, HP, EG	Astronomy	OE	2:1:0	3	3hrs/week	20	20	60	100
III	C1/C2	FSC800	KG, HP, EG	Sports science	OE	2:1:0	3	3hrs/week	20	20	60	100

Scheme of Evaluation for DSC papers

Course type	L:T:P	Total credits	Maximum Marks in the Examination/Assessment									Examination Duration	
			SEE		IA								
			Theory	Practical	Theory				Practical			Theory	Practical
DSC	4:0:2	4+2=6	60	25	40 (C1+C2)				25(C1+C2)			3h	3h
					C1		C2		C1	C2			
					IA	Assignment	IA	Seminar/ Assignment	IA	IA	Record		
					10	10	10	10	10	10	05		

Scheme of Evaluation for OE (Open Elective) papers

(Open elective paper will be given to students in first four semesters)

Course type	L:T:P	Total credits	Maximum Marks in the exam/Assessment						Exam Duration	
			SEE		IA					
			Theory	Practical	Theory			Practical	Theory	Practical
OE	3:0:0	3	60	-	40 (C1+C2)			-	3h	-
					C1		C2			
					IA	Assignment	IA	Seminar/ Assignment		
					10	10	10	10		

Scheme of Evaluation for DSC papers

Course type	L:T:P	Total credits	Maximum Marks in the Examination/Assessment									Examination Duration	
			SEE		IA								
			Theory	Practical	Theory				Practical			Theory	Practical
DSC	4:0:2	4+2=6	60	25	40 (C1+C2)				25(C1+C2)			3h	4h
					C1		C2		C1	C2			
					IA	Assignment/ Field work	IA	Seminar/ Assignment/ Activity	IA	IA	Record		
					10	10	10	10	10	10	05		

Scheme of Evaluation for OE (Open Elective) papers

(Open elective paper will be given to students in first four semesters)

<table>
<tr><th rowspan="4">Course type</th><th rowspan="4">L:T:P</th><th rowspan="4">Total credits</th><th colspan="8">Maximum Marks in the exam/Assessment</th><th colspan="2" rowspan="3">Exam Duration</th></tr>
<tr><th colspan="2">SEE</th><th colspan="5">IA</th></tr>
<tr><th>Theory</th><th>Practical</th><th colspan="4">Theory</th><th>Practical</th></tr>
<tr><td rowspan="4">OE</td><td rowspan="4">3:0:0</td><td rowspan="4">3</td><td rowspan="4">60</td><td rowspan="4">-</td><td colspan="4">40 (C1+C2)</td><td rowspan="4">-</td><td rowspan="4">3h</td><td rowspan="4">-</td></tr>
<tr><td colspan="2">C1</td><td colspan="2">C2</td></tr>
<tr><td>IA</td><td>Assignment /Field work</td><td>IA</td><td>Seminar/ Assignment/ Activity</td></tr>
<tr><td>10</td><td>10</td><td>10</td><td>10</td></tr>
</table>

Programme Educational Objectives:

1. Graduates will demonstrate competence in respective domain as they apply skills to conductscientific research and contribute to quality education.
2. Graduates will be recognized as experts in educational and research institutes as well as industriesin identifying and solving global challenges.
3. Graduates will become leading researchers and professors who create and disseminate newknowledge in scientific and allied fields.

Graduate Attributes and Programme Outcomes:

Exit with:	Credits Required
Certificate upon the Successful Completion of the First Year (Two Semesters) of the multidisciplinary Four-year Undergraduate Programme/Five-year Integrated Master's Degree Programme	44 - 48

1. **Discipline Knowledge:** Knowledge of science and ability to apply to relevant areas.
2. **Problem solving:** Execute a solution process using first principles of science to solve problems related to respective discipline.
3. **Modern tool usage:** Use a modern scientific, engineering and IT tool or technique for solving problems in the areas of their discipline.
4. **Ethics:** Apply the professional ethics and norms in respective discipline.
5. **Individual and teamwork:** Work effectively as an individual as a team member in a multidisciplinary team.
6. **Communication:** Communicate effectively with the stake holders, and give and receive clear instructions.

Exit with:	Credits Required
A **Diploma** upon the Successful Completion of the Second Year (Four Semesters) of the multidisciplinary Four-year Undergraduate Programme/Five-year Integrated Master's Degree Programme	88 - 96

Discipline Knowledge: Knowledge of science and ability to apply to relevant areas.

1. **Conduct investigations:** Conduct investigations of technical issues as per their level of understanding and knowledge.
2. **Problem solving:** Formulate and implement a solution process using first principles of science to solve problems related to respective discipline.
3. **Modern tool usage:** Apply a modern scientific, engineering and IT tool or technique for solving problems in the areas of their discipline.
4. **Ethics:** Apply and commit to the professional ethics and norms in respective profession.
5. **Individual and teamwork:** Work effectively as an individual in a multidisciplinary team.
6. **Communication:** Communicate effectively with the stake holders, and give and receive clear instructions.

Exit with:	Credits Required
Basic Bachelor Degree at the Successful Completion of the Third Year (Six Semesters) of the multidisciplinary Four- year Undergraduate Programme/Five-year Integrated Master's Degree Programme	132 - 144

1. **Discipline Knowledge:** Knowledge of basics of science and ability to apply the understanding of fundamentals of major discipline in solving complex problems.
2. **Conduct investigations:** Conduct investigations of issues in their respective disciplines and arrive at valid conclusions.
3. **Problem solving:** Implement a solution process using first principles of science to solve problems related to respective discipline.
4. **Modern tool usage:** Select and use a modern scientific, engineering and IT tool or techniquefor solving problems in the areas of their discipline.
5. **Environment and Society:** Evaluate the impact of scientific solutions on society and environment and the need for sustainable solutions.
6. **Ethics:** Demonstrate professional ethics, responsibilities and norms in respective profession.
7. **Individual and teamwork:** Work effectively as an individual as a team member and as a leader in a multidisciplinary team.
8. **Communication:** Communicate effectively with the stake holders, write and comprehend project reports and documentation, deliver effective presentations, and give and receive clear instructions.
9. **Project Management and Finance:** Apply the knowledge of scientific and technological principles to one's own work to manage projects in multidisciplinary settings.
10. **Lifelong Learning:** Engage in lifelong learning in the context of changing trends in respective discipline.

Exit with:	Credits Required
Bachelor Degree with Honours in a Discipline at the Successful Completion of the Fourth Years (Eight Semesters) of the multidisciplinary Four-year Undergraduate Programme/Five-year Integrated Master's Degree Programme	176 - 192

1. **Discipline Knowledge:** Knowledge of basics of science and research, and ability to apply the understanding of fundamentals of specialized discipline in solving complex scientific problems.
2. **Conduct investigations:** Conduct investigations of issues using research methods and research-based discipline knowledge including design of experiments, data collection, interpretation and analysis to arrive at valid conclusions.
3. **Problem analysis:** Identify, formulate and analyse complex scientific problems using first principles of respective discipline.
4. **Design and Development of solutions:** Design solutions for complex scientific problems and execute them by considering the environmental, societal and public safety aspects appropriately.

5. **Modern tool usage:** Identify, select and use a modern scientific, engineering and IT tool or technique for modelling, prediction, data analysis and solving problems in the areas of their discipline.
6. **Environment and Society:** Evaluate the impact of scientific solutions on society and environment and design sustainable solutions.
7. **Ethics:** Demonstrate professional ethics, responsibilities and norms in respective profession.
8. **Individual and teamwork:** Work effectively as an individual as a team member and as a leader in a multidisciplinary team.
9. **Communication:** Communicate effectively with the stakeholders with emphasis on communicating with scientific community, comprehend scientific reports, write research papers and projects proposals and reports, deliver effective presentations, and give and receiveclear instructions.
10. **Project Management and Finance:** Apply the knowledge of scientific and technological principles to one's own work to manage projects in multidisciplinary settings.
11. **Lifelong Learning:** Identify knowledge gaps and engage in lifelong learning in the context of changing trends in respective discipline.

Options for Study

- The programmes are flexible enough to allow liberty to students in designing them according to their requirements. Students may choose a single Major, one Major with a Minor, and one Major with two Minors. Teacher Education or Vocational courses may be chosen in place of Minor/s. Below listed are the various options students may choose from.

- One Major subject/discipline, Two Languages, Generic Electives, Ability Enhancement, Skill Development and Vocational courses including Extracurricular Activities.

- One Major and one Minor subject/discipline along with Languages, Generic Electives, Ability Enhancement, Skill Development and Vocational courses including Extracurricular Activities

- Two Major subject/disciplines along with Languages, Generic Electives, Ability Enhancement, Skill Development and Vocational courses, including Extracurricular Activities (subject to fulfilling the requirements as stated in 3.i and 3.ii)

- One Major subject/discipline and one Vocational course along with Languages, Generic Electives, Ability Enhancement and Skill Development and courses including Extracurricular Activities.

- One Major Discipline and One Education Discipline along with Languages, Generic Electives, Ability Enhancement and Skill Development Courses including Extracurricular Activities.

Proposed Curriculum Framework for Multidisciplinary Four- year Undergraduate Programme

Year	Objective	Nature of Courses	Outcome	No. of courses
1st year – (1st & 2nd Semesters)	Understanding and Exploration	1. Major Core Courses 2. Minor/Related Discipline 3. Languages, 4.Ability Enhancement Compulsory Courses 5. Skill Enhancement/ Development Courses	Understanding of Disciplines Language Competency Gaining perspective of context/Generic skills Basic skills sets to pursue any vocation	1+1 1+1 2+2 1+1 1+1
Exit option with Certification				
2nd Year - (3rd & 4th Semesters)	Focus and Immersion	1. Major Core Courses 2. Minor/ Related Discipline 3. Ability Enhancement 4. Skill based Vocational 5. Extra-Curricular Activities	Understanding of disciplines Gaining perspective of context Skill sets to pursue vocation Development of various Domains of mind &Personality	2+2 1+1 1+1 1+1 1+1
Exit Option with Diploma				
3rd Year - (5th & 6th Semesters)	Real time Learning	1. Major Discipline Core and Elective Courses 2. Minor Discipline/ Generic or Vocational Electives /Field based Learning/ Res. Project	In depth learning of major and minor disciplines, Skill sets for employability. Exposure to discipline beyond the chosen Subject Experiential learning/ Res.	2+2 1+1 1+1
Exit option with Bachelor Degree				
4th Year - (7th &8th Semesters)	Deeper Concentration	Major Discipline Core and Elective courses Research/Project Work with Dissertation	Deeper and Advanced Learning of Major Discipline Foundation to pursue Doctoral Studies & Developing Research competencies	4+4
Bachelor Degree with Honours				
5th Year - (9th & 10th Semesters)	Master of the subject	Major Discipline Core and Elective courses/Research/Project Work with Dissertation	Deeper and Advanced Learning of the Major Discipline towards gaining proficiency over the subject	4+4/6+6
Master's Degree				

MODEL FOUND APPROPRIATE AND ADOPTED

IIA. Model Program Structures for the Under-Graduate Programs

Bachelor of Science (Basic/ Hons.) in subjects with practical, with one major and one minor Sem.	Discipline Core (DSC) (Credits) (L+T+P)	Discipline Elective(DSE) / Open Elective (OE) (Credits) (L+T+P)	Ability Enhancement Compulsory Courses (AECC), Languages (Credits) (L+T+P)	Skill Enhancement Courses (SEC)		Total Credits
Skill based (Credits) (L+T+P)			**Value based (Credits) (L+T+P)**			
I	Discipline A1(4+2) Discipline B1(4+2)	OE-1 (3)	L1-1(3), L2-1(3) (4 hrs each)	SEC-1: Digital Fluency (2) (1+0+2)	Physical Education for fitness(1)(0+0+2)	Health & Wellness (1) (0+0+2)	25
II	Discipline A2(4+2) Discipline B2(4+2)	OE-2 (3)	L1-2(3), L2-2(3) (4 hrs each)	Environmental Studies (2)	Physical Education - Yoga(1) (0+0+2)	NCC/NSS/R&R(S&G)/ Cultural (1) (0+0+2)	25
Exit option with Certificate (50 credits)							
III	Discipline A3(4+2) Discipline B3(4+2)	OE-3 (3)	L1-3(3), L2-3(3) (4 hrs each)	SEC-2: Artificial Inte-lligence (2)(1+0+2)	Physical Education- Sports skills(1)(0+0+2)	NCC/NSS/R&R(S&G)/C ultural (1) (0+0+2)	25
IV	Discipline A4(4+2) Discipline B4(4+2)	OE-4 (3)	L1-4(3), L2-4(3) (4 hrs each)	Constitution of India (2)	Physical Education -Games (1) (0+0+2)	NCC/NSS/R&R(S&G)/C ultural (1) (0+0+2)	25
Exit option with Diploma (100 credits) OR Choose any one of the core subjects as Major and the other as Minor							
V	Discipline A5(3+2) Discipline A6(3+2) Discipline B5(3+2)		Vocational-1 (3)	SEC-3: SEC such as Cyber Security (2) (1+0+2)			20
VI	Discipline A7(3+2) Discipline A8(3+2) Discipline B6(3+2)		Vocational-2 (3) Internship (2)	SEC-4: Professional Communication (2)			22
Exit option with Bachelor of Arts, B.A./ Bachelor of Science, B.Sc. Basic Degree (142 credits) or continue studies with the Major							
VII	Discipline A9(3+2) Discipline A10(3+2) Discipline A11(3)	Discipline A, E-1 (3) Discipline A, E-2 (3) Res.Methodology (3)					22
VIII	Discipline A12(3+2) Discipline A13(3) Discipline A14(3)	Discipline A, E-3(3) Research Project (6)*					20
Award of Bachelor of Arts Honours, B.A. (Hons.)/ Bachelor of Science Honours, B.Sc. (Hons) degree in a discipline (184 credits)							

Curriculum Structure-Physics(Core and Electives)

Semesters- I to X

SEM	DSC	Core Papers
Sem-1 :	A1	Mechanics & Properties of Matter
Sem -2 :	A2	Electricity and Magnetism
Sem-3 :	A3	Wave motion and optics
Sem-4:	A4	Thermal Physics & Electronics
Sem-5 :	A5 A6	1. Classical Mechanics and Quantum Mechanics- I 2. Elements of Atomic, Molecular Physics
Sem -6 :	A7 A8	1. Elements of Nuclear Physics and Nuclear Instruments 2. Elements of Condensed Matter Physics
Sem-7	A9 A10 A11	1. Mathematical Methods of Physics – I 2. Classical Electrodynamics. 3. Experimental methods of Physics 4. Research Methodology (Select Two DSE subjects from the Pool B-I shown below)
Sem-8	A12 A13 A14	1. Classical Mechanics and Quantum Mechanics-II 2. Statistical Mechanics 3. Astrophysics & Astronomy 4. Research Project* (Select Two DSE subjects from the Pool B-II shown below) *In lieu of the research Project, two additional elective papers/ Internship may be offered.
Sem-9	A15	1. Mathematical Methods of Physics – II (Select One DSE subjects from the Pool B-III shown below) 2. Research Project
Sem-10	A17	1. Quantum Mechanics – III (Select One DSE subjects from the Pool B-IV shown below) 2. Research Project

** The Topics of 5th Sem and above need to be revisited*

Open Electives for 1st to 4th Semesters

Sl.No.	1 to 4 Semester
1.	Energy Sources
2.	Climate Science
3.	Astronomy
4.	Medical Physics
5.	Optical Instruments
6.	Sports Science
7.	Nanotechnology
8.	Electrical Instruments
9.	Electronic Instruments
10.	Physics for all
11.	Space Missions

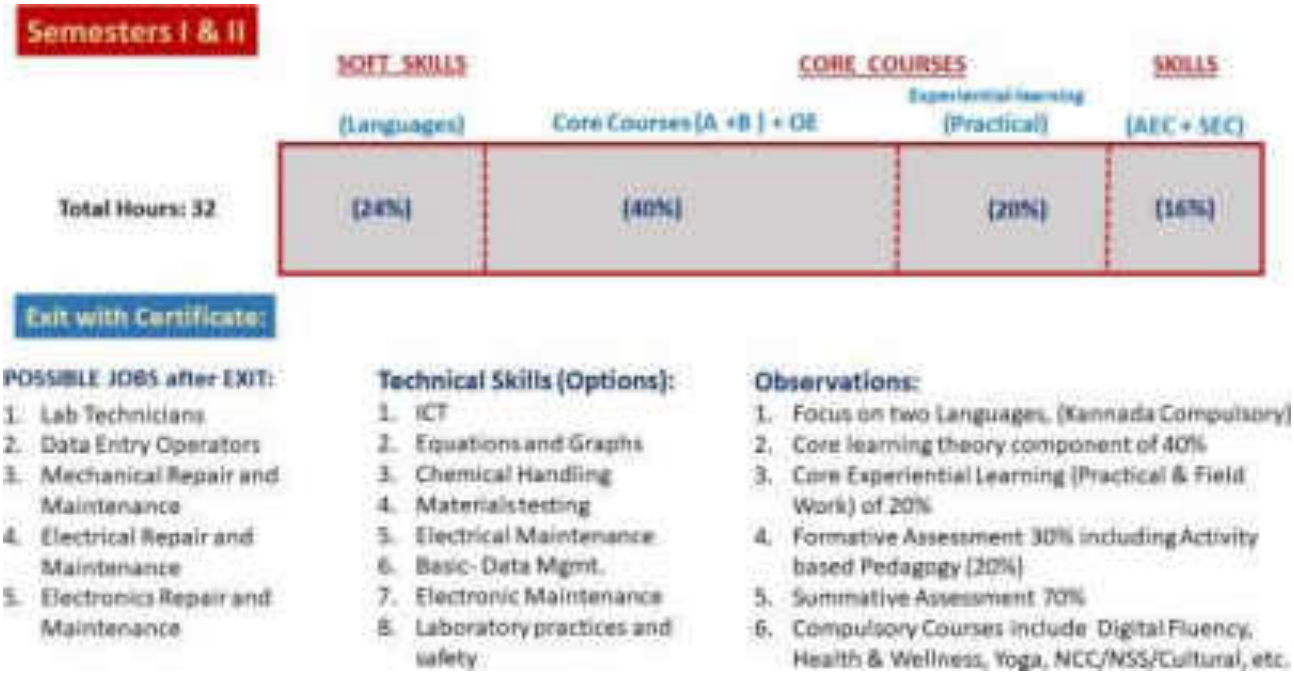
Discipline Specific Electives for 7th to 10th Semesters

	7th Sem Electives Pool B-I (Select any two)		8th Sem Electives Pool B-II (Select any two)
A.	Condensed Matter Physics-1	A.	Atomic & Molecular Physics-1
B.	Nuclear and Particle Physics	B.	Materials Physics & Nano materials
C.	Theoretical and Computational Physics-I	C.	Lasers and non-linear optics
D.	Biophysics	D.	Plasma Physics
E.	Astronomy and Astrophysics	E.	Physics of Semiconductor devices

	9th Sem Electives (Specialization papers) Pool B-III		10th Sem Electives (Specialization papers) Pool B-IV
A.	Condensed Matter Physics-2	A.	Condensed Matter Physics-3
B.	Nuclear and Particle Physics-2	B.	Nuclear and Particle Physics-3
C.	Atomic & Molecular spectroscopy-1	C.	Atomic & Molecular spectroscopy-2
D.	Materials Physics & Nanophysics –1	D.	Materials Physics & Nanophysics -2
E.	Theoretical and Computational Physics-I	E.	Theoretical and Computational Physics-2
F.	Astronomy and Astrophysics-1	F.	Astronomy and Astrophysics-2

Detailed Syllabus for Semesters I & II
B.Sc., Physics

Detailed Syllabus for Semesters I & II



I Semester

Detailed Syllabus of I Semester Physics

Mechanics and Properties of Matter

Course Title: Mechanics and Properties of Matter	Course Credits:4
Total Contact Hours: 52	Duration of ESA: 3 hours
Formative Assessment Marks: 40	Summative Assessment Marks: 60
Model Syllabus Authors: Physics Expert Committee	

Programme Outcomes (POs)

PO-1: Discipline Knowledge: Knowledge of science and ability to apply to relevant areas.

PO-2: Problem solving: Execute a solution process using first principles of science to solve problems related to respective discipline.

PO-3: Modern tool usage: Use a modern scientific, engineering and IT tool or technique for solving problems in the areas of their discipline.

PO-4: Ethics: Apply the professional ethics and norms in respective discipline.

PO-5: Individual and teamwork: Work effectively as an individual as a team member in a multidisciplinary team.

PO-6: Communication: Communicate effectively with the stake holders, and give and receive clear instructions.

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Program Outcomes (POs)

Course Outcomes (COs) *(UGC guidelines)*	1	2	3	4	5	6
CO-1: Will learn fixing units, tabulation of observations, analysis of data (graphical/analytical)	x	x				x
CO-2: Will learn about accuracy of measurement and sources of errors, importance of significant figures.	x	x				
CO-3: Will know how g can be determined experimentally and derive satisfaction.	x					

CO-4: Will see the difference between simple and torsional pendulum and their use in the determination of various physical parameters.	**x**			**x**	**x**	**x**
CO-5: Will come to know how various elastic moduli can be determined.	**x**				x	**x**
CO-6: Will measure surface tension and viscosity and appreciate the methods adopted.	**x**	**x**				
CO-7: Will get hands on experience of different equipment.	**x**	**x**	**x**		**x**	**x**

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course are Marked 'X' in the intersection cell if a course outcome addresses a particular program outcome.

Mechanics & Properties of Matter		Hrs
Credit : 4+2	**Unit – 1** **Theory : 4 hours /Week**	
Chapter No. 1	**Topics** to be covered/taught/learnt: **Units and measurements:** System of units (CGS and SI), measurement of length, mass and time, dimensions of physical quantities, dimensional formulae. Minimum deviation, errors.	(13)
Chapter No. 2	**Momentum and Energy**: Work and energy, Conservation of momentum (linear). Conservation of energy with examples. Motion of rockets.	
Chapter No. 3	**Special Theory of Relativity:** Constancy of speed of light. Postulates of Special Theory of Relativity. Length contraction. Time dilation. Relativistic addition of velocities.	
Topics for self study(If any)	**Self Study** Chapter.4 Laws of Motion: Newton's Laws of motion. Dynamics of single and a system of particles. Centre of mass. Ref: 1-4,9,10	
	Suggested Activities	
Activity No. 1	1. i). Students can measure diameters of small balls of different size and estimate their volumes. 2. ii). Students can measure lengths of nails of different size. iii). Students can measure volume of a liquid iv). Students can measure distances and put the result both in CGS and SI units in 2, 3 and 4 significant figures. Ask them to mention the precession of the measurement. v). students can estimate standard deviations wherever possible.	
Activity No. 2	Students can try and understand conservation of energy in every day examples. For example: i) What happens in solar conservation panels ii) Pushing an object on the table it moves iii) Moving car hits a parked car causes parked car to move. In these cases, energy is conserved. How? Understand and verify if possible.	
Unit – 2		
Chapter No. 4.	**Laws of Motion:** Newton's Laws of motion. Dynamics of single and a system of particles. Centre of mass.	(13)
Chapter No. 5.	**Dynamics of Rigid bodies**: Rotational motion about an axis, Relation between torque and angular momentum, Rotational energy. moment of inertia: M I of a rectangular Lamina and solid cylinders. Flywheel, Theory of compound pendulum and determination of g.	
Chapter No. 6.	**Gravitation:** Law of Gravitation. Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant). Kepler's laws (statements). Satellite in a circular orbit.	

Topics for self study(If any)	**Chapter 7**: Geosynchronous orbits. Basic idea of global positioning system (GPS). Ref: 1-4,9,10	
	Suggested Activities	
Activity No. 3	Activity: Moment of inertia is an abstract concept. It simply gives a measure of rotational inertia of a rigid body and it is proportional to the product of the square of radius, r of the body and its mass, m. Students by referring to websites, can construct and perform simple experiments to verify that MI α mr^2.	
	Reference : www.khanacademy.org, www.pinterest.com, www.serc.cerleton.edn	
Activity No. 4	Activity: Prepare suitable charts and give seminar talks in the class.	

Unit - 3		
Chapter No. 8	**Elasticity:** Hooke's law - Stress-strain diagram, elastic moduli-relation between elastic constants, Poisson's Ratio-expression for Poisson's ratio in terms of elastic constants. Work done in stretching and work done in twisting a wire-Twisting couple on a cylinder. Torsional pendulum-Determination of rigidity modulus and moment of inertia - q, η and σ by Searle's method	(13)
	Suggested Activities	
Activity No. 5	**Activity:** Arrange a steel spring with its top fixed with a rigid support on a wall and a meter scale along side. Add 100 g load at a time on the bottom of the hanger in steps. This means that while putting each 100g load, we are increasing the stretching force by 1N. Measure the extension for loads up to 500g. Plot a graph of extension versus load. Shape of the graph should be a straight line indicating that the ratio of load to extension is constant. Go for higher loads and find out elastic limit of the material.	
Activity No.6	**Activity:** Repeat the above experiment with rubber and other materials and find out what happens after exceeding elastic limit. Plot and interpret.	

Unit - 4		
Chapter No. 9	**Surface tension:** Definition of surface tension. Surface energy, relation between surface tension and surface energy, pressure difference across curved surface example, excess pressure inside spherical liquid drop, angle of contact.	(13)
Chapter No. 11	**Viscosity:** Streamline flow, turbulent flow, equation of continuity, determination of coefficient of viscosity by Poisulle's method, Stoke's method. Problems.	
Topics for self study(If any)	Capillarity determination of surface tension by drop weight method. Ref: 6,7,9,10	
	Suggested Activities	
Activity No.7	1. Measure surface tension of water and other common liquids and compare and learn i) Why water has high ST? think of reasons. ii) Check whether ST is a function of temperature? You can do it by heating the water to different temperatures and measure ST. iii) Plot ST versus T and learn how it behaves. Mix some quantity of kerosene or any oil to water and measure ST. Check whether ST for the mixture is more or less than pure water. List the reasons.	
Activity No. 8	Activity: 2. Collect a set of different liquids and measure their viscosity. i) Find out whether sticky or non-sticky liquids are most viscous. List the reasons. ii) Mix non sticky liquid to the sticky liquid in defined quantities and measure viscosity. Find out viscosity is increasing or decreasing with increase of non-sticky liquid concentration. iii) Do the above experiment by mixing sticky liquid to the non sticky liquid. Find out change in viscosity with increase of concentration of sticky liquid. List the applications where concept of Viscosity plays a dominant role	

Text Books:

Sl No	Title of the Book	Authors Name	Publisher	Year of Publication
1	Mechanics by, New Eition	D. S. Mathur	S.Chand & Co.	2000
2	Mechancis and Relativity by 3rd Edition,	Vidwan Singh Soni,	PHI Learning Pvt. Ltd.	
3	Mechanics Berkeley Physics Course, Vol.1:	Charles Kittel, *et.al.*	Tata McGraw-Hill	2007
4	Properties of Matter	Brijlal & Subramanyam.		

References Books

Sl No	Title of the Book	Authors Name	Publisher	Year of Publication
1	Physics. 9th Edn,	Resnick, Halliday & Walter,	Wiley	2010
2	Physics Vol-I	Halliday and Resnick,		

List of Experiments to be performed in the Laboratory:

1.	Determination of g using bar pendulum (L versus T and L versus LT^2 graphs).
2.	Determination of moment of inertia of a Fly Wheel.
3.	Determination of rigidity modulus using torsional pendulum.
4.	Modulus of rigidity of a rod – Static torsion method.
5.	Determination of elastic constants of a wire by Searle's method.
6.	Young's modulus by Koenig's method.
7.	Viscosity by Stoke's method.
8.	Verification of Hook's law.
9.	Determination of surface tension of a liquid and the interfacial tension between two liquids using drop weight method.
10.	Study of motion of a spring and to calculate Spring constant, g and unknown mass.
11.	Determination of Young's modulus of a bar by the single cantilever method.
12.	Determination of Young's modulus of a bar by uniform bending method.
13.	Radius of capillary tube by mercury pellet method.
14	Verification of parallel and perpendicular axis theorems.

(Minimum EIGHT experiments have to be carried out)

Reference Book for Laboratory Experiments

Sl No	Title of the Book	Authors Name	Publisher	Year of Publication
1	Physics through experiments	B.Saraf	Vikas Publications	2013
2	A lab manual of Physics for undergraduate classes, 1st Edition,		Vikas Publications.	
3	BSc Practical Physics Revised Ed	CL Arora	S.Chand & Co.	2007
4	An advanced course in practical physics.	D. Chatopadhyay, PC Rakshit, B.Saha	New Central Book Agency Pvt Ltd.	2002

Semester – II

Detailed Syllabus of II Semester Physics

Electricity & Magnetism

Course Title: Electricity and Magnetism	Course Credits: 4
Total Contact Hours: 52	Duration of ESA: 3 hours
Formative Assessment Marks: 40	Summative Assessment Marks: 60
Model Syllabus Authors:	Physics Expert Committee

Programme Outcomes

1. Discipline Knowledge: Knowledge of science and ability to apply to relevant areas.
2. Problem solving: Execute a solution process using first principles of science to solve problems related to respective discipline.
3. Modern tool usage: Use a modern scientific, engineering and IT tool or technique for solvingproblems in the areas of their discipline.
4. Ethics: Apply the professional ethics and norms in respective discipline.
5. Individual and teamwork: Work effectively as an individual as a team member in a multidisciplinary team.
6. Communication: Communicate effectively with the stake holders, and give and receive clearinstructions.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs)	Program Outcomes (POs) 1	2	3	4	5	6
i. Demonstrate Gauss law, Coulomb's law for the electric field, and apply it to systems of point charges as well as line, surface, and volume distributions of charges.	x	x				
ii. Explain and differentiate the vector (electric fields, Coulomb's law) and scalar (electric potential, electric potential energy) formalisms of electrostatics.	x					
iii. Apply Gauss's law of electrostatics to solve a variety of problems.	x	x			x	
iv. Describe the magnetic field produced by magnetic dipoles and electric currents.	x					

v. Explain Faraday-Lenz and Maxwell laws to articulate the relationship between electric and magnetic fields.	x					
vi. Describe how magnetism is produced and list examples where its effects are observed.	x				x	x
vii. Apply Kirchhoff's rules to analyze AC circuits consisting of parallel and/or series combinations of voltage sources and resistors and to describe the graphical relationship of resistance, capacitor and inductor.	x	x			x	x
viii. Apply various network theorems such as Superposition, Thevenin, Norton, Reciprocity,• Maximum Power Transfer, etc. and their applications in electronics, electrical circuit analysis, and electrical machines.	x	x			x	x

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark 'X' in the intersection cell if a course outcome addresses a particular program outcome.

Electricity & Magnetism		**Hrs**
Unit – 1		
Chapter No. 1	**Topics to be covered/taught/learnt:** Electric charge and field Coulomb's law, electric field strength, electric field lines, point charge in an electric field and electric dipole, work done by a charge (derivation of the expression for potential energy)	3
Chapter No. 2	**Topics to be Covered** Gauss's law and its applications (electric fields of a (i) spherical charge distribution, (ii) line charge and (iii) an infinite flat sheet of charge).	3
Chapter No. 3	**Topics to be Covered** Electric potential, line integral, gradient of a scalar function, relation between field and potential. Potential due to point charge and distribution of charges (Examples: potential associated with a spherical charge distribution, infinite line charge distribution, infinite plane sheet of charges). Constant potential surfaces, Potential due to a dipole and electric quadrupole.	7
Topics for self study(If any)	*Constant potential surfaces - for self learning* *Work out problems listed in the reference*	
	Suggested Activities	

Activity No. 1	1. Learn the difference between and DC and AC electricity and their characteristics. Voltage and line frequency standards in different countries. 2. A small project report on production of electricity as a source of energy: Different methods	
Activity No. 2	1. Learn to use a multimeter (analog and digital) to measure voltage, current and resistance. Continuity testing of a wire. 2. Learn about household electrical connection terminals: Live, neutral and ground and voltage between the terminals. Role of earthing and safety measures	
Unit – 2		
Chapter No. 4.	**Topics to be covered** Conductors in electrostatic field Conductors and insulators, conductors in electric field. Capacitance and capacitors, calculating capacitance in a parallel plate capacitor, parallel plate capacitor with dielectric, dielectrics: an atomic view. Energy stored in a capacitor, Dielectric and Guass's law.	6
Chapter No. 5.	**Topics to be covered** Electric currents and current density. Electrical conductivity and Ohm's law. Physics of electrical conduction, conduction in metals and semiconductors, circuits and circuit elements: Variable currents in capacitor circuits, Resistor, inductor and capacitor and their combination. force on a moving charge.	7
Topics for self study(If any)	*Currents and voltage in combination of R, L and C circuits*	
	Suggested Activities	
Activity No. 3	1. Learn about electrical appliances which work with AC and DC electricity 2. Learn about types of resistors and their colour codes and types of capacitors(electrolytic and non-electrolytic)	
Activity No. 4	1. Learn about power transmission: 3-phase electricity, voltage and phase 2. Visit a nearby electrical power station. Interact with line men, Electrical engineers and managers. Discuss about power loss in transmission. How to reduce it? 3. Prepare a small project report on street lighting and types of electrical bulbs.	

Unit – 3		
Chapter No.6	**Topics to be covered** Magnetism Definition of magnetic field, Ampere's law and Biot-Savart law (magnetic force and magnetic flux), Magnetic force on a current carrying conductor, Hall effect. Electromagnetic induction, conducting rod moving in a magnetic field, law of induction and mutual inductance, self inductance and energy stored in a magnetic field.	7
Chapter No. 7	**Topics to be covered** Alternating current circuits: Resonant circuit, alternating current, quality factor, RL, RC, LC, LCR circuits, admittance and impedance, power and energy in AC circuits.	6
Topics for self study(If any)	Hall Effect	
	Suggested Activities	
Activity No. 5	**Activity:** 1. Prepare a small project report on street lighting and types of electrical bulbs. 2. Learn the measurement of electric current using tangent galvanometer.	
Activity No.6	**Activity:** Build a small coil with insulated copper wire. Connect an ammeter micro/milli ammeter. Verify magnetic induction using a powerful bar magnet.	
Unit - 4		
Chapter No. 8	Electromagnetic waves: Equation of continuity, Maxwell's equations, displacement current, electromagnetic wave, energy transported by electromagnetic waves. Electromagnetic waves in different frames of reference, Field of a current loop, magnetic moment, Electric current in atoms, electron spin and magnetic moment, magnetization and magnetic susceptibility.	8
Chapter No. 9	**Topics to be covered:** Types of magnetic materials: diamagnetic, paramagnetic and ferromagnetic materials. B-H hysteresis curves.	5
Topics for self study(If any)	*B-H curves and its characteristics* *Ferrites*	

	Suggested Activities	
Activity No.7	**Activity:** 1. Prepare a small project report on production of magnetic field: Permanent magnets, electromagnets and superconducting magnets. 2. Learn the principle of working of a Gauss meter to measure magnetic field	
Activity No. 8	**Activity:** 1. Model the earth's magnetic field with a diagram. Explain the effect of tilt of the earth's axis and reasons for the change in the tilt of the earth's axis over thousands of years.	

References Books:

Sl No	Title of the Book	Authors Name	Publisher	Year of Publication
1	Physics-Part-II,	David Halliday and Robert Resnick	Wiley Eastern Limited	2001
2	Berkeley Physics Course, Vol-2, Electricity and Magnetism, Special Edition	Edward M Purcell	Tata Mc Graw-Hill Publishing Company Ltd, New Delhi	2008

List of Experiments to be performed in the Laboratory

1.	Experiments on tracing of electric and magnetic flux lines for standard configuration.
2.	Determination of components of earth's magnetic field using a Ballistic galvanometer.
3.	Determination of capacitance of a condenser using B.G.
4.	Determination of high resistance by leakage using B.G.
5.	Determination of mutual inductance using BG.
6.	Charging and discharging of a capacitor (energy dissipated during charging and time constant measurements.
7.	Series and parallel resonance circuits (LCR circuits).
8.	Impedance of series RC circuits- determination of frequency of AC.
9.	Study the characteristics of a series RC and RL Circuit.
10.	Determination of self-inductance of a coil.
11.	Verification of laws of combination of capacitances and determination of unknown capacitance using de - Sauty bridge.
12.	Determination of B_H using Helmholtz double coil galvanometer and potentiometer.

(Minimum EIGHT experiments have to be carried out)

Semester – III

Detailed Syllabus of III Semester Physics

Program Outcomes:	
1.	Disciplinary knowledge
2.	Communication Skills
3.	Critical thinking, Reflective thinking, Analytical reasoning, Scientific reasoning
4.	Problem-solving
5.	Research-related skills
6.	Cooperation/ Teamwork/ Leadership readiness/Qualities
7.	Information/ Digital literacy/Modern Tool Usage
8.	Environment and Sustainability
9.	Multicultural competence
10.	Multi-Disciplinary
11.	Moral and ethical awareness/Reasoning
12.	Lifelong learning / Self Directed Learning

Course Content Semester -III Wave Motion and Optics	
Course Title: Wave Motion and Optics	Course Credits:4
Total Contact Hours: 52	Duration of ESA: 3 hours
Formative Assessment Marks: 40	Summative Assessment Marks: 60
Model Syllabus Authors: Physics Expert Committee	

Prerequisites	
i.	Fundamentals of waves

Course Learning Outcomes	
At the end of the course students will be able to:	
i.	Identify different types of waves by looking into their characteristics.
ii.	Formulate a wave equation and obtain the expression for different parameters associated with waves.
iii.	Explain and give a mathematical treatment of the superposition of waves under different conditions, such as, when they overlap linearly and perpendicularly with equal or different frequencies and equal or different phases.
iv.	Describe the formation of standing waves and how the energy is transferred along the standing wave in different applications, and mathematically model in the case of stretched string and vibration of a rod.
v.	Give an analytical treatment of resonance in the case of open and closed pipes in general and Helmholtz resonators in particular.
vi.	Describe the different parameters that affect the acoustics in a building, measure it and control it.
vii.	Give the different models of light propagation and phenomenon associated and measure the parameters like the wavelength of light using experiments like Michelson interferometer, interference and thin films.
viii.	Explain diffraction due to different objects like singles slit, two slits, diffraction of grating, oblique incidence, circular aperture and give the theory and experimental setup for the same.
ix.	Explain the polarization of light and obtain how the polarization occurs due to quarter wave plates, half wave plates, and through the optical activity of a medium.

Course Articulation Matrix

Mapping of Course Outcomes (CO) Program Outcomes

Course Outcomes / Program Outcomes		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
i.	Identify different types of waves by looking into their characteristics.	X	X	X	X	X	X					X	X
ii.	Formulate a wave equation and obtain the expression for different parameters associated with waves.	X	X	X	X	X	X					X	X

iii.	Explain and give a mathematical treatment of the superposition of waves under different conditions such as when they overlap linearly and perpendicularly	X	X	X	X	X	X					X	X
	with equal or different frequencies and equal or different phases.												
iv.	Describe the formation of standing waves and how the energy is transferred along the standing wave in different applications, and mathematically model in the case of stretched string and vibration of a rod.	X	X	X	X	X	X					X	X
v.	Give an analytical treatment of resonance in the case of open and closed pipes in general and Helmholtz resonators in particular.	X	X	X	X	X	X					X	X
vi.	Describe the different parameters that affect the acoustics in a building, measure it and control it.	X	X	X	X	X	X					X	X
vii.	Give the different models of light propagation and phenomenon associated and measure the parameters like the wavelength of light using experiments like Michelson interferometer, interference and thin films.	X	X	X	X	X	X					X	X
viii.	Explain diffraction due to different objects like singles slit, two slits, diffraction grating, oblique incidence, circular aperture and give the theory and experimental setup for the same.	X	X	X	X	X	X					X	X
ix.	Explain the polarization of light and obtain how the polarization occurs due to quarter wave plates, half wave plates, and through the optical activity of a medium.	X	X	X	X	X	X					X	X

Wave Motion and Optics

Unit – 1 - Waves and Superposition of Harmonic Waves

The Portion to be Covered

Waves: Plane and Spherical Waves. Longitudinal and Transverse Waves. Characteristics of wave motion, Plane Progressive (Travelling) Wave and its equation, Wave Equation – Differential form (derivation). Particle and Wave Velocities: Relation between them, Energy Transport – Expression for intensity of progressive wave, Newton's Formula for Velocity of Sound. Laplace's Correction (Derivation). Brief account of Ripple and Gravity Waves. **(Text Book : 1-4) (5 Hours)**

Superposition of Harmonic Waves : Linearity and Superposition Principle. Superposition of two collinear oscillations having (1) equal frequencies and (2) different frequencies (Beats) – Analytical treatment. Superposition of two perpendicular Harmonic Oscillations: Lissajous Figures with equal and unequal frequency- Analytical treatment. Uses of Lissajous' figures. **(Text Book : 1-4) (6 Hours)**

Topic Learning Outcomes
At the end of the topic, students should be able to:

SL No	TLO 's	BL	CO	PO
i.	Explain the difference between plane and spherical waves, longitudinal and transverse waves and give their characteristics.	L2	1	1-6, 11-12
ii.	Write down an equation for the progressive wave in its differential form.	L2	1	1-6, 11-12
iii.	Obtain the relation between particle and wave velocity.	L2	1	1-6, 11-12
iv.	Obtain an expression for intensity of progressive waves.	L2	1	1-6, 11-12
v.	Obtain Newton's formula for the velocity of sound and discuss the factors for which sound velocity is dependent.	L2	2	1-6, 11-12
vi.	Apply the Laplace's correction to the equation of motion of a progressive wave.	L2	2	1-6, 11-12
vii.	With examples explain ripple and gravity waves.	L1	2	1-6, 11-12
viii.	Give the theory of superposition of two linear waves having equal frequencies and different frequencies.	L2	3	1-6, 11-12
ix.	Discuss the formation of different Lissajous figures under different conditions of amplitude and frequency when they superimpose perpendicularly.	L2	3	1-6, 11-12
x.	Give some applications of an Lissajous figures.	L1	3	1-6, 11-12
xi.	Higher order problems.	L3	1,2,3	1-6, 11-12

Teaching and Learning Methodology

Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.
Assessment Techniques
One minute paper/ Predict-Observe-Explain/ Think-Pair-Share/ Class Test/ Quiz/ Crosswords/ Group Assessment/ Assignment/ Peer-to-Peer Evaluation/Seminar etc
Suggested Activities (2 Hours)

Activity No. 1	We know that sound is produced because of vibration. Look into at least 10 musical instruments and identify the regions of vibrations that produces the sound and those parts which enhances the sound because of reverberation. 1. Identify one common element in all of these. 2. Identify equipment which creates beats and try to explain the underlying basic principles. Demonstrate the examples of beats using two tuning forks. 3. Identify what will happen when you drop a stone in a standing water, and when your drop two stones side by side. 4. Make your observations sketch them and comment on it in a report.
Activity No. 2	Draw two sine waves (Amplitude vs time) one shifted with other in phase. Identity where the resonation occurs for each phase shift. Plot phase vs time taken for resonance.
Activity No. 3	Take smooth sand, place a pointed edged pen vertically on the sand. To the mid of the pen, connect two perpendicular threads. Pull these perpendicular threads by varying the forces and timings. Note down the different shapes produced on the sand. Try to interpret the shapes. Make a report of it
Activity No. 4	Hang a pot with sand, which has a hole in the bottom. Gently pull the pot on one side and observe the pattern formed by the sand on the floor. Report the observations.
Activity No. 5	Design a coupled pendulum. Study the impact of the motion of one pendulum over the other pendulum by varying the length, direction of the motion of one pendulum and mass of pendulum and observe the resultant changes. Trace the path of the bobs and make a report.
Activity No. 6	**Note for the teachers for the activity:** Make 3 groups among students and assign each group the activity of drawing one of the 3 graphs given below. Provide a few days to complete the activity. One the specific day, each group has to make a ppt presentation of the following three slides. One the day of the presentation select a member from each group randomly to make the presentation. Based on the work and presentation,

	teacher shall assign marks to each group, wherein all members of the group will get equal marks. 1. The first slide will explain the process of doing the experiment. 2. In the second slide. Students will show the graph of measurement. 3. In the third slide, they will list three observations from that study. **Activity:** Take a stretched spring. Stretch it across two edges. Put a weight on the string, pluck it and measure the amplitude of the vibration. All group will measure the total damping time of oscillating spring. (Using mobile or scale) And plot a graph of the- 1. Varying load on the spring and amplitude at the centre. 2. Take another weight and put that in another place and measure the amplitude of vibration at the centre. 3. Vary the load in the centre of the spring and measure the amplitude at the centre.

Wave Motion and Optics

Unit – 2 - Standing Waves and Acoustics

The Portion to be Covered

Standing Waves : Velocity of transverse waves along a stretched string (derivation), Standing (Stationary) Waves in a String - Fixed and Free Ends (qualitative). Theory of Normal modes of vibration in a stretched string, Energy density and energy transport of a transverse wave along a stretched string. Vibrations in rods – longitudinal and transverse modes (qualitative). Velocity of Longitudinal Waves in gases (derivation). Normal Modes of vibrations in Open and Closed Pipes – Analytical treatment. Concept of Resonance, Theory of Helmholtz resonator. **(Text Book : 1-4)** **(8 Hours)**

Acoustics: Absorption coefficient, Reverberation and Reverberation time, Sabine's Reverberation formula (derivation), Factors affecting acoustics in buildings, Requisites for good acoustics. Acoustic measurements – intensity and pressure levels. **(Text Book : 1-4) (3 Hours)**

Topic Learning Outcomes
At the end of the topic, students should be able to:

SL No	TLO's	BL	CO	PO
i.	Discuss the Transverse waves produced in stretched string and obtain the expression for the same.	L2	3	1-6, 11-12

ii.	Give a qualitative treatment of vibration of a string when it's both ends are fixed and free.	**L2**	**3**	**1-6, 11-12**
iii.	Explain normal modes of a stretched string. Obtain an expression for the energy density and discuss how this energy is transported along a stretched string.	**L2**	**3**	**1-6, 11-12**
iv.	Quantitatively bring about the mode of vibrations created in a rod.	**L2**	**4**	**1-6, 11-12**
v.	Explain types of waves that are produced in gas. Obtain an expression for the same.	**L2**	**4**	**1-6, 11-12**
vi.	With an analytical treatment explain the concept of resonance using the normal modes of vibrations of open and closed pipes.	**L2**	**5**	**1-6, 11-12**
vii.	Give the theory of Helmholtz resonator and explain how it is used to calculate some parameters of the way the standing waves are set in there.	**L2**	**5**	**1-6, 11-12**
viii.	Define Reverberation, Reverberation time and absorption coefficient of a material.	**L1**	**5**	**1-6, 11-12**
ix.	Obtain Sabine's Reverberation formula and discuss what are the factors on which the Reverberation time depends on?	**L2**	**5**	**1-6, 11-12**
x.	List out which are different parameters within a building which effects the acoustics.	**L1**	**6**	**1-6, 11-12**
xi.	Explain what good acoustics of a building are and how acoustics is measured in terms of intensity and pressure inside a building.	**L2**	**6**	**1-6, 11-12**
xii.	Higher order problems.	**L3**	**4,5,6**	**1-6, 11-12**

Teaching and Learning Methodology

Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

Formative Assessment Techniques

One minute paper/ Predict-Observe-Explain/ Think-Pair-Share/ Class Test/ Quiz/ Crosswords/ Group Assessment/ Assignment/ Peer-to-Peer Evaluation/Seminar etc.	
Suggested Activities (2 Hours)	
Activity No. 7	List different phenomenon where standing waves are found in nature. Identify the phenomena and reason for standing waves. Also identify the standing waves in musical instruments. Make a report.
Activity No. 8	1. Go to 5 different newly constructed houses when they are not occupied and when they are occupied. Make your observations on sound profile on each room. Give the reasons. Make a report**.** 2. Visit three very good auditoriums, list out different ways in which the acoustic arrangements have been done (as decoration and Civil works). Look for the reasons in Google and identify which is acoustically the best auditorium among the three you visited. Make a report.
Activity No. 9	**Note for the teachers for the activity:** Make 3-4 groups among students and assign each group the activity of drawing one of the graphs given below. Provide a few days to complete the activity. One the specific day, each group has to make a ppt presentation of the following three slides. One the day of the presentation select a member from each group randomly to make the presentation. Based on the work and presentation, teacher shall assign marks to each group, wherein all members of the group will get equal marks. 1. The first slide will explain the process of doing the experiment. 2. In the second slide. Students will show the graph of measurement. 3. In the third slide, they will list three observations from that study. **Activity:** Take a bowl of different liquids (water, milk, kerosene, salt water, Potassium Permanganate (KMNO4) solution. Place a small non oily floating material (ex: thin plastic) on the surface of the liquid. Drop a marble on the liquid at the centre of the bowl. Repeat the experiment by dropping the marble from the different heights. Plot a graph of- 1. Height v/s time of oscillation 2. Weight of the marble v/s time of oscillation

Activity No. 10	**Note for the teachers for the activity:** Make 3-4 groups among students and assign each group the activity of drawing one of the graphs given below. Provide a few days to complete the activity. One the specific day, each group has to make a ppt presentation of the following three slides. One the day of the presentation select a member from each group randomly to make the presentation. Based on the work and presentation, teacher shall assign marks to each group, wherein all members of the group will get equal marks. 1. The first slide will explain the process of doing the experiment. 2. In the second slide. Students will show the graph of measurement. 3. In the third slide, they will list three observations from that study.
	Activity: Take two marble of same weight. Drop both the marbles on the surface of the liquid from some height. With the help of the mobile take the picture and measure the position of interface of two wave fronts formed in the liquid. Plot graphs for different activities by doing the following activities. 1. By dropping two marbles of same weight from different heights. 2. By dropping two marbles of different weight from the same height

Wave Motion and Optics

Unit – 3 - Nature of light and Interference

The Portion to be Covered

Nature of light : To Determine wavelength of light, distances and shapes using Michelson interferometer. The corpuscular model of light-The wave model - Maxwells electromagnetic waves-Wave Particle Duality **(Text Book No 5; Sections 2.1 to 2.4 and 2.8) (2 Hours)**

Interference of light by division of wave front: Huygen's theory-Concept of wave-front-Interference pattern produced on the surface of water-Coherence-Interference of light waves by division of wave- front- Young's double slit experiment- derivation of expression for fringe width-Fresnel Biprism- Interference with white light (Text Book No 5; Sections 12.1 to 12.2, 14.1 to 14.5, 14.7 to 14.9) **(4 Hours)**

Interference of light by division of amplitude: Interference by division of amplitude-Interference by a plane parallel film illuminated by a plane wave-Interference by a film with two non-parallel reflecting surfaces- color of thin films—Newton's rings-(Reflected light)-Michelson Interferometer-Determination of wavelength of light* (Text Book No 5; Sections 15.1 to 15.2, 15.8 to 15.11) **(5 Hours)**

Topic Learning Outcomes
At the end of the topic, students should be able to:

SL No	TLO	BL	CO	PO

	's			
i.	Explain using Michelson interferometer how to determine the wavelength of light.	**L2**	**7**	**1-6, 11-12**
ii.	Give an account of the different possible shapes that are obtained in Michelson interferometer experiment and their relevance.	**L2**	**7**	**1-6, 11-12**
iii.	Discuss the wave model and the Corpuscular model of light.	**L2**	**7**	**1-6, 11-12**
iv.	Explain Maxwells electromagnetic waves.	**L2**	**7**	**1-6, 11-12**
v.	Give an account of the phenomenon of wave-particle duality.	**L1**	**7**	**1-6, 11-12**
vi.	Give the Huygen theory of wave-front.	**L1**	**7**	**1-6, 11-12**
vii.	Define Interference. Give some examples of Interference.	**L1**	**7**	**1-6, 11-12**
viii.	Give the theory of interference due to two coherent sources of light and obtain an expression for the wavelength of monochromatic source of light (Young's double slit experiment)	**L 2**	**7**	**1-6, 11-12**
ix.	Explain how using personal biprism, a monochromatic coherent source of light are obtained. Using this experimental setup explain how the wavelength of monochromatic sources of light is determined.	**L 2**	**7**	**1-6, 11-12**
x.	Give the theory of interference due to division of amplitude by parallel and non-parallel plates.	**L 1**	**7**	**1-6, 11-12**
xi.	Explain how Newton's rings are obtained and discuss how the wavelength of light is determined using this experiment.	**L 2**	**7**	**1-6, 11-12**
xii.	Higher order problems.	**L 3**	**7**	**1-6, 11-12**

Teaching and Learning Methodology

Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

Formative Assessment Techniques

One minute paper/ Predict-Observe-Explain/ Think-Pair-Share/ Class Test/ Quiz/ Crosswords/ Group Assessment/ Assignment/ Peer-to-Peer Evaluation/Seminar etc

Suggested Activities (2 Hours)	
Activity No. 11	In the table given below explore which phenomenon can be explained by what and Make a report**.**
Activity No. 12	Why colour strips are seen in paddles on roads in rainy seasons try to simulate the same. Give the reasons. Make a report**.**
Activity No. 13	**Note for the teachers for the activity:** Make 3-4 groups among students and assign each group the activity of drawing one of the graphs given below. Provide a few days to complete the activity. One the specific day, each group has to make a ppt presentation of the following three slides. One the day of the presentation select a member from each group randomly to make the presentation. Based on the work and presentation, teacher shall assign marks to each group, wherein all members of the group will get equal marks. 1. The first slide will explain the process of doing the experiment. 2. In the second slide. Students will show the graph of measurement. 3. In the third slide, they will list three observations from that study. **Activity:** Take a bowl of different liquids (water, milk, kerosene, salt water, Potassium Permanganate (KMNO4) solution. Place a small non oily floating material (ex: thin plastic) on the surface of the liquid. Drop two marbles of same weight (mass) from the same height on to the surface of the water but at the different time intervals. Plot graph for the different observations. **For teachers:** Demonstrate the formation of Lissajous Figure using a CRO. Give different shapes of Lissajous Figure with varying frequency and amplitude. Ask the students to comment on the observations.

Wave Motion and Optics

Unit – 4 - Diffraction and Polarisation

The Portion to be Covered

Fraunhofer diffraction : Introduction- Fraunhofer diffraction- Single slit diffraction pattern-position of Maxima and Minima (Qualitative arguments)- Two slit diffraction pattern-position of Maxima and minima- Theory of plane diffraction Grating-Grating spectrum- normal and oblique incidence-Resolving power and dispersive power of a grating Single slit; Double Slit. Multiple slits & Diffraction grating. (Text Book No 5; Sections 18.1 to 18.2, 18.6,18.8 to 18.9) **(4 Hours)**

Fresnel Diffraction- Fresnel half period zones-Diffraction by a circular aperture-diffraction by an opaque disc-The zone plate -comparison between zone plate and convex lens. (Text Book No 5; Sections 20.1 to 20.3) **(3 Hours)**

Polarisation: Introduction-Production of polarized light- The wire Grid polarizer and Polaroid-Superposition of two disturbances-Phenomenon of double refraction-Quarter wave plates and half wave plates- Analysis of polarized light-optical activity**.** (Text Book No 5; Sections 22.1, 22.3,22.4,22.6
to 22.8) **(4 Hours)**

Topic Learning Outcomes
At the end of the topic, students should be able to:

SL No	TLO 's	BL	CO	PO
i.	Define Fraunhofer diffraction.	L2	8	1-6, 11-12
ii.	Give a qualitative treatment of single slit/diffraction double slit diffraction.	L2	8	1-6, 11-12
iii.	Explain the theory of diffraction due to grating and the normal and oblique incidence.	L2	8	1-6, 11-12
iv.	Explain how the resolving power of a grating depends of the number of slits used.	L2	8	1-6, 11-12
v.	Give the theory of Fersnel half period zones.	L2	8	1-6, 11-12
vi.	Discuss zone plates with respect to convex lenses.	L2	8	1-6, 11-12
vii.	Explain optical polarization and polaroids.	L2	9	1-6, 11-12
viii.	Give different types of polaroids.	L2	9	1-6, 11-12
ix.	Give the theory of phenomenon of double refraction and explain what are ordinary and extraordinary rays.	L2	9	1-6, 11-12
x.	Give the theory of quarter wave plates and half wave plates.	L2	9	1-6, 11-12
xi.	Explain optical activity with theory. Give an experimental method to measure the optical activity of a material.	L2	9	1-6, 11-12
xii.	Higher order problems.	L3	8,9	1-6, 11-12

Teaching and Learning Methodology

Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.
Assessment Techniques
One minute paper/ Predict-Observe-Explain/ Think-Pair-Share/ Class Test/ Quiz/ Crosswords/ Group Assessment/ Assignment/ Peer-to-Peer Evaluation/Seminar etc

Suggested Activities (2 Hours)	
Activity No. 14	Explain polarization of light through a chart. List out the surfaces that reflect polarized light. Learn how polarization of light can be done by both transmission and reflection. Perform an experiment and make a report. USING CDs AND DVDs AS DIFFRACTION Gratings Ref:https://www.nnin.org/sites/default/files/files/Karen_Rama_USING_CDs_AND_DVDs_AS_DIFFRACTION_GRATINGS_0.pdf Obtain the diffraction spectra using a CD and design an experiment to find the distance between the tracks on it) (Ref: https://www.brighthubeducation.com/science-lessons-grades-9-12/39347-diffraction-experiment-measuring-groove-spacing-on-cds/, https://silo.tips/download/diffraction-from-a-compact-disk)
Activity No. 15	What is the physics behind making 3D movies? Group Discussion (https://www.slideserve.com/rae/physics-behind-3d-movies-powerpoint-ppt-presentation) Make a report.
Activity No. 16	List out different types of zone plates and look for their applications in day to day life. Make a report.
Activity No. 17	Collect information and study how optically polarizing lenses are made. Visit a nearby lens making facility. Learn the principle behind sunglasses. Make a report.
Activity No. 18	**Note for the teachers for the activity:** Make 3 groups among students and assign each group the activity of drawing one of the graphs given below. Provide a few days to complete the activity. One the specific day, each group has to make a ppt presentation of the following three slides. One the day of the presentation select a member from each group randomly to make the presentation. Based on the work and presentation, teacher shall assign marks to each group, wherein all members of the group will get equal marks. 1. The first slide will explain the process of doing the experiment.

	2. In the second slide. Students will show the graph of measurement. 3. In the third slide, they will list three observations from that study. **Activity:** Identify any 3 sharp edges of varying thickness and assign them to 3 groups. Shine a laser light pointing towards the edge of the needle. Observe the patterns formed on the wall or screen and measure the distance between the bands. Correlate the distance between the bands formed with the thickness of the edge and the distance from the edge to the screen. By this, calculate the wavelength of the laser light used.

Textbooks

Sl No	Title of the Book	Authors Name	Publisher	Year of Publication
1.	The Physics of Waves and Oscillations,	N K Bajaj	Tata McGraw-Hill Publishing Company Ltd., Second Edition,	1984
2.	Waves and Oscillations	N Subramanyam and Brij Lal	Vikas Publishing House Pvt. Ltd., Second Revised Edition	2010
3.	A Text Book of Sound	D R Khanna and R S Bedi	Atma Ram & Sons, Third Edition	1952
4.	Oscillations and Waves	Satya Prakash	Pragathi Prakashan, Meerut, Second Edition	2003
5.	Optics	Ajoy Ghatak	McGraw Hill Education (India) Pvt Ltd	2017
6.	A text Book of Optics	Brij Lal, M N Avadhanulu & N Subrahmanyam	S. Chand Publishing	2012

References Books

Sl No	Title of the Book	Authors Name	Publisher	Year of Publication
1.	Berkeley Physics Course – Waves,	Frank S Crawford Jr.	Tata Mc Graw-Hill Publishing Company Ltd., Special Indian Edition,.	2011

2.	Optics	Eugene *Hecht*	Pearson Paperback	2019
3.	Introduction To Optics	Pedrotti and Frank L ,	Pearson India	3rd Edition
4.	Fundamentals of Optics	Francis Jenkins Harvey White	McGraw Hill Education	2017

Formative Assessment	
Assessment	**Marks**
Internal Assessment	10
Activity	10
REU based Group Activity (Conduct, Report, Presentation)	10
Science Communication Seminar/Poster etc.)	10
Total	40

List of Experiments to be performed in the Laboratory (Minimum 8 experiments are to be conducted)	
1.	Velocity of sound through a wire using Sonometer.
2.	Frequency of AC using Sonometer.
3.	Study of Lissajous' Figures
4.	To verify the laws of transverse vibration using Melde's apparatus.
5.	Helmholtz resonator using tuning fork.
6.	Helmholtz resonator using electrical signal generator.
7.	To determine refractive index of the Material of a prism using sodium source.
8.	To determine the dispersive power and Cauchy constants of the material of a prism using mercury source.
9.	To determine the wavelength of sodium source using Michelson's interferometer.
10.	To determine wavelength of sodium light using Fresnel Biprism.
11.	To determine wavelength of sodium light using Newton's Rings
12.	To determine the thickness of a thin paper by measuring the width of the interference fringes produced by a wedge-shaped Film.
13.	To determine wavelength of (1) Na source and (2) spectral lines of Hg source using plane diffraction grating.
14	To determine dispersive power and resolving power of a plane diffraction grating.

Reference Book for LaboratoryExperiments

Sl No	Title of the Book	Authors Name	Publisher	Year of Publication
1.	Advanced Practical Physics for students	B.L. Flint and H.T. Worsnop	Asia Publishing House.	1971
2.	A Text Book of Practical Physics	I. Prakash & Ramakrishna	Kitab Mahal, 11th Edition	2011
3.	Advanced level Physics Practicals	Michael Nelson and Jon M. Ogborn	Heinemann Educational Publishers, 4th Edition	1985
4.	A Laboratory Manual of Physics for undergraduate classes	D.P.Khandelwal	Vani Publications.	1985

Open Elective : OPTICAL INSTRUMENTS (III SEM)

Time: 3 hrs./week **Max Marks: 60**

Unit 1.	**Basics of Optics** Scope of optics, optical path, laws of reflection and refraction as per Fermat's principle, magnifying glass, Lenses (thick and thin), convex and concave lenses, Lens makers formulae for double concave and convex lenses, lens equation. Focal and nodal points, focal length, image formation, combination of lenses,	13
	dispersion of light: Newton's experiment, angular dispersion and dispersion power. Dispersion without deviation. (Expressions need not be derived, but have to be discussed qualitatively).	
Unit 2.	**Camera and microscopes** Human eye (constitution and working), Photographic camera (principle, construction and working), construction, working and utilities of Simple microscopes, Compound microscope, Electron microscopes, Binocular microscopes **Self study** Experimental determination of magnifying power of a microscope. (Construction part can be discussed through block diagrams)	14
Unit 3.	**Telescopes and Spectrometer** Construction, working and utilities of Astronomical telescopes Terrestrial telescopes Reflecting telescopes, Construction, working and utilities of Eyepieces or Oculars (Huygen, Ramsden's, Gauss) Spectrometer - Construction, working and utilities, measurement of refractive index. **Self study** Telescopes used at different observatories in and outside India.	13
	Activities: Find position and size of the image in a magnifying glass and magnification. Observe rain bows and understand optics. Create a rainbow. Find out what makes a camera to be of good quality. Observe the dispersion of light through prism. Make a simple telescope using magnifying glass and lenses. Learn principle of refraction using prisms. Check bending of light in different substances and find out what matters here. Learn about different telescopes used to see galaxies and their ranges. Many more activities can be tried to learn optics by going through you tubes and webistes such as https://spark.iop.org, http://www.yenka.com, https://publiclab.org etc.	

Open Elective: Sports Science (III Sem)

Time: 3 hrs./week **Max Marks: 60**

Content (Use maths of 10th Std only – Only qualitative discussion)		Hrs
Unit - 1		
Chapter No. 1	**Measurement**: Physical quantities. Standards and Units. International system of Units. Standards of time, length and mass. Precision and significant figures.	o4
Chapter No. 2	**Newton's laws of motion**: Newton's first law. Force, mass. Newton's second law. Newton's third law. Mass and weight. Applications of Newton's laws.	03
Chapter No. 3	**Projectile motion**: Shooting a falling target. Physics behind Shooting, Javelin throw and Discus throw.	03
Topics for self study (If any)	**https://www.real-world-physics-problems.com/physics-of-sports.html**	
Unit - 2		
Chapter No. 4.	**Conservation laws**: Conservation of linear momentum, collisions – elastic and inelastic. Angular momentum. (Physics behind Carom, Billiards, Racing)	04
Chapter No. 5.	**Centre of mass**: Physics behind Cycling, rock climbing, Skating,	02
Chapter No. 6.	**Gravitation**: Origin, Newton's law of gravitation. Archimedes's principle, Buoyancy (Physics behind swimming)	04
Topics for self study (If any)	Archimedes' Principle: Made EASY | Physics in You tube	
Unit - 3		
Chapter No.7	**Food and Nutrition:** Proteins, Vitamins, Fat, Blood pressure. Problems due to the deficiency of vitamins.	04
Chapter No. 8	**Energy:** Different forms of Energy, Conservation of mass-energy.	03
Chapter No . 9	**Physical exercises:** Walking, Jogging and Running, Weight management.	03
Topics for self study (If any)	10 Best Exercises for Everyone – Healthline	
	Suggested Activities	
Activity No. 1	Identify the methods of measurement of time, length and mass from ancient time and build models for them.	02
	Reference : History of measurement - Wikipedia *https://en.wikipedia.org › wiki › History_of_measurem*	

Activity No. 2	Identify Physics principles behind various Sports activities.	01

	https://www.real-world-physics-problems.com/physics-of-sports.html	
Activity No. 3	List the difficulties experienced in Gymnastics, Cycling and weight lifting.	02
Activity No. 4	List the difficulties experienced in swimming.	01
Activity No. 3	List the difficulties experienced in Gymnastics, Cycling and weight lifting.	02
Activity No. 4	List the difficulties experienced in swimming.	01
Activity No. 5	Learn breathing exercises. Reference : 1)Simple Breathing Exercise for Beginners | Swami Ramdev *2) https://www.yogajournal.com*	02
Activity No.6	Write an essay on Physical health v/s Mental health or conduct a debate on Physical health v/s Mental health.	01

Text Books

Sl No	Title of the Book	Authors Name	Publisher	Year of Publication
1	Physics for Entertainment	Yakov Perelman	Createspace Independent Pub.	
2	Physics Everywhere	Yakov Perelman	Prodinnova	2014
3	Mechanics for Entertainment	Yakov Perelman	Prodinnova	2014
4	Handbook of Food and Nutrition	M.Swaminathan	Bangalore Press 2012	2012
5	Food Science	B. Srilakshmi	New Age International Pub	2015

References Books

Sl No	Title of the Book	Authors Name	Publisher	Year of Publication
1	Physics	Resnick, Halliday and Krane, Vol 1	Wiley Student Edition.	
2	For the love of Physics	Walter Lewin	Taxmann Publications Private Limited	2012
3	An Introduction to the Physics of Sports	VassiliosMcInnesSpathopoulos	CreateSpace Independent Publishing Platform	2013

Internet resources
https://www.topendsports.com/biomechanics/physics.htm
https://www.real-world-physics-problems.com/physics-of-sports.html
https://www.healthline.com/
https://www.mayoclinic.org/
https://www.who.int/news-room/

Semester – IV

Detailed Syllabus of IV Semester Physics

Program Outcomes:	
1.	Disciplinary knowledge
2.	Communication Skills
3.	Critical thinking, Reflective thinking, Analytical reasoning, Scientific reasoning
4.	Problem-solving
5.	Research-related skills
6.	Cooperation/ Teamwork/ Leadership readiness/Qualities
7.	Information/ Digital literacy/Modern Tool Usage
8.	Environment and Sustainability
9.	Multicultural competence
10.	Multi-Disciplinary
11.	Moral and ethical awareness/Reasoning
12.	Lifelong learning / Self Directed Learning

Course Content Semester – IV Thermal Physics and Electronics	
Course Title: Thermal Physics and Electronics	Course Credits:4
Total Contact Hours: 52	Duration of ESA: 3 hours
Formative Assessment Marks: 40	Summative Assessment Marks: 60
Model Syllabus Authors: Physics Expert Committee	

Prerequisites	
i.	Study of Pre-University

Course Learning Outcomes	
At the end of the course students will be able to:	
i.	Apply the laws of thermodynamics and analyze the thermal system.
ii.	Apply the laws of kinetic theory and radiation laws to the ideal and practical thermodynamics systems through derived thermodynamic relations.
iii.	Use the concepts of semiconductors to describe different Semiconductor devices such as diode transistors, BJT, FET etc and explain their functioning.
iv.	Explain the functioning of OP-AMPS and use them as the building blocks of logic gates.
v.	Give the use of logic gates using different theorems of Boolean Algebra followed by logic circuits.

Course Articulation Matrix

Mapping of Course Outcomes (CO) Program Outcomes

Course Outcomes / Program Outcomes		1	2	3	4	5	6	7	8	9	10	11	12
i.	Apply the laws of thermodynamics and analyze the thermal system.	X	X	X	X	X	X					X	X
ii.	Apply the laws of kinetic theory and radiation laws to the ideal and practical thermodynamics systems through derived thermodynamic relations.	X	X	X	X	X	X					X	X
iii.	Use the concepts of semiconductors to describe different Semiconductor devices like diode transistors, BJT, FET etc and explain their functioning.	X	X	X	X	X	X					X	X
iv.	Explain the functioning of OP-AMPS and them as the building blocks of logic gates.	X	X	X	X	X	X					X	X
v.	Give the use of logic gates using different theorems of Boolean Algebra followed by logic circuits.	X	X	X	X	X	X					X	X

Thermal Physics and Electronics

Unit – 1

The Portion to be Covered

Laws of Thermodynamics:
Review of the concepts of Heat and Temperature. **(1 Hour)**
First Law of Thermodynamics: Differential form, Internal Energy. Equation of state for an adiabatic process, Work Done during Isothermal and Adiabatic Processes. **(3 Hours)**
Second Law of Thermodynamics: Kelvin-Planck and Clausius Statements and their Equivalence. Reversible and Irreversible processes with examples. Heat Engines: Carnot engine & efficiency (no derivation). Refrigeration & coefficient of performance, Applications of Carnot engine in locomotion, Thermodynamic Scale of Temperature and its Equivalence to Perfect Gas Scale. Concept of Entropy, Second Law of Thermodynamics in terms of Entropy **(5 Hours)**
Third Law of Thermodynamics: Statement, Significance and Unattainability of Absolute Zero. **(2 Hours)**

Topic Learning Outcomes
At the end of the topic, students should be able to:

SL No	TLO's	BL	CO	PO
i.	Explain the first law of thermodynamics.	L1	1	1-6,11-12
ii.	Give the differential form of the first law of thermodynamics and define what the internal energy is.	L2	1	1-6,11-12
iii.	Obtain an expression for work done in isothermal and adiabatic processes.	L2	1	1-6,11-12
iv.	Give two systems of units of temperature measurement and give their equivalence.	L2	1	1-6,11-12
v.	Describe and Discuss heat engine based on Carnot cycle.	L2	1	1-6,11-12
vi.	Explain how the efficiency of refrigeration is measured?	L2	1	1-6,11-12
vii.	Detail out the application of the Carnot engine to a locomotion system.	L1	1	1-6,11-12
viii.	Define entropy and write an expression for entropy using the second law of thermodynamics.	L2	1	1-6,11-12
ix.	State the third law of thermodynamics and give its significance using the third law of thermodynamics describing why absolute zero temperature is not unattainable.	L2	1	1-6,11-12

x.	High Order Problems.	**L3**	**1**	**1-6,11-12**

Teaching and Learning Methodology

Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

Assessment Techniques

One minute paper/ Predict-Observe-Explain/ Think-Pair-Share/ Class Test/ Quiz/ Crosswords/ Group Assessment/ Assignment/ Peer-to-Peer Evaluation/Seminar etc

Suggested Activities (2 Hours)

Activity No. 1	I feel cold because coldness enter my body. Discuss the statement in day-to-day life. Approximately give examples of **(i)** open system **(ii)** closed system and **(iii)** isolated system Discuss when the temperature of the body is locked until what time you hold the thermometer in contact with a body. Discuss it in contact with laws of thermodynamics. Discuss why when a person works or does exercise, he sweats. Reason it with the laws of thermodynamics.

Activity No. 2	**Note for the teachers for the activity:** Make 3-4 groups among students and assign each group the activity of drawing one of the graphs given below. Provide a few days to complete the activity. One the specific day, each group has to make a ppt presentation of the following three slides. One the day of the presentation select a member from each group randomly to make the presentation. Based on the work and presentation, teacher shall assign marks to each group, wherein all members of the group will get equal marks. **(i)** The first slide will explain the process of doing the experiment. **(ii)** In the second slide. Students will show the graph of measurement. **(iii)** In the third slide, they will list three observations from that study. **Activity:** Take four different sizes of same metal, preferable of same shape and give one piece to each group. Heat it uniformly on a hot plate. Keep a beaker of water with a thermometer immersed in it. Drop one hot metal into the water and record the temperature with time. Repeat the experiment for the other heated metal pieces of different sizes. **(i)** Plot a graph for the volume of the metal piece used v/s respective temperature change observed. **(ii)** Determine the heat capacity and specific heat of the metal used.
	All groups shall also do the following activity:
Activity No. 3	**Note for the teachers for the activity:** Make 3-4 groups among students and assign each group the activity of drawing one of the graphs given below. Provide a few days to complete the activity. One the specific day, each group has to make a ppt presentation of the following three slides. One the day of the presentation select a member from each group randomly to make the presentation. Based on the work and presentation, teacher shall assign marks to each group, wherein all members of the group will get equal marks. **(i)** The first slide will explain the process of doing the experiment. **(ii)** In the second slide. Students will show the graph of measurement. **(iii)** In the third slide, they will list three observations from that study. **Activity:** Take ice cubes of different size and immerse in water and measure the temperature change with time and repeat the experiment. Graph the observations.

Thermal Physics and Electronics

Unit – 2

The Portion to be Covered

Thermodynamic Potentials: Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy. Properties and Applications. **(1 Hour)**

Maxwell's Thermodynamic Relations: Derivations and applications of Maxwell's Relations (1) First order Phase Transitions with examples, Clausius - Clapeyron Equation (2) Values of Cp-Cv (3) Joule- Thomson Effect and Joule-Thomson coefficient and Derive an equation for Vander Walls gas. Attainment of low temperature by liquefaction of gases and adiabatic demagnetization. **(3 Hours)**

Kinetic Theory of Gases: Distribution of Velocities: Maxwell-Boltzmann Law of Distribution of Velocities in an Ideal Gas: Mean, RMS and Most Probable Speeds. Degrees of Freedom, Law of Equipartition of Energy. Specific heats of Gases. **(3 Hours)**

Radiation: Blackbody radiation, spectral distribution, the concept of energy density and pressure of radiation, Wien's law, Wien's displacement law, Stefan-Boltzmann law, Rayleigh-Jeans law,
Ultraviolet Radiation catastrophe and Planck's law of radiation. **(3 Hours)**

Topic Learning Outcomes
At the end of the topic, students should be able to:

SL No	TLO's	BL	CO	PO
i.	State Maxwell relations.	L1	2	1-6, 11-12
ii.	Give examples where Maxwells relations are used.	L1	2	1-6, 11-12
iii.	Explain the phase transition. Which is called as first order phase transition? Give Examples	L2	2	1-6, 11-12
iv.	State Clausius - Clapeyron Equation.	L1	2	1-6, 11-12
v.	Obtain an equation for difference in C_P - C_V.	L2	2	1-6, 11-12
vi.	State Joule-Thomson effect and Joule-Thomson coefficient.	L1	2	1-6, 11-12
vii.	Obtain an expression, giving the relation between pressure, volume and temperature for a real gas (Vander Waals gas).	L2	2	1-6, 11-12
viii.	Explain adiabatic demagnetization and how it is used to obtain low temperature by the liquidation of gases?	L2	2	1-6, 11-12

ix.	State Maxwell-Boltzmann Law of Distribution of Velocities in Ideal gases.	**L1**	**2**	**1-6, 11-12**
x.	Explain the mean RMS and most probable speeds in ideal gases.	**L1**	**2**	**1-6, 11-12**
xi.	Explain degrees of freedom associated with particles in an ideal gas?	**L2**	**2**	**1-6, 11-12**
xii.	Define the specific heat of a gas.	**L1**	**2**	**1-6, 11-12**
xiii.	Explain black body radiation and its spectral distribution.	**L1**	**2**	**1-6, 11-12**
xiv.	Explain the different laws used to describe different parts of the curves of a spectral distribution of black body radiation.	**L2**	**2**	**1-6, 11-12**
xv.	Define ultraviolet radiation catastrophe? Discuss its importance in the explanation of black body radiation.	**L2**	**2**	**1-6, 11-12**
xvi.	Define Planck's law of radiation and discuss how it could describe the whole black body radiation curve.	**L2**	**2**	**1-6, 11-12**
xvii.	High Order Problems.	**L3**	**2**	**1-6, 11-12**

Teaching and Learning Methodology

Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

Assessment Techniques

One minute paper/ Predict-Observe-Explain/ Think-Pair-Share/ Class Test/ Quiz/ Crosswords/ Group Assessment/ Assignment/ Peer-to-Peer Evaluation/Seminar etc

Suggested Activities (2 Hours)

Activity No. 4	**(i)** Measuring the Solar Constant Materials: Simple flat sided Jar and Thermometer. Activity: Bottle containing water is exposed to solar radiation. The rise in temperature and time taken are noted. Calculate the heat absorbed by water and relate it to the output of the Sun. **(ii)** Thermo emf Materials: Suitable two dissimilar metal wires, voltage measuring device. Activity: In this experiment student will assemble the thermocouple and study the three effects namely, Seebeck, Peltier, and Thompson. **(iii)** Inverse square law of radiation Materials: A cardboard with a grid, cardboard with a hole, supporting clips, a ruler, candle. **(iv)** Activity: Students set the device. They count the lighted squares on the cardboard with the grid by varying the distance. And make necessary measurements and calculations to arrive at the inverse square law of radiation. Ref: Activity Based Physics Thinking Problems in Thermodynamics: Kinetic Theory http://www.physics.umd.edu/perg/abp/think/thermo/kt.htm
Activity No. 5	**Note for the teachers for the activity:** Make 3-4 groups among students and assign each group the activity of drawing one of the graphs given below. Provide a few days to complete the activity. One the specific day, each group has to make a ppt presentation of the following three slides. One the day of the presentation select a member from each group randomly to make the presentation. Based on the work and presentation, teacher shall assign marks to each group, wherein all members of the group will get equal marks. **(i)** The first slide will explain the process of doing the experiment. **(ii)** In the second slide. Students will show the graph of measurement. **(iii)** In the third slide, they will list three observations from that study. **Activity:** Take two dissimilar metal wires. Spot weld them forming two junctions. Dip one junction in ice and heat the other junction with a burner. Plot a graph of time of heating v/s Thermo EFM generated in the voltmeter.
Activity No. 6	**Note for the teachers for the activity:** Make 3-4 groups among students and assign each group the activity of drawing one of the graphs given below. Provide a few days to complete the activity. One the specific day, each group has to make a ppt presentation of the following three slides. One the day of the presentation select a member from each group randomly to make the presentation. Based on the work and presentation, teacher shall assign marks to each group, wherein all members of the group will get equal marks. **(i)** The first slide will explain the process of doing the experiment. **(ii)** In the second slide. Students will show the graph of measurement. **(iii)** In the third slide, they will list three observations from that study.

	Activity: Make 4 groups and give different-sized balloons to each group. Fit different-sized nozzles into the mouth of the large balloons. Measure the temperature or the EMF generated using a thermocouple placed at the mouth of the nozzle as the pressurised gas is released. Plot a graph of time v/s temperature. Vary the volume of the balloon and repeat the experiment. Plot the graph of volume v/s temperature difference created.

Thermal Physics and Electronics

Unit – 3

The Portion to be Covered

Semiconductor devices: Review of Intrinsic and Extrinsic semiconductors, p-n junction and its Characteristics and Parameters, Diode approximations, Half-wave rectifier, Full-wave rectifier, Zener diode voltage regulators: Regulator circuit with no load, Loaded Regulator. **(5 hours)**

Junction Transistors: Basics of Bipolar Junction Transistors (BJT), BJT operation, Common Base, Common Emitter and Common Collector Characteristics. Field Effect Transistor (FET) and its
characteristics. Transistor as an Amplifier and Oscillator. **(6 hours)**

Topic Learning Outcomes
At the end of the topic, students should be able to:

SL No	TLO 's	BL	CO	PO
i.	Define Semiconductors and Band Gap. Explain on what basis they are classified as intrinsic and extrinsic.	L2	3	1-6, 11-12
ii.	Define PN junction. Explain it's functioning in forward and reverse bias.	L1	3	1-6, 11-12
iii.	Explain the approximation used in a real diode with respect to an ideal PN Junction?	L2	3	1-6, 11-12
iv.	With a schematic diagram, explain half wave and full wave rectifiers.	L1	3	1-6, 11-12
v.	Define a Zener diode and explain how it is different from an ordinary diode using V-I curves?	L2	3	1-6, 11-12
vi.	With the schematic diagram, explain the working of voltage regulators of different types using a Zener diode.	L1	3	1-6, 11-12
vii.	Give the basic concepts used in the instruction of bipolar junction transistor and its operation.	L1	3	1-6, 11-12

viii.	Compare the V-I curve of common base common emitter and common collector BJT curves while explaining their working principles.	**L2**	**3**	**1-6, 11-12**
ix.	Define FET? Give its characteristics.	**L1**	**3**	**1-6, 11-12**
x.	Explain how a transistor can be used as an amplifier and an oscillator using a circuit diagram.	**L2**	**3**	**1-6, 11-12**
xi.	High Order Problems.	**L3**	**3**	**1-6, 11-12**

Teaching and Learning Methodology

Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

Assessment Techniques

One minute paper/ Predict-Observe-Explain/ Think-Pair-Share/ Class Test/ Quiz/ Crosswords/ Group Assessment/ Assignment/ Peer-to-Peer Evaluation/Seminar etc

Suggested Activities (2 Hours)

Activity No. 7	Wire a regulated DC power supply on a bread board or groove board to give a regulated output voltage of + 5 V; +15 V; Dual power output : ± 5 V; Dual power output : ± 15 V. Use: 3-pin voltage regulators. Components required: 1. Step down transformer- 1 No. (5 V tapping, 100 – 500 mA current rating), BY 127 semiconductor diodes – 4 Nos, Inductor -1, Capacitor - 1, 3 pin 5V regulator-1 Search for circuit diagram in books/net. **Note for the teachers for the activity:** Make 3-4 groups among students and assign each group the activity of drawing one of the graphs given below. Provide a few days to complete the activity. One the specific day, each group has to make a ppt presentation of the following three slides. One the day of the presentation select a member from each group randomly to make the presentation. Based on the work and presentation, teacher shall assign marks to each group, wherein all members of the group will get equal marks. **(i)** The first slide will explain the process of doing the experiment. **(ii)** In the second slide. Students will show the graph of measurement. **(iii)** In the third slide, they will list three observations from that study.

	Activity: Form 3 groups and tell them to make a DC supply of low current of different voltages like 5V, 10V, and 15V on a breadboard
Activity No. 8	**(i)** Learn to identify the terminals of different types (packages) of BJTs. **(ii)** In the case of power transistors, learn how to fix a heat sink for the transistor. **(iii)** Learn the difference between BJT and FET in its operational characteristics.
Activity No. 9	**Note for the teachers for the activity:** Make 3-4 groups among students and assign each group the activity of drawing one of the graphs given below. Provide a few days to complete the activity. One the specific day, each group has to make a ppt presentation of the following three slides. One the day of the presentation select a member from each group randomly to make the presentation. Based on the work and presentation, teacher shall assign marks to each group, wherein all members of the group will get equal marks. **(i)** The first slide will explain the process of doing the experiment. **(ii)** In the second slide. Students will show the graph of measurement. **(iii)** In the third slide, they will list three observations from that study. **Activity:** Take any 3 diode and assign one to each group. Measure its resistance when dipped in ice and heating the ice till it boils. Using this data, plot calibration curve of temperature v/s resistance and also the cooling curve of temperature V/s time for the diode by each group.

Thermal Physics and Electronics

Unit – 4

The Portion to be Covered

Electronics: Integrated Circuits (Analog and Digital), Operational Amplifier, Ideal characteristics of Op-Amp, Inverting and Non-Inverting Configurations. Applications- Voltage Follower, Addition and Subtraction. **(4 hours)**

Digital: Switching and Logic Levels, Digital Waveform. Number Systems: Decimal Number System, Binary Number System, Converting Decimal to Binary, Hexadecimal Number System: Converting Binary to Hexadecimal, Hexadecimal to Binary. **(3 hours)**

Boolean Algebra Theorems: De Morgan's theorem. Digital Circuits: Logic gates, NOT Gate, AND Gate, OR Gate, NAND Gate, NOR Gate, Algebraic Simplification, Implementation of NAND and NOR
functions. **(4 hours)**

Topic Learning Outcomes
At the end of the topic, students should be able to:

SL No	TLO 's	BL	CO	PO
i.	Define op-amps and give the characteristics of an ideal op-amp.	L 1	4	1-6, 11-12
ii.	Explains an inverting and non-inverting configuration of typical op-amps, with a schematic diagram.	L 2	4	1-6, 11-12
iii.	Explain how op-amps can be used as a voltage follower, with a schematic diagram and with relevant expressions.	L 2	4	1-6, 11-12
iv.	Explain how op-amps can be used as a voltage follower, adder and subtractor, with a schematic diagram and with relevant expressions.	L 2	4	1-6, 11-12
v.	Give different digital wave forms and explain how one can visualize the switching and logic levels.	L 1	5	1-6, 11-12
vi.	Write any four-digit numbers other than zero in the decimal number system and convert that into binary and hexadecimal.	L 2	5	1-6, 11-12
vii.	Write any number in a Binary System of 8 digits other than zero and convert it into decimal and hexadecimal.	L 2	5	1-6, 11-12
viii.	Write any number in the hexadecimal system of 4 digits other than zero and converted it into a binary and decimal number.	L 2	5	1-6, 11-12
ix.	Give simplified diagram for a given Boolean circuit diagram of logic gates, and verify using the De-Morgans theorem.	L 2	5	1-6, 11-12
x.	Why are X-NOR gates called Universal Gates?	L 2	5	1-6, 11-12
xi.	High Order Problems.	L 3	4, 5	1-6, 11-12

Teaching and Learning Methodology

Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

Assessment Techniques

One minute paper/ Predict-Observe-Explain/ Think-Pair-Share/ Class Test/ Quiz/ Crosswords/ Group Assessment/ Assignment/ Peer-to-Peer Evaluation/Seminar etc	
Suggested Activities (2 Hours)	
Activity No. 10	Learn how to implement logic functions (AND, OR, NOT) using just diodes and resistors.
	With a circuit diagram show how different types of gates can be built by X-NOR gates.
Activity No. 11	**Operational Amplifiers** **(i)** Understand the concept of virtual ground of an OP-AMP. **(ii)** Learn the different types of op-amps used for different applications. **(iii)** What is a buffer? Prepare a report on buffers and its application in instrumentation electronics.
Activity No. 12	**(i)** A man has to take a wolf, a goat, and some cabbage across a river. His rowboat has enough room for the man plus either the wolf or the goat or the cabbage. If he takes the cabbage with him, the wolf will eat the goat. If he takes the wolf, the goat will eat the cabbage. Only when the man is present are the goat and the cabbage safe from their enemies. All the same, the man carries wolf, goat, and cabbage across the river. How? Write the truth table for the above story and implement using gates. **(ii)** A locker has been rented in the bank. Express the process of opening the locker in terms of digital operation. **(iii)** A bulb in a staircase has two switches, one switch being at the ground floor and the other one at the first floor. The bulb can be turned ON and also can be turned OFF by and one of the switches irrespective of the state of the other switch. The logic of switching of the bulb resembles.

Textbooks

Sl No	Title of the Book
1.	Electronic Devices and Circuits, David A. Bell, 2004, PHI, New Delhi
2.	Integrated Electronics, Jacob Millman and CC Halkias
3.	Digital Fundamentals, Floyd, 2001, PHI, New Delhi

References Books

Sl No	Title of the Book
1.	Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, 1981, McGraw-Hill.
2.	Thermal Physics, S. Garg, R. Bansal and Ghosh, 2nd Edition, 1993, Tata McGraw-Hill
3.	A Treatise on Heat, Meghnad Saha, and B.N.Srivastava, 1958, Indian Press

4.	Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009, Springer.
5.	Thermodynamics, Kinetic Theory & Statistical Thermodynamics, Sears & Salinger. 1988, Narosa.
6.	An Introduction to Thermal Physics, Daniel V Schroeder, 2020, Oxford University Press

Formative Assessment	
Assessment	**Marks**
Internal Assessment	10
Activity	10
REU based Group Activity (Conduction, Report, Presentation)	10
Science Communication (Seminar/Poster etc)	10
Total	40

List of Experiments to be performed in the Laboratory	
1.	Mechanical Equivalent of Heat by Callender and Barne's method
2.	Coefficient of thermal conductivity of Copper by Searle's apparatus
3.	Coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method
4.	Determination of Stefan's constant/ Verification of Stefan's law
5.	Variation of thermo-emf across two junctions of a thermocouple with temperature
6.	Verification of Clausius –Clapeyron equation and determination of specific enthalpy
7.	V-I Characteristics of Silicon & Germanium PN Junction diodes (FB & RB) OR V-I Characteristics of Zener Diode and voltage regulator
8.	Characteristics of BJT in Common Emitter Configuration OR Frequency response of CE Amplifier
9.	Half Wave and Full Wave Rectifier with and without Filter
10.	Non-inverting and Inverting op-amp circuits OR Voltage follower, Adder and Subtractor circuits
11.	Truth table verification of logic gates using TTL 74 series ICs. OR Logic Gates; Combinational Circuits; Sequential Circuits

Minimum 8 experiments are to be conducted

Reference Book for Laboratory Experiments	
Sl No	**Title of the Book**
1.	Basic Electronics Lab (P242) Manual 2015-16, National Institute of Science Education and Research, Bhubaneswar, 2015.
2.	**Suggested Readings:** 1. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd., London, 1962, 9e. 2. S. Panigrahi, B. Mallick, "Engineering Practical Physics", Cengage Learning India Pvt. Ltd., 2015, 1e.

SYLLABUS FOR OPEN ELECTIVES

(SEM I to IV)

3 Credits: 3 Lectures + 1 Tutorial

SYLLABUS FOR OPEN ELECTIVEENERGY SOURCES

Time: 2 hrs./week + 01 Hr tutorial **Max Marks:**

		No. of lectures
Unit-I	**Non-Renewable energy sources**	
	Chapter-1: Introduction	
	Energy concept-sources in general, its significance & necessity. Classification of energy sources: Primary and Secondary energy, Commercial and Non-commercial energy, Renewable and Non-renewable energy, Conventional and Non-conventional energy, Based on Origin-Examples and limitations. Importance of Non-commercial energy resources.	**04**
	Chapter-2: Conventional energy sources	
	Fossil fuels & Nuclear energy- production & extraction, usage rate and limitations. Impact on environment and their issues& challenges. Overview of Indian & world energy scenario with latest statistics- consumption & necessity. Need of eco-friendly & green energy & their related technology.	**09**
	Total	**13**
Unit-II	**Renewable energy sources**	
	Chapter-1: Introduction:	
	Need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity.	**05**
	Chapter 2 : Solar energy:	
	Solar Energy-Key features, its importance, Merits & demerits of solar energy, Applications of solar energy. Solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell -brief discussion of each. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems.	**08**
	Total	**13**
Unit-III	**Chapter-3: Wind and Tidal Energy harvesting**:	
	Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies. Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices. Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy.	**08**
	Chapter-4 : Geothermal and hydro energy	
	Geothermal Resources, Geothermal Technologies.	**02**
	Hydropower resources, hydropower technologies, environmental impact of hydro power sources.	**03**
	Carbon captured technologies, cell, batteries, power consumption	**01**
	Total	**13**

	Activity for tutorial classes 01 lectures/week 1. Demonstration of on Solar energy, wind energy, etc, using training modules at Labs. 2. Conversion of vibration to voltage using piezoelectric materials. 3. Conversion of thermal energy into voltage using thermoelectric (using thermocouples or heat sensors) modules. 4. Project report on Solar energy scenario in India 5. Project report on Hydro energy scenario in India 6. Project report on wind energy scenario in India 7. Field trip to nearby Hydroelectric stations. 8. Field trip to wind energy stations like Chitradurga, Hospet, Gadag, etc. 9. Field trip to solar energy parks like Yeramaras near Raichur. 10. Videos on solar energy, hydro energy and wind energy.	
	Reference Books: 1. Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi 2. Solar energy - M P Agarwal - S Chand and Co. Ltd. 3. Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd. 4. Godfrey Boyle, "Renewable Energy, Power for a sustainable future", 2004, Oxford University Press, in association with The Open University. 5. Dr. P Jayakumar, Solar Energy: Resource Assessment Handbook, 2009 6. J.Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA). 7. http://en.wikipedia.org/wiki/Renewable_energy	

Climate Science

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Time: 2 hrs./week + 01 Hr tutorial **Max Marks:**

Module 1:	**Atmosphere** Atmospheric Science (Meteorology) as a multidisciplinary science. Physical and dynamic meteorology, Some terminology, difference between weather and climate, weather and climate variables, composition of the present atmosphere: fixed and variable gases, volume mixing ratio (VMR), sources and sinks of gases in the atmosphere. Green house gases. Structure (layers) of the atmosphere. Temperature variation in the atmosphere, temperature lapse rate, mass, pressure and density variation in the atmosphere. Distribution of winds.	(13 hours)
Module 2:	**Climate Science** Overview of meteorological observations, measurement of : temperature, humidity, wind speed and direction and pressure. Surface weather stations, upper air observational network, satellite observation. Overview of clouds and precipitation, aerosol size and concentration, nucleation, droplet growth and condensation (qualitative description). Cloud seeding, lightning and discharge. Formation of trade winds, cyclones. Modelling of the atmosphere: General principles, Overview of General Circulation Models (GCM) for weather forecasting and prediction. Limitations of the models. R and D institutions in India and abroad dedicated to climate Science, NARL, IITM, CSIR Centre for Mathematical Modeling and Computer Simulation, and many more	(13 hours)
Module 3:	**Global Climate Change** Green house effect and global warming, Enhancement in concentration of carbon dioxide and other green house gases in the atmosphere, Conventional and non-conventional energy sources and their usage. EL Nino/LA Nino Southern oscillations. Causes for global warming: Deforestation, fossil fuel burning, industrialization. Manifestations of global warming: Sea level rise, melting of glaciers, variation in monsoon patterns, increase in frequency and intensity of cyclones, hurricanes, tornadoes. Geo-engineering as a tool to mitigate global warming? Schemes of geo-engineering.	(13 hours)

	Activities to be carried out on Climate Science: 1. Try to find answer to the following questions: (a) Imagine you are going in a aircraft at an altitude greaten than 100 km. The air temperature at that altitude will be greater than 200^{o}C. If you put your hands out of the window of the aircraft, you will not feel hot. (b) What would have happened if ozone is not present in the stratosphere. 2. Visit a nearby weather Station and learn about their activities. 3. Design your own rain gauge for rainfall measurement at your place.	
	4. Learn to determine atmospheric humidity using wet bulb and dry bulb thermometers. 5. Visit the website of Indian Institute of Tropical Meteorology (IITM), and keep track of occurrence and land fall of cyclone prediction. 6. Learn about ozone layer and its depletion and ozone hole. 7. Keep track of melting of glaciers in the Arctic and Atlantic region through data base available over several decades. 8. Watch documentary films on global warming and related issues (produced by amateur film makers and promoted by British Council and BBC).	
	References: 1. Basics of Atmospheric Science – A Chndrashekar, PHI Learning Private Ltd. New Delhi, 2010. 2. Fundamentals of Atmospheric Modelling- Mark Z Jacbson, Cambridge University Press, 2000.	

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Astronomy

Time: 2 hrs./week + 01 Hr tutorial **Max Marks:**

Content		Hrs
Unit – 1 -History and Introduction		
Chapter 1	Ancient Astronomy Greek Observations, Sumerian Observations,Mayan Observations, Arabic Observations ,Chinese Observations	2
Chapter 2	Indian Astronomy Vedic Astronomy, Ancient Astronomy – Aryabhata, Varahamihira, Bhaskara Astronomy in Indian Scriptures, Precession of the Equinox,Celebrations of Equinox	2
Chapter 3	Medieval & Modern Astronomy Invention of Telescopes, Models of the Solar System & Universe, Observations by Tycho Brahe, Kepler, Galileo, Herschel and Other,Modern Astronomy	2
Chapter 4	Optical tools for Astronomy Pin Hole, Binoculars, Telescopes & Imaging.	1
Chapter 5	Mathematical Methods of Observations Angular Measurement, Trigonometric functions, Stellar Parallax	1
Chapter 6	Observational Terminologies Cardinal Directions, Azimuth, Altitude, Measurements using Compass and Hand. Equatorial Co-ordinates, Light years, Magnitude, Colors etc.	2
Unit – 2: Unit 2: Observations of the Solar System		
Chapter 7.	The Sun Ecliptic and the Orientation of the Earth, Seasons - Solstices and Equinox, Observations of the Sun from Earth during seasons. Eclipses, Zero-shadow day, Sunspots	1
Chapter 8	The Moon Earth-Moon system – Phases, Lunar Eclipses, Ecliptic and Lunar Orbital Plane – Nodes, Lunar Month, Full Moon Names	1
Chapter 9.	Inner Planets: Mercury & Venus Observational History, Observational Windows, Appearance, Apparitions, Elongations, Superior Conjunctions, Inferior Conjunctions, Transits.	2
Chapter 10	**Outer Planets** **Outer Planets: Mars, Jupiter & Saturn** Observational History.Observational Windows, Appearance, Frequency of Oppositions Oppositions, Conjunctions, Moons Eclipses.Galilean Moons, Saturn's Rings	2

Unit III Major Astronomy Observations		
Chapter 11	March to June Prominent Stars and Constellations Visible during this period, Methods of Spotting.	2
Chapter 12	June to September Prominent Stars and Constellations Visible during this period, Methods of Spotting.	2
Chapter 13	September to December Prominent Stars and Constellations Visible during this period, Methods of Spotting.	2
Chapter 14	December to March **Pr**ominent Stars and Constellations Visible during this period, Methods of Spotting.	2

Reference Books:

1. The Stargazer's Guide - How to Read Our Night Sky by Emily Winterburn
2. A guide to the Night Sky – Beginner's handbook by P.N. Shankar
3. The Complete Idiot's guide to Astronomy by Christopher De Pree and Alan Axelrod

Text Books

1. P. N. SHANKAR A GUIDE TO THE NIGHT SKY
   https://www.arvindguptatoys.com/arvindgupta/nightskyshankar.pdf
2. BimanBasu , Joy of Star Watching , National Book Trust of India 2013

References Books

Christopher De Pree :The Complete Idiot's Guide to Astronomy, Penguin USA, 2008

Emily Winterburn ,The Stargazer's Guide: How to Read Our Night Sky, Constable and Robinson, 2008

Activities

Sl No	Experiment
1	Measuring Seasons using Sun's Position.
2	Measuring Distance using Parallax
3	Estimation of the Stellar Diameter using Pin Hole
4	Measuring Height of an Object Using Clinometer.
5	Star spotting using constellation maps
6	Constellation spotting using Skymaps
7	Estimation of 'Suitable Periods' to observe deep sky objects using Planisphere.
8	Estimation of the Size of the Solar System in using Light Years.
9	Identification of Lunar Phases across a year.
10	Measuring Constellation of the Sun using Night Skymaps or Planispheres.

Medical Physics

Time: 2 hrs./week + 01 Hr tutorial **Max Marks:**

Unit I:	**Human Anatomy and Physiology** Overview of human anatomy - cells, cell structure, type of cells and their functions, tissues, organs, and their functions. Different systems in the human body, their structure and function, physiological properties of the circulatory system, digestive system, respiratory system, reproductive system, excretory system, endocrine system and nervous system	(13 hours)
Unit II:	**Physics of Medical Diagnostics** Principle of production of X-rays. Use of X-rays in medical diagnosis, X-ray imaging systems. Computed Tomography (CT): principle and generation of CT. Magnetic Resonance Imaging (MRI): basic principle and image characteristics. Ultrasound Imaging: Interaction of sound waves with body tissues, production of ultrasound, transducers, acoustic coupling, image formation, modes of image display and color Doppler.	(13 hours)
Unit III:	**Physics of Radiotherapy** Clinical aspects of radiation therapy: Biological basis of radiotherapy, radiation sources, radiation dose, time dose fractionation. External beam radiation therapy, radiation therapy modalities, production of radioisotopes, use of radioisotopes in therapy, particle and ion beam radiotherapy. Brachytherapy - principle of brachytherapy and classification of brachytherapy techniques.	(13 hours)

	Class Room Activities Unit I: Students can demonstrate the shape, size, positions and functions of different organs in the body with the help of models. Unit II: The use of X-rays in the diagnosis of the fractured bone can be demonstrated with the help of a gamma source and a gamma ray survey meter. As the density of materials between the source and the detector changes the reading on the meter (or intensity of the beefing sound) changes. Unit III: (i) Students can be asked to list out different type of cancers and possible causative factors. They can be asked to list out the healthy practices to reduce the risk of cancers. (ii) As there will be students from different disciplines in the OE course, group discussion can be arranged to discuss about their programme and outcome. This will be an opportunity for the students to know about other disciplines. **Other related activities/projects:** 1. Visit to nearby hospitals/diagnostic centers to study the working of X-ray machines. 2. Visit to ultrasound diagnostic centers to study the principle and use of ultrasound in diagnosis. 3. Project on principle and use of X-ray films in imaging. 4. Visit to radiotherapy centers to study the modalities of radiotherapy.	

Text Books

1. C. H. Best and N. B. Taylor. A Test in Applied Physiology. Williams and Wilkins Company, Baltimore, 1999.

2. C. K. Warrick. Anatomy and Physiology for Radiographers. Oxford University Press, 2001.

3. Jerrold T. Bushberg. The Essential Physics for Medical Imaging (2nd Edition). Lippincott Williams & Wilkins, 2002.

4. Jean A. Pope. Medical Physics: Imaging. Heinemann Publishers, 2012.

5. Faiz M. Khan and Roger A. Potish. Treatment Planning in Radiation Oncology. Williams and Wilkins, USA, 2003.

6. D. Baltas. The physics of modern brachytherapy for oncology. Taylor and Francis, 2007.

Reference Books

1. J. R. Brobek. Physiological Basis of Medical Practice. Williams and Wilkins, London, 1995.

2. Edward Alcamo, Barbara Krumhardt. Barron's Anatomy and Physiology the Easy Way. Barron's Educational Series, 2004.

3. Lippincott, Anatomy and Physiology. Lippincott Williams & Wilkins, 2002.

4. W. E. Arnould Taylor. A textbook of anatomy and physiology, Nelson Thornes, 1998.

5. G. S. Pant. Advances in Diagnositc Medical Physics. Himalaya Publishing House, 2006.

6. Sabbahaga, Diagnositc Ultrasound applied to OBG. Maryland, 1980.

7. Faiz M Khan. The Physics of Radiation Therapy (3rd edition). Lippincott Williams & Wilkins, USA, 2003.

8. Jatinder R. Palta and T. Rockwell Mackie. Intensity Modulation Radiation Therapy. Medical Physics publishing, Madison, Wisconsin, 2003.

9. AAPM Report No. 72. Basic Applications of Multileaf collimators, AAPM, USA, 2001.

10. AAPM Report No. 91. Management of Respiratory motion in radiation oncology, 2006.

11. CA Joslin, A. Flynn, E. J. hall. Principles and Practice of Brachytherapy. Arnold publications, 2001.

12. Peter Hoskin, Catherine Coyle. Radiotherapy in Practice. Oxford University Press, 2011.

13. W. R. Handee. Medical Radiation Physics. Year Book Medical Publishers Inc., London, 2003.

14. Donald T. Graham, Paul J. Cloke. Principles of Radiological Physics. Churchill Livingstone, 2003.

15. Thomas S. Curry. Christensen',s Physics of Diagnostic Radiology (4th Edition). Lippincott Williams & Wilkins, 1990.

16. Madison. MRI – Perry Sprawls – Medical Physics Publishing. Wisconsin, 2000.

	17. Steve Webb. The Physics of Three–Dimensional Radiotherapy. Institute of Physics Publishing, Bristol and Philadelphia, 2002. 18. Radiation oncology physics: A Handbook for teachers and students. IAEA publications, 2005. 19. F. M. Khan. The Physics of Radiation Therapy (3rd Edition), Lippincott Williams and Wilkins, U.S.A., 2003.	

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OPTICAL INSTRUMENTS

Time: 2 hrs./week + 01 Hr tutorial **Max Marks:**

Unit 1.	**Basics of Optics** Scope of optics, optical path, laws of reflection and refraction as per Fermat's principle, magnifying glass, Lenses (thick and thin), convex and concave lenses, Lens makers formulae for double concave and convex lenses, lens equation. Focal and nodal points, focal length, image formation, combination of lenses, dispersion of light: Newton's experiment, angular dispersion and dispersion power. Dispersion without deviation. (Expressions need not be derived, but have to be discussed qualitatively).	13
Unit 2.	**Camera and microscopes** Human eye (constitution and working), Photographic camera (principle, construction and working), construction, working and utilities of Simple microscopes, Compound microscope, Electron microscopes, Binocular microscopes **Self study** Experimental determination of magnifying power of a microscope. (Construction part can be discussed through block diagrams)	14
Unit 3.	**Telescopes and Spectrometer** Construction, working and utilities of Astronomical telescopes Terrestrial telescopes Reflecting telescopes, Construction, working and utilities of Eyepieces or Oculars (Huygen, Ramsden's, Gauss) Spectrometer - Construction, working and utilities, measurement of refractive index. **Self study** Telescopes used at different observatories in and outside India.	13
	Activities: Find position and size of the image in a magnifying glass and magnification. Observe rain bows and understand optics. Create a rainbow. Find out what makes a camera to be of good quality. Observe the dispersion of light through prism. Make a simple telescope using magnifying glass and lenses. Learn principle of refraction using prisms. Check bending of light in different substances and find out what matters here. Learn about different telescopes used to see galaxies and their ranges. Many more activities can be tried to learn optics by going through you tubes and webistes such as https://spark.iop.org, http://www.yenka.com, https://publiclab.org etc.	

Sports Science

Time: 2 hrs./week + 01 Hr tutorial **Max Marks:**

Content (Use maths of 10th Std only – Only qualitative discussion)		Hrs
Unit - 1		
Chapter No. 1	**Measurement**: Physical quantities. Standards and Units. International system of Units. Standards of time, length and mass. Precision and significant figures.	o4
Chapter No. 2	**Newton's laws of motion**: Newton's first law. Force, mass. Newton's second law. Newton's third law. Mass and weight. Applications of Newton's laws.	03
Chapter No. 3	**Projectile motion**: Shooting a falling target. Physics behind Shooting, Javelin throw and Discus throw.	03
Topics for self study (If any)	**https://www.real-world-physics-problems.com/physics-of-sports.html**	
Unit - 2		
Chapter No. 4.	**Conservation laws**: Conservation of linear momentum, collisions – elastic and inelastic. Angular momentum. (Physics behind Carom, Billiards, Racing)	04
Chapter No. 5.	**Centre of mass**: Physics behind Cycling, rock climbing, Skating,	02
Chapter No. 6.	**Gravitation**: Origin, Newton's law of gravitation. Archimedes's principle, Buoyancy (Physics behind swimming)	04
Topics for self study (If any)	Archimedes' Principle: Made EASY | Physics in You tube	
Unit - 3		
Chapter No.7	**Food and Nutrition:** Proteins, Vitamins, Fat, Blood pressure. Problems due to the deficiency of vitamins.	04
Chapter No. 8	**Energy:** Different forms of Energy, Conservation of mass-energy.	03
Chapter No . 9	**Physical exercises:** Walking, Jogging and Running, Weight management.	03
Topics for self study (If any)	10 Best Exercises for Everyone – Healthline	
	Suggested Activities	
Activity No. 1	Identify the methods of measurement of time, length and mass from ancient time and build models for them.	02
	Reference : History of measurement - Wikipedia *https://en.wikipedia.org › wiki › History_of_measurem*	

Activity No. 2	Identify Physics principles behind various Sports activities.	01
	https://www.real-world-physics-problems.com/physics-of-sports.html	
Activity No. 3	List the difficulties experienced in Gymnastics, Cycling and weight lifting.	02
Activity No. 4	List the difficulties experienced in swimming.	01
Activity No. 3	List the difficulties experienced in Gymnastics, Cycling and weight lifting.	02
Activity No. 4	List the difficulties experienced in swimming.	01
Activity No. 5	Learn breathing exercises.	02
	Reference : 1)Simple Breathing Exercise for Beginners | Swami Ramdev *2) https://www.yogajournal.com*	
Activity No.6	Write an essay on Physical health v/s Mental health or conduct a debate on Physical health v/s Mental health.	01

Text Books

Sl No	Title of the Book	Authors Name	Publisher	Year of Publication
1	Physics for Entertainment	Yakov Perelman	Createspace Independent Pub.	
2	Physics Everywhere	Yakov Perelman	Prodinnova	2014
3	Mechanics for Entertainment	Yakov Perelman	Prodinnova	2014
4	Handbook of Food and Nutrition	M.Swaminathan	Bangalore Press 2012	2012
5	Food Science	B. Srilakshmi	New Age International Pub	2015

References Books

Sl No	Title of the Book	Authors Name	Publisher	Year of Publication
1	Physics	Resnick, Halliday and Krane, Vol 1	Wiley Student Edition.	
2	For the love of Physics	Walter Lewin	Taxmann Publications Private Limited	2012
3	An Introduction to the Physics of Sports	VassiliosMcInnesS pathopoulos	CreateSpace Independent Publishing Platform	2013

Internet resources

https://www.topendsports.com/biomechanics/physics.htm

https://www.real-world-physics-problems.com/physics-of-sports.html

https://www.healthline.com/
https://www.mayoclinic.org/
https://www.who.int/news-room/

NANOTECHNOLOGY

Time: 2 hrs./week + 01 Hr tutorial **Max Marks:**

Unit 1:	Introduction to nanomaterials Length scales in physics, Nanostructures: 1D, 2D and 3Dnanostructures (nano dots, thin films,nanowires, nanorods), Band structure and density of states of materials at nanoscale, Size Effects in nano systems, Quantum confinement: Applications of Schrodinger equationInfinite potential well, potential step, potential box, quantum confinement of carriers in 3D,2D, 1D nanostructures and its consequences.	(13hours)
Unit 2:	Synthesis and Characterization of nanostructure materials Top down and Bottom up approach, Photolithography. Ball milling. Gas phase condensation.Vacuum deposition. Physical vapor deposition (PVD): Thermal evaporation, E-beamevaporation, Pulsed Laser deposition. Chemical vapor deposition (CVD). Sol-Gel. Electrodeposition. Spray pyrolysis. Hydrothermal synthesis. Preparation through colloidal methods.MBE growth of quantum dots. X-Ray Diffraction. Optical Microscopy. Scanning ElectronMicroscopy. Transmission Electron Microscopy. Atomic Force Microscopy. ScanningTunneling Microscopy.	(13 hours)
Unit 3:	Properties and applications of nanomaterials Coulomb interaction in nanostructures. Concept of dielectric constant for nanostructures andcharging of nanostructure. Quasi-particles and excitons. Excitons in direct and indirect bandgap semiconductor nanocrystals. Quantitative treatment of quasiparticles and excitons,charging effects. Radiative processes: General formalization-absorption, emission andluminescence. Optical properties of heterostrctures and nanostructures. Applications ofnanoparticles, quantum dots, nanowires and thin films for photonic devices (LED, solarcells). Nanomaterial Devices: Quantum dots heterostructure lasers, optical switching andoptical data storage. Magnetic quantum well; magnetic dots - magnetic data storage.	(13 hours)
References Books: ➢ C.P. Poole, Jr. Frank J. Owens, Introduction to Nanotechnology (Wiley India Pvt. Ltd.). ➢ S.K. Kulkarni, Nanotechnology: Principles & Practices (Capital Publishing Company) ➢ K.K. Chattopadhyay and A. N. Banerjee, Introduction to Nanoscience and Technology(PHI Learning Private Limited). ➢ Richard Booker, Earl Boysen, Nanotechnology (John Wiley and Sons). ➢ M. Hosokawa, K. Nogi, M. Naita, T. Yokoyama, Nanoparticle Technology Handbook(Elsevier, 2007). ➢ Introduction to Nanoelectronics, V.V. Mitin, V.A. Kochelap and M.A. Stroscio, 2011,Cambridge University Press. ➢ Bharat Bhushan, Springer Handbook of Nanotechnology (Springer-Verlag, Berlin, 2004).		

Student Activities:	
1. Synthesis of metal nanoparticles by chemical route. 2. Synthesis of semiconductor nanoparticles. 3. XRD pattern of nanomaterials and estimation of particle size. 4. To study the effect of size on color of nanomaterials. 5. Growth of quantum dots by thermal evaporation. 6. Prepare a disc of ceramic of a compound using ball milling, pressing and sintering, and study its XRD. 7. Fabricate a thin film of nanoparticles by spin coating (or chemical route) and studytransmittance spectra in UV-Visible region. 8. Prepare a thin film capacitor and measure capacitance as a function of temperature orfrequency. 9. Visit to nearby research labs to study the working of XRD, SEM, UV-Visible Spectrophotometer instruments 10. Visit to nearby research labs for project work and interaction with scientists at IISC, JNCSR, Universities etc.	

ELECTRICAL INSTRUMENTS

Time: 2 hrs./week + 01 Hr tutorial **Max Marks:**

Content		Hrs
Unit - 1		
Chapter No. 1	Voltage and current sources, Kirchoff's current and voltage laws, loop and nodal analysis of simple circuits with dc excitation. Ammeters,voltmeters: (DC/AC)	03
Chapter No. 2	Representation of sinusoidal waveforms, peak and rms values, power factor. Analysis of single-phase series and parallel R-L-C ac circuits. Three-phase balanced circuits, voltage and current relations in star and delta connections. Wattmeters: Induction type, single phase and three phase wattmeter, Energy meters: AC. Induction type single phase and three phase energy meter	05
Chapter No. 3	Instrument Transformers: Potential and current transformers, ratio and phase angle errors, phasor diagram, methods of minimizing errors; testing and applications.	05
Topics for self study (If any)	Types of switches and Circuits, Safety precautions and rules in handling electrical appliances, Electric shock, first aid for electrical shocks, Fuses, MCB, ELCB and Relays, Filament lamp, Tube light, CFL and LED	
	Suggested Activities	
Activity No. 1	Identify variety of electrical switches and note down their applications/utility.	
	Reference: Weblink/Youtube/Book	
Activity No. 2	Identify the hazards involved in handling electrical circuits and instruments, make a list of safety precautions as well as first aid for electrical shocks.	
	Reference : Weblink/Youtube/Book	
Unit - 2		
Chapter No. 4.	Galvanometers: General principle and performance equations of D'ArsonvalGalvanometers, Vibration Galva nometer and Ballistic Galvanometer.	03
Chapter No. 5.	Potentiometers: DCPotentiometer, Crompton potentio meter, construction, standardization, application. AC Potentio meter, Drysdalepolar potentio meter; standardization, application.	03
Chapter No. 6.	DC/AC Bridges: General equations for bridge balance, measurement of self inductance by Maxwell's bridge (with variable inductance & variable capacitance), Hay's bridge, Owen's bridge, measurement of capacitance by Schearing bridge, errors, Wagner's earthing device, Kelvin's double bridge.	07
Topics for self study (If any)	Importance of grounding and Earthing, Methods for Earthing,	

	Suggested Activities	
Activity No. 3	Make a study of importance of grounding in electrical circuits.	
	Reference : Weblink/Youtube/Book	
Activity No. 4	Prepare a detailed account of various methods of earthing and their utility/applications	
	Reference : Weblink/Youtube/Book	
Unit - 3		
Chapter No.7	Transducer: Strain Gauges, Thermistors, Thermocouples, Linear Variable Differential Transformer (LVDT), Capacitive Transducers, Peizo-Electric transducers, Optical Transducer, Hall Effect Transducer	06
Chapter No. 8	CRO: Block diagram, Sweep generation, vertical amplifiers, use of CRO in measurement of frequency,phase, Amplitude and rise time of a pulse. Digital Multi-meter: Block diagram, principle of operation	03
Chapter No. 9	Basics of lead acid batteries, Lithium Ion Battery , Battery storage capacity, Coulomb efficiency, Numerical of high and low charging rates, Battery sizing.	04
Topics for self study (If any)	Fuses, MCB, ELCB and Relays, Filament lamp, Tube light, CFL and LED	
	Suggested Activities	
Activity No. 5	Prepare a document on evolution of incandescent bulbs to the present day LED lights	
	Reference : Weblink/Youtube/Book	
Activity No.6	Make a comparative study of Fuses, MCB, ELCB and Relays highlighting their use and applications	
	Reference : Weblink/Youtube/Book	

AK.Sawhney, ACourse inElec.&Electronics Measurements&Instrumentation **,Dhanpatrai& Co. 1978**
A.D. Helfrick& W.D. Cooper, Modern Electronic Instrumentation and Measurement Techniques **PHI 2016**

Text Books

References Books

1. D C Kulshreshtha, Basic Electrical Engineering, Mc Graw Hill Publications,**2019**
2. David G Alciatore and Michel B Histand, Introduction to Mechatronics and Measurement Systems, 3rd, Tata McGraw Hill Education Private Limited, New Delhi., 2005
3. Vincent Del Toro, Electrical Engineering Fundamentals Prentice Hall India**2009**

List of Experiments to be performed in the Laboratory

Sl No	Experiment
1	Introduction to Lab Equipment
2	Voltmeter Design
3	Ammeter Design
4	Ohmmeter Design
5	Multimeter Design
6	Measurement of Resistance using Wheatstone Bridge
7	Measurement of Capacitance using Schering Bridge
8	Measurement of Inductance using Maxwell Bridge
9	Measurement of Light Intensity
10	Measurement of Temperature
	Reference Book for Laboratory Experiments
	AK.Sawhney ACourse inElec.&Electronics Measurements&Instrumentation:
	Helfrick& Cooper, Modern Electronic Instrumentation and Measurement Techniques:

PHYSICS FOR ALL

Time: 2 hrs./week + 01 Hr tutorial **Max Marks:**

Unit I	**Energy and Power** Explosions and energy; Energy, heat and its units; Energy table and discussions; Discussion of cost of energy; Measuring energy; Power; Different power sources; Kinetic energy.	(13 Hours)
Unit II	**Gravity, Force and Space** The force of Gravity; Newton's third law; Weightlessness; Low earth orbit; Geosynchronous satellites; Spy satellites; Medium Earth Orbit satellite; Circular Acceleration; momentum; Rockets; Airplanes, helicopters and fans; Hot air and helium balloons; angular momentum and torque.	(13 Hours)
Unit III	**Nuclei and radioactivity** Radioactivity; Elements and isotopes; Radiation and rays; Seeing radiation; The REM – The radiation poisoning; Radiation and cancer; The linear hypothesis; Different types of radiation; The half-life rule; Smoke detectors; measuring age from radioactivity; Environmental radioactivity; Glow of radioactivity; Nuclear fusion.	(13 Hours)
Unit IV	**Climate change** Global warming; IPCC; A brief history of climate; carbon dioxide; The greenhouse effect; Enhancement of Greenhouse effect; Hurricane and tornadoes; Antarctica; Fluctuations; Paleoclimate; Global warming vs Human caused global warming; Can we stop global warming?, Fossil Fuel Resources; Energy security; Energy efficiency and conservation; Bio-fuels; Nuclear, Wind and Solar power.	(13 Hours)
	References This course is extracted from the book titled "Physics and Technology for Future Presidents: An Introduction to the Essential Physics Every World Leader Needs to Know" by Richard A Muller, WW Norton and Company, 2007. (Unit-1 to 4 are from chapters 1, 3, 4 and 10, respectively).	

SPACE MISSIONS

Time: 2 hrs./week + 01 Hr tutorial **Max Marks:**

Unit 1:	**Introduction to Space Missions :** Rockets, types and their applications, Different types of orbits, Artificial satellites – basic idea and their applications, Introduction to Space Missions, Beginning of Space Missions - World and India, Applications of Space Research, Space crafts, Launching Vehicles.	**13 Hours**
Unit 2:	**National Aeronautics and Space Administration (NASA)** About NASA and its Goals, History of Creation. Foundational human spaceflight: X-15 program (1954–1968), Project Mercury (1958–1963), Project Gemini (1961–1966), Project Apollo (1960–1972), Skylab (1965–1979), Apollo-Soyuz (1972–1975). Modern human spaceflight programs: Space Shuttle program (1972–2011), International Space Station (1993–present), Constellation program (2005–2010), Commercial Crew Program (2011–present), Journey to Mars (2010–2017), Artemis program (2017–present).	**13 Hours**
Unit 3:	**Indian Space Research Organisation (ISRO)** About ISRO and its Goals, History of Creation. General Satellite Programmes: The IRS series, The INSAT series. Gagan Satellite Navigation System, Navigation with Indian Constellation (NavIC), Other satellites. Launch vehicles: Satellite Launch Vehicle (SLV), Augmented Satellite Launch Vehicle (ASLV), Polar Satellite Launch Vehicle (PSLV), Geosynchronous Satellite Launch Vehicle (GSLV). Experimental Satellites: Details and applications (Any Five) Earth Observation Satellites: Details and applications (Any Five) Communication satellites: Details and applications (Any Five)	**13 Hours**
	Self Study: Major Space Centres in the World (at least 10) – brief idea about their location, establishment, capabilities and achievements. People behind space programs – at least 2 from India. Successful Missions (Any Five). **Activities*:** • Design of working model of Rocket launching. • Preparation of report and presentation on application of satellites in agriculture, communication, weather forecasting, exploration of natural resources and Global positioning system (GPS). * Faculty may suggest any other relevant activity as well. Preparation of report and presentation onApollo 11: A Success story	

	Activities: • Preparation of report and presentation on the recent space missions of NASA. • Preparation of report on any one proposed space programmeof NASA. * Faculty may suggest any other relevant activity as well. Chandrayaan 1: Details and applications. Mars Orbiter Mission: Details and applications. **Activities:** • Preparation of report and presentation on the recent space missions of ISRO. • Preparation of report and presentation on any one proposed space programmeof ISRO. • Preparation of report and presentation on the contributions of Scientists from Karnataka to Indian Space Program and use of space technology in the local district. * Faculty may suggest any other relevant activity as well.	

Activity Based Pedagogy:

(Design, Activity and Assessment)

Conducting activity based teaching-leaning experience for students empower students with several graduate attributes by addressing several Outcomes at different levels of the Cognitive Blooms Taxanomy of Learning: like Clarity of Concept, ability to apply knowledge, evaluate and analyse the results, while they are also learn through the Affective and Psycho-motor domains of Learning through self-learning, group dynamics and team work, communication and presentation skills, ethics, life-long learning, etc. These experiments must be ones that do not involve sophisticated instrumentation and should be able to be performed outside laboratories.

Example 1: Elastic Properties of Solids:

The most important concept of studying elastic properties of solids is the Hooke's Law, which defines the stress-strain relationship.

Class 1: Defining problems, forming groups and giving instructions:

- The students should be made into forced groups of 6 to 8 members, depending on the class strength, consisting of diverse kinds of students in cognition, cultural, sex, behaviour, etc.
- Different materials of varying elastic properties should be given to each group, and should be asked to plot a graph of stress-strain of these materials in 8-10 days.
- Give clear instructions and clarify doubts, but not giving the procedure for the experiments. Students should discuss among themselves and consult books and internet to identify the procedure to obtain the Stress-strain graph. They should use only house-hold items or other commonly available tools to perform all the experiments.

Class 2: Presentation and discussion by students (max 8-10 mins each)

- Each group will be asked to make a presentation of 2 power point slides, where the first one explains the process they went through to arrive at the results and the second one shows their measured graph and an ideal text book plots. This slide should also contain two or three explanations of why both the plots differ.
- The student who will make the presentation on behalf of the group will be randomly selected just before the presentations. This will ensure that all group members will be mutually train each other for the presentation.
- The teacher should give equal marks to each member of a group depending on the methods adopted and clarity of concepts and results obtained and ability to analyse.

The following Program Outcomes will be attained by the students in such an activity based learning:

P.O. 1 : Discipline Knowledge: Knowledge of science and ability to apply to relevant areas.
P.O. 3 : Modern tool usage: Use a modern scientific, engineering and IT tool or technique for solving problems in the areas of their discipline.
P.O. 5 : Individual and teamwork: Work effectively as an individual as a team member in a multidisciplinary team.
P.O. 6 : Communication: Communicate effectively with the stake holders, and give and receive clear instructions.

Example 2: Periodic and Non-Periodic Motions

Most important aspect of understanding this topic is to distinguish them with the amplitude versus distance and amplitude versus time plots.

Class 1: Defining problems and giving instructions

- Each student will be asked to list as many observations as possible, under the two types ofmotion as they observe in the external world (home, market, college, etc) in 8-10 days.
- The student will be asked to identify any one motion in each of the lists and plot graphs ofamplitude versus distance and amplitude versus time for each of them in the 8-10 days.

Class 2: Peer evaluation by students and defending self

- Each student is asked to submit the lists of periodic and non-periodic motions observed in everyday life.
- Each student is also asked to submit the amplitude versus distance and amplitude versus timeof one periodic motion and one non-periodic motion of his/her choice among his/her list.
- The submissions are randomly distributed among other students. Teacher now discusses thetwo types of motions in the lists of students and shows how the graphs will ideally look like.
- Now students are asked to evaluate and mark the submissions of other students they have withthem and then the marked papers are returned to the respective students.
- Each student should be given an opportunity to question the marks he has got and each studentwho has given the marks should be able to defend his choice or marks.
- While observing the lists, marks obtained and the plots made, the teacher can assign marks toeach student.

The following Program Outcomes will be attained by the students in such an activity based learning:

P.O. 1. Discipline Knowledge: Knowledge of science and ability to apply to relevant areas.
P.O. 4. Ethics: Apply the professional ethics and norms in respective discipline.
P.O. 6. Communication: Communicate effectively with the stake holders, and give and receive clear instructions.

Continuous Formative Evaluation/ Internal Assessment:

Total marks for each course shall be based on continuous assessments and semester end examinations. The pattern of 40 : 60 for IA and Semester End theory examinations respectively and 50 : 50 for IA and Semester End practical examinations respectively.

Total Marks for each Course = 100 marks
Continuous assessment (C1) = 20 marks
Continuous assessment (C2) = 20 marks
Semester End Examination (C3) = 60 marks

Evaluation process of IA marks shall be as follows:

a) The first component (C1) of assessment is for 20% marks. This shall be based on test, assignment, seminar, case study, field work, project work etc. This assessment and score process should be completed after completing 50% of syllabus of the course/s and within 45 working days of semester program
b) The second component (C2) of assessment is for 20% marks. This shall be based on test, assignment, seminar, case study, field work, internship / industrial practicum / project work etc. This assessment and score process should be based on completion of remaining 50 percent of syllabus of the courses of the semester.
c) During the 17th – 19th week of the semester, a semester end examination shall be conducted by the University for each Course. This forms the third and final component of assessment (C3) and the maximum marks for the final component will be 60%.
d) In case of a student who has failed to attend the C1 or C2 on a scheduled date, it shall be deemed that the student has dropped the test. However, in case of a student who could not take the test on scheduled date due to genuine reasons, such a candidate may appeal to the Program Coordinator / Principal. The Program Coordinator / Principal in consultation with the concerned teacher shall decide about the genuineness of the case and decide to conduct special test to such candidate on the date fixed by the concerned teacher but before commencement of the concerned semester end examinations.
e) For assignments, tests, case study analysis etc., of C1 and C2, the students should bring their own answer scripts (A4 size), graph sheets etc., required for such tests/assignments and these be stamped by the concerned department using their department seal at the time of conducting tests / assignment / work etc.
f) The outline for continuous assessment activities for Component-I (C1) and Component-II (C2) of a course shall be as under.
g)

Activities	C1	C2	Total Marks
Session Test	10 marks	10 marks	20
Seminars/Presentations/Activity	10 marks		10
Case study /Assignment / Field work / Project work etc.		10 marks	10
Total	20 marks	20 marks	40

- For practical course of full credits, Seminar shall not be compulsory. In its place, marks shall be awarded for Practical Record Maintenance.(the ratio is 50 (25 + 25) : 50)
- Conduct of Seminar, Case study / Assignment, etc. can be either in C1 or in C2 component at the convenience of the concerned teacher.
- The teachers concerned shall conduct test / seminar / case study, etc. The students should be informed about the modalities well in advance. The evaluated courses / 29 assignments during component I (C1) and component II (C2) of assessment are immediately provided to the candidates after obtaining acknowledgement in the register by the concerned teachers(s) and maintained by the Chairman in the case of a University Post-Graduate Department and the Principal / Director in the case of affiliated institutions. Before commencement of the semester end examination, the evaluated test, assignment etc. of C1 and C2 shall be obtained back to maintain them till the announcement of the results of the examination of the concerned semester.

h) The marks of the internal assessment shall be published on the notice board of the department / college for information of the students.

i) The Internal assessment marks shall be communicated to the Registrar (Evaluation) at least 10 days before the commencement of the University examinations and the Registrar (E) shall have access to the records of such periodical assessments.

j) There shall be no minimum in respect of internal assessment marks.

k) Internal assessment marks may be recorded separately. A candidate who has failed or rejected the result, shall retain the internal assessment marks.

Scheme of Valuation for Practical's

C1 and C2 are internal tests to be conducted during 8th and 16th weeks respectively of the semester. C3 is the semester-end examination conducted for 3 hours. The student will be evaluated on the basis of skill, comprehension and recording the results. The student has to compulsorily submit the practical record for evaluation during C1 and C2. For C3, the record has to be certified by the Head of the Department.

• The student is evaluated for 25 marks in C1 and C2 as per the

following scheme:Experiment: 20, Record: 05 for C1 (25 marks)

Experiment: 20, Record: 05 for C2 (25 marks)

• The student is evaluated for 50 marks in C3 as per the

following scheme:Experiment: 35, Viva: 15 for C3 (50 marks)

The experimental portion of evaluation (C3) is carried out as per the following scheme:

Formula with proper units and explanation	08
Setting up the apparatus / circuit connections	07
Taking readings and tabulating	10
Calculations and Graph	10
Viva	15
Total	50

QUESTION PAPER PATTERN

DSC Courses and similar courses

Max Marks: Time: 3 hours

Unit 1

Long answer questions; Answer 1 out of 2 $1 \times 10 = 10$

Unit 2

Long answer questions; Answer 1 out of 2 $1 \times 10 = 10$

Unit 3

Long answer questions; Answer 1 out of 2 $1 \times 10 = 10$

Unit 4

Long answer questions; Answer 1 out of 2 $1 \times 10 = 10$

Numerical problems: Six numerical problems (one each from unit); 4 to be answered $4 \times 5 = 20$

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE

(Autonomous)

OOTY ROAD, MYSURU- 570 025

DEPARTMENT OF PHYSICS

Syllabus

CHOICE BASED CREDIT SYSTEM

For B.Sc programmes

- **Physics, Mathematics and Chemistry**
- **Physics, Mathematics and Computer Science**
- **Physics, Mathematics and Electronics**
- **Physics, Mathematics and Computer Maintenance**

wef

2019-20

Department of Physics

PROGRAMME: BSc PCM, PROGRAMME CODE: BSc-01 (2019-20) PCM01

Year	Sem	Course code	Course type	Course Title	L:T:P	Total credits	Maximum Marks in the Exam/Assessment				Exam Duration	
							SEE		IA			
							Theory	Practical	Theory	Practical	Theory	Practical
I BSc	I	DMA29001	DSC-1	Mechanics	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DMA29101		**Practical**	0:0:2		----	35	----	15 (7.5+7.5)	----	3h
	II	DMB29001	DSC-2	Electricity and Magnetism	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DMB29101		**Practical**	0:0:2		----	35	----	15 (7.5+7.5)		3h
II BSc	III	DMC29001	DSC-3	Thermal physics and Statistical mechanics	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DMC29101		**Practical**	0:0:2		----	35	----	15 (7.5+7.5)	---	3h
	IV	DMD29001	DSC-4	Waves and Optics	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DMD29101		**Practical**	0:0:2		----	35	----	15 (7.5+7.5)	---	3h
III BSc	V	DME29001	DSE-1A	Digital, Analog circuits and Instrumentation	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DME29101		**Practical**	0:0:2		----	35	----	15 (7.5+7.5)	---	3h
		DME29201	DSE-1B	Solid State Physics	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DME29301		**Practical**	0:0:2		----	35	----	15 (7.5+7.5)	---	3h
		DME29401	DSE-1D	Mathematical Physics	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DME29501		**Practical**	0:0:2		----	35	----	15 (7.5+7.5)	----	3h
	V	DME29601	SEC-1A	Renewable Energy and Energy harvesting	2:0:0	02	35	--	15	--	2h	---
		DME29801	SEC-1B	Radiation Safety	2:0:0	02	35	--	15	--	2h	---
		DME30001	SEC-1C	Basic Instrumentation Skills	2:0:0	02	35	--	15	--	2h	---
		DME30201	SEC-1I	Applied Optics	2:0:0	02	35	--	15	--	2h	---
	VI	DMF29001	DSE-1A	Elements of Modern Physics	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DMF29101		**Practical**	0:0:2		----	35	----	15 (7.5+7.5)	---	3h
		DMF29201	DSE-1B	Nuclear and particle physics	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DMF29301		**Practical**	0:0:2		----	35	----	15 (7.5+7.5)	----	3h
		DMF29401	DSE-1C	Quantum Mechanics	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DMF29501		**Practical**	0:0:2		----	35	----	15 (7.5+7.5)	----	3h

Department of Physics

PROGRAMME: PROGRAMME CODE: BSc-01 (2019-20) PMCs02

Year	Sem	Course code	Course type	Course Title	L:T:P	Total credits	Maximum Marks in the Exam/Assessment				Exam Duration	
							SEE		IA			
							Theory	Practical	Theory	Practical	Theory	Practical
I BSc	I	DMA29002	DSC-1	Mechanics	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DMA29102		Practical	0:0:2		----	35	----	15 (7.5+7.5)	----	3h
	II	DMB29002	DSC-2	Electricity and Magnetism	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DMB29102		Practical	0:0:2		----	35	----	15 (7.5+7.5)		3h
II BSc	III	DMC29002	DSC-3	Thermal physics and Statistical mechanics	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DMC29102		Practical	0:0:2		----	35	----	15 (7.5+7.5)	---	3h
	IV	DMD29002	DSC-4	Waves and Optics	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DMD29102		Practical	0:0:2		----	35	----	15 (7.5+7.5)	---	3h
III BSc	V	DME29002	DSE-1A	Digital, Analog circuits and Instrumentation	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DME291012		Practical	0:0:2		----	35	----	15 (7.5+7.5)	---	3h
		DME29202	DSE-1B	Solid State Physics	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DME29302		Practical	0:0:2		----	35	----	15 (7.5+7.5)	---	3h
		DME29402	DSE-1D	Mathematical Physics	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DME29502		Practical	0:0:2		----	35	----	15 (7.5+7.5)	----	3h
	V	DME29602	SEC-1A	Renewable Energy and Energy harvesting	2:0:0	02	35	--	15	--	2h	---
		DME29802	SEC-1B	Radiation Safety	2:0:0	02	35	--	15	--	2h	---
		DME30002	SEC-1C	Basic Instrumentation Skills	2:0:0	02	35	--	15	--	2h	---
		DME30202	SEC-1I	Applied Optics	2:0:0	02	35	--	15	--	2h	---
	VI	DMF29002	DSE-1A	Elements of Modern Physics	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DMF29102		Practical	0:0:2		----	35	----	15 (7.5+7.5)	---	3h
		DMF29202	DSE-1B	Nuclear and particle physics	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DMF29302		Practical	0:0:2		----	35	----	15 (7.5+7.5)	----	3h
		DMF29402	DSE-1C	Quantum Mechanics	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DMF29502		Practical	0:0:2		----	35	----	15 (7.5+7.5)	----	3h

Department of Physics

PROGRAMME: PROGRAMME CODE: BSc-01 (2019-20) PMCM03

Year	Sem	Course code	Course type	Course Title	L:T:P	Total credits	Maximum Marks in the Exam/Assessment				Exam Duration	
							SEE		IA			
							Theory	Practical	Theory	Practical	Theory	Practical
I BSc	I	DMA29002	DSC-1	Mechanics	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DMA29103		**Practical**	0:0:2		----	35	----	15 (7.5+7.5)	----	3h
	II	DMB29003	DSC-2	Electricity and Magnetism	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DMB29103		**Practical**	0:0:2		----	35	----	15 (7.5+7.5)		3h
II BSc	III	DMC29003	DSC-3	Thermal physics and Statistical mechanics	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DMC29103		**Practical**	0:0:2		----	35	----	15 (7.5+7.5)	---	3h
	IV	DMD29003	DSC-4	Waves and Optics	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DMD29103		**Practical**	0:0:2		----	35	----	15 (7.5+7.5)	---	3h
III BSc	V	DME29003	DSE-1A	Digital, Analog circuits and Instrumentation	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DME29103		**Practical**	0:0:2		----	35	----	15 (7.5+7.5)	---	3h
		DME29203	DSE-1B	Solid State Physics	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DME29303		**Practical**	0:0:2		----	35	----	15 (7.5+7.5)	---	3h
		DME29403	DSE-1D	Mathematical Physics	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DME29503		**Practical**	0:0:2		----	35	----	15 (7.5+7.5)	----	3h
	V	DME29603	SEC-1A	Renewable Energy and Energy harvesting	2:0:0	02	35	--	15	--	2h	---
		DME29803	SEC-1B	Radiation Safety	2:0:0	02	35	--	15	--	2h	---
		DME30003	SEC-1C	Basic Instrumentation Skills	2:0:0	02	35	--	15	--	2h	---
		DME30203	SEC-1I	Applied Optics	2:0:0	02	35	--	15	--	2h	---
	VI	DMF29003	DSE-1A	Elements of Modern Physics	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DMF29103		**Practical**	0:0:2		----	35	----	15 (7.5+7.5)	---	3h
		DMF29203	DSE-1B	Nuclear and particle physics	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DMF29303		**Practical**	0:0:2		----	35	----	15 (7.5+7.5)	----	3h
		DMF29403	DSE-1C	Quantum Mechanics	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DMF29503		**Practical**	0:0:2		----	35	----	15 (7.5+7.5)	----	3h

Department of Physics

PROGRAMME: PROGRAMME CODE: BSc-01 (2019-20) PME04

Year	Sem	Course code	Course type	Course Title	L:T:P	Total credits	Maximum Marks in the Exam/Assessment				Exam Duration	
							SEE		IA			
							Theory	Practical	Theory	Practical	Theory	Practical
I BSc	I	DMA29004	DSC-1	Mechanics	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DMA29104		**Practical**	0:0:2		----	35	----	15 (7.5+7.5)	----	3h
	II	DMB29004	DSC-2	Electricity and Magnetism	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DMB29104		**Practical**	0:0:2		----	35	----	15 (7.5+7.5)		3h
II BSc	III	DMC29004	DSC-3	Thermal physics and Statistical mechanics	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DMC29104		**Practical**	0:0:2		----	35	----	15 (7.5+7.5)	---	3h
	IV	DMD29004	DSC-4	Waves and Optics	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DMD29104		**Practical**	0:0:2		----	35	----	15 (7.5+7.5)	---	3h
III BSc	V	DME29004	DSE-1A	Digital, Analog circuits and Instrumentation	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DME29104		**Practical**	0:0:2		----	35	----	15 (7.5+7.5)	---	3h
		DME29204	DSE-1B	Solid State Physics	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DME29304		**Practical**	0:0:2		----	35	----	15 (7.5+7.5)	---	3h
		DME29404	DSE-1D	Mathematical Physics	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DME29504		**Practical**	0:0:2		----	35	----	15 (7.5+7.5)	----	3h
	V	DME29604	SEC-1A	Renewable Energy and Energy harvesting	2:0:0	02	35	--	15	--	2h	---
		DME29804	SEC-1B	Radiation Safety	2:0:0	02	35	--	15	--	2h	---
		DME30004	SEC-1C	Basic Instrumentation Skills	2:0:0	02	35	--	15	--	2h	---
		DME30204	SEC-1I	Applied Optics	2:0:0	02	35	--	15	--	2h	---
	VI	DMF29004	DSE-1A	Elements of Modern Physics	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DMF29104		**Practical**	0:0:2		----	35	----	15 (7.5+7.5)	---	3h
		DMF29204	DSE-1B	Nuclear and particle physics	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DMF29304		**Practical**	0:0:2		----	35	----	15 (7.5+7.5)	----	3h
		DMF29404	DSE-1C	Quantum Mechanics	4:0:0	06	70	---	30 (15+15)	---	3h	--
		DMF29504		**Practical**	0:0:2		----	35	----	15 (7.5+7.5)	----	3h

Programme Outcome for Bachelor of Science in Physics, Chemistry and Mathematics:

After completing the graduation in the Bachelor of Science the students are able to:

PO1.Demonstrate proficiency in Mathematics and the Mathematical concepts needed for a proper understanding of Physics.

PO2.Demonstrate the ability to justify and explain their thinking and/or approach

PO3.Develop state-of-the-art laboratory and professional communication skills

PO4.Apply the scientific method to design, execute, and analyze an experiment

PO5.Explain scientific procedures and experimental observations

PO6.Appreciate the role of chemistry in the society

PO7.Use this as a basis for ethical behaviour in issues facing chemists /drugs

PO8.Understand chemistry as an integral part for addressing social, economic, and environmental problems

PO9.Understand the value of Mathematical proof

PO10.Demonstrate proficiency in writing and understanding proofs

PO11.Apply mathematical problems and solution in aspects of science and technology

PO12.Gain experience to investigate the real world problems

PO13.Apply mathematical ideas and models to those problems

Programme Specific Outcome

Bachelor of Science in Physics, Chemistry and Mathematics

After completing the graduation in Physics, Chemistry and Mathematics the students are able to:

PSO1.Find career opportunities

PSO2.Develop competence to write competitive examinations

PSO3.Develop proficiency in the analysis of complex physical problems

PSO4.Use of mathematical or other appropriate techniques to solve problems

PSO5.Apply appropriate techniques for the qualitative and quantitative analysis of chemicals in laboratories and in industries

PSO6.Create a hypothesis and appreciate how it relates to broader theories

PSO7.Demonstrate skills in the use of computers

Programme Outcome for Bachelor of Science in Physics, Mathematics and Computer Science:

After completing the graduation in the Bachelor of Science the students are able to:

PO1.Demonstrate proficiency in Mathematics and the Mathematical concepts needed for a proper understanding of Physics

PO2.Demonstrate the ability to justify and explain their thinking and/or approach

PO3.Develop state-of-the-art laboratory and professional communication skills

PO4.Apply the scientific method to design, execute, and analyze an experiment

PO5.Explain scientific procedure and experimental observations

PO6.Understand the value of Mathematical proof

PO7.Demonstrate proficiency in writing an understanding proofs

PO8. Apply mathematical problems and solutions in aspects of science and technology.

PO9.Gain experience to investigate the real world problems

PO10. Apply mathematical ideas and models to those problems.

PO11. Apply Mathematical principles for computing and logical design.

PO12.Design, implements, and evaluates a computational system to meet desired needs within realistic constraints

PO13. Use the System principles in the design and development of software for systems of varying complexity.

Programme Specific Outcome

Bachelor of Science in Physics, Mathematics, Computer Science

After completing the graduation in the Bachelor of Science the students are able to:

PSO1.Find career opportunities

PSO2. Develop competence to write competitive examinations.

PSO3.Develop proficiency in the analysis of complex physical problems

PSO4.Use of mathematical or other appropriate techniques to solve problems

PSO5.Create a hypothesis and appreciate how it relates to broader theories.

PSO6.Demonstrate skills in the use of Computers

PSO7.Join as Entry level Technical job role for an IT Industry

PSO8. Build small database ERP software/ web applications.

Programme Outcome for Bachelor of Science in Physics, Mathematics and Computer Maintenance:

After completing the graduation in the Bachelor of Science the students are able to:

PO1.Demonstrate proficiency in Mathematics and the Mathematical concepts needed for a proper understanding of Physics

PO2.Demonstrate the ability to justify and explain their thinking and/or approach

PO3.Develop state-of-the-art laboratory and professional communication skills

PO4.Apply the scientific method to design, execute, and analyze an experiment

PO5.Explain scientific procedure and experimental observations

PO6.Understand the value of Mathematical proof

PO7.Demonstrate proficiency in writing and understanding proofs

PO8.Apply mathematical problems and solutions in aspects of science and technology.

PO9.Gain experience to investigate the real world problems

PO10.Apply mathematical ideas and models to those problems

PO11.Design, implement and evaluate a computational system to meet desired needs within realistic constraints

PO12.Apply system design and development principals in the construction of software systems of varying complexity

PO13.Apply the knowledge techniques , skills and modern tools in computer maintenance

PO14.Understand networking applications to include basic electronics, programming, operation and computer network

Programme Specific Outcome

Bachelor of Science in Physics, Mathematics, Computer Maintenance

After completing the graduation in the Bachelor of Science the students are able to:

PSO1.Find career opportunities

PSO2.Develop competence to write competitive examinations

PSO3.Develop proficiency in the analysis of complex physical problems

PSO4.Use of mathematical or other appropriate techniques to solve them

PSO5.Create a hypothesis and appreciate how it relates to broader theories.

PSO6.Demonstrate skills in the use of Computers

PSO7. Start small enterprise in PC Maintenance/ Networking field.

PSO8.Join organizations related to Computer Hardware and Networking Maintenance.

Programme Outcome for Bachelor of Science in Physics, Mathematics and Electronics:

After completing the graduation in the Bachelor of Science the students are able to:

PO1.Demonstrate proficiency in mathematics and the mathematical concepts needed for a proper understanding of physics.

PO2.Demonstrate the ability to justify and explain their thinking and/or approach

PO3. Develop state-of-the-art laboratory skills and professional communication skills.

PO4.Apply the scientific method to design, execute, and analyze an experiment

PO5.Understand the value of Mathematical proof

PO6.Gain experience to investigate the real world problems

PO7.Explain scientific procedures and their experimental observations

PO8. Demonstrate proficiency in writing and understanding proofs.

PO9.Apply mathematical problems and solutions in aspects of science and technology

PO10. Apply mathematical ideas and models to problems.

PO11.Apply appropriate troubleshooting techniques to electronic circuits / systems and perform test procedures

PO12.Assist, Assemble, modify and test electronic circuits in accordance with job requirements.

PO13.Communicate effectively in technical and non-technical environments

Programme Specific Outcome

Bachelor of Science in Physics, Mathematics, Electronics

After completing the graduation in the Bachelor of Science the students are able to:

PSO1.Find career opportunities

PSO2.Develop competence to write competitive examinations.

PSO3.Develop proficiency in the analysis of complex physical problems.

PSO4.Use mathematical or other appropriate techniques to solve complex physical problems.

PSO5.Create a hypothesis and appreciate how it relates to broader theories.

PSO6.Demonstrate skills in the use of Computers for control, data acquisition, and data analysis in experimental investigations

PSO7.Apply knowledge of Physics, Mathematics and Electronics fundamentals to the solve problems in electronic circuits & communication systems

PSO8.Apply appropriate troubleshooting techniques to Electronic circuits / systems and perform test procedures

Discipline Specific Elective papers: Choose 1

SEMESTER V

Course code: DME29001/ DME29002/ DME29003/ DME29004

Credits: Theory – 04, Practical – 02 **Theory: 60 Lectures**

COURSE OUTCOME:

After the completion of the course, Students will be able to

CO1.Deliberate in detail with examples Digital Circuits

CO2.Specify the details of Operational amplifier

CO3.Learn the characteristics of sinusoidal oscillator

CO4.Identify in detail with application Instrumentation

CO5.Deliberate the classification and characteristics of gates

CO6.Identify in detail with application of semiconductor devices

DIGITAL AND ANALOG CIRCUITS AND INSTRUMENTATION: DSE 1A

Unit-1

Digital Circuits

Difference between Analog and Digital Circuits. Binary Numbers. Decimal to Binary and Binary to Decimal Conversion, AND, OR and NOT Gates (Realization using Diodes and Transistor). NAND and NOR Gates as Universal Gates. XOR and XNOR Gates. **(04 Lectures)**

De Morgan's Theorems. Boolean Laws. Simplification of Logic Circuit using Boolean algebra. Fundamental Products.Minterms and Maxterms.Conversion of a Truth Table into an Equivalent Logic Circuit by (1) Sum of Products Method and (2) Karnaugh Map. **(05 Lectures)**

Binary Addition.Binary Subtraction using 2's Complement Method).Half Adders and Full Adders and Subtractors, 4-bit binary Adder-Subtractor. **(04 Lectures)**

Semiconductor Devices and Amplifiers:

Semiconductor Diodes: p and n type semiconductors. Barrier Formation in PN Junction Diode. Qualitative Idea of Current Flow Mechanism in Forward and Reverse Biased Diode. PN junction and its characteristics.Static and Dynamic Resistance.Principle and structure of (1) LEDs (2) Photodiode (3) Solar Cell. **(05 Lectures)**

Bipolar Junction transistors*:* n-p-n and p-n-p Transistors. Characteristics of CB, CE and CC Configurations.Active, Cutoff, and Saturation Regions.Current gains α and β. Relations between α and β. Load Line analysis of Transistors.DC Load line and Q-point.Voltage Divider Bias Circuit for CE Amplifier.h-parameter Equivalent Circuit. Analysis of a single-stage CE amplifier using Hybrid Model. Input and Output Impedance. Current, Voltage and Power Gains. Class A, B, and C Amplifiers. Two stage RC coupled amplifier. **(12 Lectures)**

Unit-2

Operational Amplifiers (Black Box approach):

Characteristics of an Ideal and Practical Op-Amp (IC 741), Open-loop& Closed-loop Gain.CMRR, concept of Virtual ground. Applications of Op-Amps: (1) Inverting and Non-inverting Amplifiers (2) Adder (3) Subtractor (4) Differentiator (5) Integrator (6) Zero Crossing Detector **(13 Lectures)**

Sinusoidal Oscillators: Barkhausen's Criterion for Self-sustained Oscillations. Determination of Frequency of RC Oscillator **(05Lectures)**

Instrumentations:

Introduction to CRO: Construction and Working of CRO Applications of CRO: (1) Study of Waveform, (2) Measurement of Voltage, Current, Frequency, and Phase Difference. **(03 Lectures)**

Power Supply: Half-wave Rectifiers. Centre-tapped and Bridge Full-wave Rectifiers Calculation of Ripple Factor and Rectification Efficiency, Basic idea about capacitor filter, Zener Diode and Voltage Regulation. **(06 Lectures)**

Timer IC: IC 555 Pin diagram and its application as Astable & Monostable Multivibrator.

(03 Lectures)

Reference Books:

- Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.
- Electronic devices and circuits, S. Salivahanan and N. Suresh Kumar, 2012, Tata Mc-Graw Hill.
- Microelectronic Circuits, M.H. Rashid, 2nd Edn. 2011, Cengage Learning.
- Modern Electronic Instrumentation & Measurement Tech., Helfrick&Cooper,1990, PHI Learning
- Digital Principles & Applications, A.P. Malvino, D.P. Leach &Saha, 7th Ed.,2011, Tata McGraw Hill
- Microelectronic circuits, A.S. Sedra, K.C. Smith, A.N. Chandorkar, 2014, 6th Edn., Oxford University Press.
- Fundamentals of Digital Circuits, A. Anand Kumar, 2nd Edition, 2009, PHI Learning Pvt. Ltd.
- OP-AMP and Linear Digital Circuits, R.A. Gayakwad, 2000, PHI Learning Pvt. Ltd.

PRACTICALS - DSE LAB: DIGITAL AND ANALOG CIRCUITS AND INSTRUMENTS

Course code: DME29101/ DME29102/ DME29103/ DME29104

(Minimum of eight is to be conducted)

1. To verify and design AND, OR, NOT and XOR gates using IC 7400
2. To verify and design AND, OR, NOT and XOR gates using IC 7402
3. Half adder and Full adder
4. FET-characteristics
5. To study the characteristics of a Transistor in CE configuration.
6. To study the characteristics of a Transistor in CB configuration.
7. Phase shift oscillator
8. Op-amp has inverting and non-inverting amplifier
9. Wien Bridge Oscillator

10. CE-amplifier
11. To minimize a given logic circuit.
12. To design an astable multivibrator of given specifications using 555 Timer.
13. To design a monostable multivibrator of given specifications using 555 Timer
14. UJT Characteristics
15. Op Amp has Adder and Subtractor.

Reference Books:

- Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994, Mc-Graw Hill.
- Electronics: Fundamentals and Applications, J.D. Ryder, 2004, Prentice Hall.
- OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, Prentice Hall.
- Electronic Principle, Albert Malvino, 2008, Tata Mc-Graw Hill

SEMESTER V

Course code: DME29201/ DME29202/ DME29203/ DME29204

Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOME:

After the completion of the course, Students will be able to

CO1.Write down in detail with application of crystal structure

CO2.Write down the details of Elementary lattice dynamics

CO3.Deliberate in detail with examples Magnetic properties of matter

CO4.Identify the characteristics of elementary band theory

CO5.Learn the classification and characteristics of superconductivity

CO6.Understand the elastic properties of solids and lattice vibrations

SOLID STATE PHYSICS: DSE 1B

Unit-1

Crystal Structure: Solids: Amorphous and Crystalline Materials. Lattice TranslationVectors.Lattice with a Basis – Central and Non-Central Elements. Unit Cell. Miller Indices. Reciprocal Lattice. Types of Lattices. Brillouin Zones. Diffraction of X-rays by Crystals. Bragg's Law. Bragg spectrometer. Continuous x-ray spectra, Duane and Hunt limit. Characteristic x-ray spectra. Mosley law and its significance. **(10 Lectures)**

Elementary Lattice Dynamics: Lattice Vibrations and Phonons: Linear Monatomic and Diatomic Chains. Acoustical and Optical Phonons. Qualitative Description of the Phonon Spectrum in Solids. Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids.

(09 Lectures)

Magnetic Properties of Matter: Dia, Para, Ferri and Ferromagnetic Materials. Classical Langevin Theory of dia – and Paramagnetic Domains. Quantum Mechanical Treatment of Paramagnetism. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. Discussion of B-H Curve. Hysteresis and Energy Loss. **(11 Lectures)**

Unit-2

Electrical Properties of metals: Free electron theory, Quantum theory, Conductivity of metals on the basis of free electron theory- Ohm's law. **(04 Lectures)**

Dielectric Properties of Materials: Polarization. Local Electric Field at an Atom. Depolarization Field. Electric Susceptibility.Polarizability.Clausius Mosotti Equation. Classical Theory of Electric Polarizability.Normal and Anomalous Dispersion.Cauchy and Sellmeir relations. Langevin-Debye equation. Complex Dielectric Constant. Optical Phenomena. Application: Plasma Oscillations, Plasma Frequency, Plasmon's. **(10 Lectures)**

Elementary band theory: Kronig Penny model. Band Gaps.Conductors, Semiconductors and insulators. P and N type Semiconductors, carrier concentration in intrinsic semiconductor, Fermi energy, effect of temperature and concentration on Fermi energy, Conductivity of Semiconductors, mobility, Hall Effect, Hall coefficient. **(10 Lectures)**

Superconductivity: Experimental Results. Critical Temperature. Critical magnetic field. Meissner effect. Type I and type II Superconductors, London's Equation and Penetration Depth. Isotope effect.BCS theory, application of Superconductors.

(06 Lectures)

Reference Books:

- Introduction to Solid State Physics, Charles Kittel, 8th Ed., 2004, Wiley India Pvt. Ltd.
- Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India
- Introduction to Solids, Leonid V. Azaroff, 2004, Tata Mc-Graw Hill
- Solid State Physics, Neil W. Ashcroft and N. David Mermin, 1976, Cengage Learning
- Solid State Physics, Rita John, 2014, McGraw Hill
- Solid-state Physics, H. Ibach and H Luth, 2009, Springer
- Elementary Solid State Physics, 1/e M. Ali Omar, 1999, Pearson India
- Solid State Physics, M.A. Wahab, 2011, Narosa Publications

PRACTICALS-DSE LAB: SOLID STATE PHYSICS

Course code: DME29301/ DME29302/ DME29303/ DME29304

(Minimum of eight is to be conducted)

1. Determination of energy gap of a semiconductor using Meter Bridge.
2. Determination Fermi energy of metal (copper).
3. To measure the Dielectric Constant of a given solid Materials
4. Study of LDR characteristics.
5. Verification of Inverse square law for light Intensity using a Photo-diode.
6. Bridge rectifier with and without filters.
7. Clipping and clamping circuits using diodes.
8. Zener diode as a voltage regulator.
9. Study of powder X-ray photograph-the determination of inter planar distances.
10. To determine value of Planck's constant using LEDs of at least 4 different colors.
11. To determine value of Boltzmann constant using V-I characteristic of PN diode.
12. Study of Hall Effect.
13. To determine the refractive index of a dielectric layer using SPR
14. To study the PE Hysteresis loop of a Ferroelectric Crystal.
15. To measure the resistivity of a semiconductor (Ge) crystal with temperature by four-probe method (from room temperature to 150 ^{o}C) and to determine its band gap
16. To draw the BH curve of iron using a Solenoid and determine the energy loss from Hysteresis.
17. To determine the complex dielectric constant and plasma frequency of metal using Surface Plasmon resonance (SPR)
18. Measurement of Magnetic susceptibility of solids.

Reference Books

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Ed., 2011, KitabMahal, New Delhi
- Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India

SEMESTER V

Course code: DME29401/ DME29402/ DME29403/ DME29404

Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOME:

After successful completion of the course, the student is able to:

CO1.Learn in detail with examples calculus of functions of more than one variable

CO2.Specify the details of Fourier series.

CO3.Specify in depth integrals.

CO4.Deliberate in detail with application of partial differential equations

CO5.Understand in depth complex analysis

CO6.Deliberate in detail with examples of beta and gamma function

MATHEMATICAL PHYSICS: DSE 1D

Unit-1

Calculus of functions of more than one variable: Partial derivatives, exact and inexact differentials. Integrating factor, with simple illustration. Constrained Maximization using Lagrange Multipliers. **(06 Lectures)**

Fourier series: Periodic functions. Orthogonality of sine and cosine functions, Dirichlet Conditions (Statement only).Expansion of periodic functions in a series of sine and cosine functions and determination of Fourier coefficients. Complex representation of Fourier series. Expansion of functions with arbitrary period. Expansion of non-periodic functions over an interval. Even and odd functions and their Fourier expansions.Application.Summing of Infinite Series. **(10 Lectures)**

Frobenius Method and Special Functions: Singular Points of Second Order Linear Differential Equations and their importance. Frobenius method and its applications to differential equations.Legendre, Bessel, Hermite and Laguerre Differential Equations. Properties of Legendre Polynomials: Rodrigues Formula, Orthogonality. Simple recurrence relations. **(14 Lectures)**

Unit-2

Some Special Integrals: Beta and Gamma Functions and Relation between them. Expression of Integrals in terms of Gamma Functions. Error Function (Probability Integral). **(06 Lectures)**

Partial Differential Equations: Solutions to partial differential equations, using separation of variables: Laplace's Equation in problems of rectangular, cylindrical and spherical symmetry.

(10 Lectures)

Complex Analysis: Brief Revision of Complex Numbers and their Graphical Representation. Euler's formula, De Moivre's theorem, Roots of Complex Numbers. Functions of Complex Variables. Analyticity and Cauchy-Riemann Conditions. Examples of analytic functions. Singular functions: poles and branch points, order of singularity, branch cuts. Integration of a function of a complex variable. Cauchy's Inequality. Cauchy's Integral formula.

(14 Lectures)

Reference Books:

- Mathematical Methods for Physicists: Arfken, Weber, 2005, Harris, Elsevier.
- Fourier analysis by M.R. Spiegel, 2004, Tata McGraw-Hill.
- Mathematics for Physicists, Susan M. Lea, 2004, Thomson Brooks/Cole.
- An Introduction to Ordinary Differential Equations, Earl A Coddington, 1961, PHI Learning.
- Differential Equations, George F. Simmons, 2006, Tata McGraw-Hill.
- Essential Mathematical Methods, K.F. Riley and M.P. Hobson, 2011, Cambridge University Press
- Partial Differential Equations for Scientists and Engineers, S.J. Farlow, 1993, Dover Publications.
- Mathematical methods for Scientists and Engineers, D.A. McQuarrie, 2003, Viva Books.

PRACTICALS -DSE LAB: MATHEMATICAL PHYSICS

Course code: DME29501/ DME29502/ DME29503/ DME29504

The aim of this course is not just to teach computer programming and numerical Analysis but to emphasize its role in solving problems in Physics.

- Highlights the use of computational methods to solve physical problems
- Use of computer language as a tool in solving physics problems (applications)
- The course will consist of lectures (both theory and practical) in the Computer Lab
- Evaluation done not on the programming but on the basis of formulating the problem
- Aim at teaching students to construct the computational problem to be solved
- Students can use anyone operating system Linux or Microsoft Windows

Topics Description with Applications	Introduction and Overview
Introduction and Overview	Computer architecture and organization, memory and Input/output devices
Basics of scientific computing	Binary and decimal arithmetic, Floating point numbers, algorithms, Sequence, Selection and Repetition, single and double precision arithmetic, underflow & overflow-emphasize the importance of making equations in terms of dimensionless variables, Iterative methods
Errors and error Analysis	Truncation and round off errors, Absolute and relative errors, Floating point computations.
Review of C & C++ Programming fundamentals	Introduction to Programming, constants, variables and data types, operators and Expressions, I/O statements, scanf and printf, c in and c out, Manipulators for data formatting, Control statements (decision making and looping statements) (*If-statement. If-else Statement. Nested if Structure. Else-if Statement. Ternary Operator. Goto Statement. Switch Statement. Unconditional and Conditional Looping. While-Loop. Do-While Loop. FOR Loop. Break and Continue Statements. Nested Loops*), Arrays (*1D&2D*) and strings, user defined functions, Structures and Unions, Idea of classes and objects
Programs: using C/C++ language	Sum & average of a list of numbers, largest of a given list of numbers and its location in the list, sorting of numbers in ascending-descending order, Binary search

Random number generation	Area of circle, area of square, volume of sphere, value of pi (**π**)
Solution of Algebraic and Transcendental equations by Bisection, Newton Raphson and Secant methods	Solution of linear and quadratic equation, solving $\alpha = \tan\alpha; I = I_0\left(\frac{\sin\alpha}{\alpha}\right)^2$ in optics
Interpolation by Newton Gregory Forward and Backward difference formula, Error estimation of linear interpolation	Evaluation of trigonometric functions e.g. *sin θ, cos θ, tanθ, etc.*
Numerical differentiation (Forward and Backward difference formula) and Integration (Trapezoidal a n d Simpson rules), Monte Carlo method	Given Position with equidistant time data to calculate velocity and acceleration and vice-versa. Find the area of B-H Hysteresis loop
Solution of Ordinary Differential Equations (ODE) First order Differential equation Euler, modified Euler and Runge-Kutta (RK) second and fourth order methods	First order differential equation • Radioactive decay • Current in RC, LC circuits with DC source • Newton's law of cooling • Classical equations of motion Attempt following problems using RK 4 order method: • Solve the coupled differential equations $\frac{dx}{dt} = y + x - \frac{x^3}{3}; \frac{dy}{dx} = -x$ for four initial conditions x(0) = 0, y(0) = -1, -2, -3, -4. Plot x vs y for each of the four initial conditions on the same screen for 0 ≤t ≤15 The differential equation describing the motion of a Pendulum is $\frac{d^2\theta}{dt^2} = -\sin(\theta)$. The pendulum is released from rest at an angular displacement α, i. e. $\theta(0) = \alpha, and \theta^1(0) = 0.$ Solve the equation for α= 0.1, 0.5 and 1.0 and plot θ as a function of time in the range 0 ≤ t ≤8Π. Also plot the analytic solution valid for small θsin(θ)=θ

Reference Books:

- Introduction to Numerical Analysis, S.S. Sastry, 5thEdn., 2012, PHI Learning Pvt. Ltd.
- Schaum's Outline of Programming with C++. J.Hubbard, 2000, McGraw-Hill Publications.
- Numerical Recipes in C++: The Art of Scientific Computing, W.H. Pressetal., 3rdEdn., 2007, Cambridge University Press.
- A first course in Numerical Methods, Uri M. Ascher and Chen Greif, 2012, PHI Learning
- Elementary Numerical Analysis, K.E. Atkinson, 3 r dEdn. , 2007, Wiley India Edition.
- Numerical Methods for Scientists and Engineers, R.W. Hamming, 1973, Courier Dover Pub.
- An Introduction to Computational Physics, T. Pang, 2ndEdn., 2006, Cambridge Univ. Press

Discipline Specific Elective papers: Choose 1

SEMESTER VI

Course code: DMF29001/ DMF29002/ DMF29003/ DMF29004
Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOME:

After successful completion of the course, the student is able to:

CO1.Understand in detail with examples planks quantum

CO2.Identify the classification and characteristics of Planck's quantum

CO3.Learn the classification and characteristics of fission and fusion reaction

CO4.Write down the characteristics of matter waves

CO5.Understand the classification and characteristics of radioactivity

CO6.Specify in depth Eigen values

ELEMENTS OF MODERN PHYSICS: DSE 1A

Unit-1

Planck's quantum, Planck's constant and light as a collection of photons; Photo-electric effect and Compton scattering. De Broglie wavelength and matter waves; Davisson-Germer experiment.
(08 Lectures)

Problems with Rutherford model- instability of atoms and observation of discrete atomic spectra; Bohr's quantization rule and atomic stability; calculation of energy levels for hydrogen like atoms and their spectra. **(04 Lectures)**

Position measurement-gamma ray microscope thought experiment; wave-particle duality, Heisenberg uncertainty principle-impossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle **(04 lectures)**

Two slit interference experiment with photons, atoms and particles; linear superposition principle as a consequence; Matter waves and wave amplitude; Schrodinger equation for non-relativistic particles; Momentum and Energy operators; stationary states; physical interpretation of wave function, probabilities and normalization; Probability and probability current densities in one dimension. **(10 Lectures)**

Fission and fusion - mass deficit, relativity and generation of energy; Fission - nature of fragments and emission of neutrons. Nuclear reactor: slow neutrons interacting with Uranium 235; Fusion and thermonuclear reactions. **(04 Lectures)**

Unit-2

One dimensional infinitely rigid box- energy eigenvalues and Eigen functions, normalization; Quantum dot as an example; Quantum mechanical scattering and tunnelling in one dimension - across a step potential and across a rectangular potential barrier. **(12 Lectures)**

Size and structure of atomic nucleus and its relation with atomic weight; Impossibility of an electron being in the nucleus as a consequence of the uncertainty principle. Nature of nuclear force, NZ graph, semi-empirical mass formula and binding energy. **(07 Lectures)**

Radioactivity: stability of nucleus; Law of radioactive decay; Mean life & half-life; Alpha decay; Beta decay - energy released, spectrum and Pauli's prediction of neutrino; gamma-ray emission. **(11 Lectures)**

Reference Books:

- Concepts of Modern Physics, Arthur Beiser, 2009, McGraw-Hill
- Modern Physics, John R. Taylor, Chris D. Zafiratos, Michael A.Dubson,2009, PHI Learning
- Six Ideas that Shaped Physics: Particle Behave like Waves, Thomas A. Moore, 2003, McGraw Hill

- Quantum Physics, Berkeley Physics Course Vol.4. E.H. Wichman, 2008, Tata McGraw-Hill Co.
- Modern Physics, R.A. Serway, C.J. Moses, and C.A.Moyer, 2005, Cengage Learning
- Modern Physics, G. Kaur and G.R. Pickrell, 2014, McGraw Hill

PRACTICALS –DSE LAB: ELEMENTS OF MODERN PHYSICS
Course code: DMF29101/ DMF29102/ DMF29103/ DMF29104

(Minimum of eight is to be conducted)

1. To study the Divergence of laser.
2. Characteristics of LED – To measure efficiency and output power.
3. The logic gates AND, OR, NOT gates using Transistors.
4. Phase measurement in LCR circuit using CRO.
5. Negative feedback amplifier.
6. Hartley Oscillator.
7. Determine Rydberg constant using Charging Hydrogen discharge tube.
8. Two stages RC coupled Amplifier
9. Triode characteristics.
10. Energy dissipation during charging of capacitors
11. To determine the ionization potential of mercury.
12. To study photoelectric effect.
13. Determination of dielectric constant of a material used in capacitor.
14. To determine work function of material of filament of directly heated vacuum diode.
15. To determine the absorption lines in the rotational spectrum of Iodine vapor. To study the diffraction patterns of single and double slits using laser source and measure its intensity variation using Photo sensor and compare with incoherent source – Na light.
16. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light
17. To setup the Millikan oil drop apparatus and determine the charge of an electron.
18. To study the diffraction patterns of single and double slits using laser source and measure its intensity variation using Photo sensor and compare with incoherent source – Na light.
19. To determine work function of material of filament of directly heated vacuum diode.

20. Spectral response of solar cell.

References:

- Physics of Radiation Therapy: F M Khan Williams and Wilkins, Third edition (2003)
- Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House.
- Practical Applications of Radioactivity and Nuclear Radiations, G.C. Lowental and P.L. Airey, Cambridge University Press, U.K., 2001
- A. Martin and S.A. Harbisor, An Introduction to Radiation Protection, John Willey & Sons, Inc. New York, 1981.
- Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Edition, 2011, KitabMahal, New Delhi.

SEMESTER VI

Course code: DMF29201/ DMF29202/ DMF29203/ DMF29204
Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOME:

After the completion of the course, Students will be able to

CO1.Write down in detail with application and properties of nuclei

CO2.Learn in detail with application and nuclear models

CO3.Understand in detail with examples radioactivity

CO4.Identify the details of particle physics

CO5.Write down the details of particle accelerators

CO6.Write down the details of detector for nuclear radiator

Nuclear & Particle Physics: DSE 1B

Unit-1

General Properties of Nuclei: Constituents of nucleus and their Intrinsic properties, quantitative facts about size, mass, charge density (matter energy), binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve, N/A plot, angular momentum, parity, magnetic moment, electric moments, nuclear excites states.

(10 Lectures)

Nuclear Models: Liquid drop model approach, semi empirical mass formula and binding energy, significance of various terms, condition of nuclear stability. Concept of Nuclear force.

(06 Lectures)

Nuclear Reactions: Types of Reactions, Conservation Laws, kinematics of reactions, Q-value, Rutherford alpha scattering. **(04 Lectures)**

Radioactivity decay :(a) Alpha decay: basics ofα-decay processes, Geiger Nuttall law, α-decay spectroscopy. (b) beta-decay: energy kinematics for beta-decay, positron emission, electron capture, neutrino hypothesis. (c) Gamma decay **(06 Lectures)**

Nuclear fission and fusion: Estimation of the fission energy on the basis of liquid drop model, controlled and uncontrolled chain reaction, four factor formula, types of reactor

(04 Lectures)

Unit-2

Interaction of Nuclear Radiation with matter: Gamma ray interaction through matter, photoelectric effect, Compton scattering, pair production, neutron interaction with matter.

(06 Lectures)

Detector for Nuclear Radiations: GM Counter. Basic principle of Scintillation. Detectors and construction of photo-multiplier tube (PMT). Semiconductor Detectors (Si &Ge) for charge particle and photon detection (concept of charge carrier and mobility)

(06 Lectures)

Particle Accelerators: Linear accelerator, Cyclotron, Betatron.

(04 Lectures)

Particle physics: Particle interactions; basic features, types of particles and its families. Symmetries and Conservation Laws: energy and momentum, angular momentum, parity, baryon number, Lepton number, Isospin, Strangeness and charm, concept of quark model, color quantum number and gluons. **(14 Lectures)**

PRACTICALS –DSE LAB: NUCLEAR AND PARTICLE PHYSICS
Course code: DMF29301/ DMF29302/ DMF29303/ DMF29304

(Minimum of eight is to be conducted)

1. Study of Characteristics of GM tube and determination of operating voltage, plateau length.
2. Verification of inverse square law of gamma rays.
3. Study of Absorption coefficient of gamma particle.
4. Verification of inverse square law of beta rays.
5. Half-life of K-40
6. Determine the ionization potential of Xenon.
7. Cockcroft Walton voltage multiplier.
8. Solar cell characteristics – To determine efficiency and fill factor.
9. Determine wavelength of laser light.
10. To determine the value of e/m by magnetic focusing.
11. Determination of range of electron in aluminum using GM counter

12. Study of Absorption coefficient of beta particle
13. To determine the wavelength of H-alpha emission line of Hydrogen atom.
14. Study of counting statistics using background radiation using GM counter
15. Study of radiation in various materials (e.g. KSO4 etc.). Investigation of possible radiation in different routine materials by operating GM at operating voltage.

Reference Books:

- Introductory nuclear Physics by Kenneth S. Krane (Wiley India Pvt. Ltd., 2008).
- Concepts of nuclear physics by Bernard L. Cohen. (Tata Mcgraw Hill, 1998).
- Introduction to the physics of nuclei & particles, R.A. Dunlap. (Thomson Asia, 2004)
- Introduction to Elementary Particles, D. Griffith, John Wiley & Sons
- Quarks and Leptons, F. Halzen and A.D. Martin, Wiley India, New Delhi
- Basic ideas and concepts in Nuclear Physics - An Introductory Approach by K. Heyde (IOP-Institute of Physics Publishing, 2004).
- Radiation detection and measurement, G.F. Knoll (John Wiley & Sons, 2000).
- Theoretical Nuclear Physics, J.M. Blatt &V.F.Weisskopf (Dover Pub.Inc., 1991)

SEMESTER VI

Course code: DMF29401/DMF29402/DMF29403/DMF29404
Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOME:

After successful completion of the course, the student is able to:

CO1.Understand the classification and characteristics of time dependent Schrodinger equation

CO2.Understand in depth time independent Schrodinger equation

CO3.Understand the classification and characteristics of quantum theory of hydrogen like atoms

CO4.Specify the details of atoms in external magnetic field

CO5.Write down the characteristics of many electron atoms

QUANTUM MECHANICS: DSE 1C

Unit-1

Time dependent Schrodinger equation: Time dependent Schrodinger equation and dynamical evolution of a quantum state; Properties of Wave Function. Interpretation of Wave Function Probability and probability current densities in three dimensions; Conditions for Physical Acceptability of Wave Functions. Normalization. Linearity and Superposition Principles. Eigenvalues and Eigenfunctions. Position, momentum & Energy operators; commutator of position and momentum operators; Expectation values of position and momentum. Wave Function of a Free Particle. **(08 Lectures)**

Time independent Schrodinger equation-Hamiltonian, stationary states and energy eigenvalues; expansion of an arbitrary wavefunction as a linear combination of energy eigenfunctions; General solution of the time dependent Schrodinger equation in terms of linear combinations of stationary states; Application to the spread of Gaussian wavepacket for a free particle in one dimension; wave packets, Fourier transforms and momentum space wavefunction; Position-momentum uncertainty principle. **(10 Lectures)**

General discussion of bound states in an arbitrary potential- continuity of wave function, boundary condition and emergence of discrete energy levels; application to one-dimensional problem- square well potential; Quantum mechanics of simple harmonic oscillator-energy levels and energy eigenfunctions using Frobenius method. **(12 Lectures)**

Unit-2

Quantum theory of hydrogen-like atoms: time independent Schrodinger equation in spherical polar coordinates; separation of variables for the second order partial differential equation; angular momentum operator and quantum numbers; Radial wave functions from Frobenius method; Orbital angular momentum quantum numbers l and m; s, p, d,.. Shells (idea only) **(10 Lectures)**

Atoms in Electric and Magnetic Fields:- Electron Angular Momentum. Space Quantization. Electron Spin and Spin Angular Momentum. Larmor's Theorem. Spin Magnetic Moment. Stern-Gerlach Experiment. Zeeman Effect: Electron Magnetic Moment and Magnetic Energy, Gyromagnetic Ratio and Bohr Magneton. **(08 Lectures)**

Atoms in External Magnetic Fields:- Normal and Anomalous Zeeman Effect. **(02 Lectures)**

Many electron atoms:- Pauli's Exclusion Principle. Symmetric and Antisymmetric Wave Functions. Periodic table.Fine structure. Spin orbit coupling. Spectral Notations for Atomic States. Total Angular Momentum. Vector Model. Spin-orbit coupling in atoms-L-S and J-J couplings. **(10 Lectures)**

Reference Books:

- A Text book of Quantum Mechanics, P.M. Mathews & K. Venkatesan, 2nd Ed., 2010, McGraw Hill
- Quantum Mechanics, Robert Eisberg and Robert Resnick, 2ndEdn. 2002, Wiley.
- Quantum Mechanics, Leonard I. Schiff, 3rdEdn. 2010, Tata McGraw Hill.
- Quantum Mechanics, G. Aruldhas, 2ndEdn. 2002, PHI Learning of India.
- Quantum Mechanics, Bruce Cameron Reed, 2008, Jones and Bartlett Learning.
- Quantum Mechanics for Scientists & Engineers, D.A.B. Miller, 2008, Cambridge University Press
- Quantum Mechanics, EugenMerzbacher, 2004, John Wiley and Sons, Inc.
- Introduction to Quantum Mechanics, David J. Griffith, 2nd Ed. 2005, Pearson Education

- Quantum Mechanics, Walter Greiner, 4thEdn., 2001, Springer

PRACTICAL-DSE LAB: QUANTUM MECHANICS

Course code: DMF29501/DMF29502/DMF29503/DMF29504

Use C/C++/Scilab for solving the following problems based on Quantum Mechanics Like

1. Solve the s-wave Schrodinger equation for the ground state and the first excited state of the hydrogen atom:

$$\frac{d^2y}{dr^2} = A(r)u(r), A(r) = \frac{2m}{\hbar^2}[V(r) - E] where V(r) = \frac{-e^2}{r}$$

Here, m is the reduced mass of the electron. Obtain the energy Eigen values and plot the corresponding wave functions. Remember that the ground state energy of the hydrogen atom is ≈ -13.6 eV. Take e=3.795 $(eVÅ)^{1/2}$, ħc = 1973 (eVÅ) and m = 0.511x10^6eV/c^2

2. Solve the s-wave radial Schrodinger equation for an atom

$$\frac{d^2y}{dr^2} = A(r)u(r), A(r) = \frac{2m}{\hbar^2}[V(r) - E]$$

Where m is the reduced mass of the system (which can be chosen to be the mass of an electron), for the screened coulomb potential

$$V(r) = \frac{-e^2}{r} e^{\frac{-r}{a}}$$

Find the energy (in eV) of the ground state of the atom to an accuracy of three Significant digits. Also, plot the corresponding wave function. Take e = 3.795 $(eVÅ)^{1/2}$, m = 0.511x10^6eV/c^2 , and a = 3 Å, 5 Å, 7 Å. In these units ħc = 1973(eVÅ). The ground state energy is expected to be above -12 eV in all three cases.

3. Solve the s-wave radial Schrodinger equation for a particle of mass m:

$$\frac{d^2y}{dr^2} = A(r)u(r), A(r) = \frac{2m}{\hbar^2}[V(r) - E]$$

For the anharmonic oscillator potential

$$V(r) = \frac{1}{2}kr^2 + \frac{1}{3}br^3 \qquad - \qquad -$$

for the ground state energy (in MeV) of the particle to an accuracy of three significant digits. Also, plot the corresponding wave function. Choose m = 940 MeV/c^2, k = 100 MeV fm^{-2}, b = 0, 10, 30 MeV fm^{-3}In these units, cħ = 197.3 MeV fm. The ground state energy I expected to lie between 90 and 110 MeV for all three cases.

4. Solve the s-wave radial Schrodinger equation for the vibrations of hydrogen molecule:

$$\frac{d^2y}{dr^2} = A(r)u(r), A(r) = \frac{2\mu}{\hbar^2}[V(r) - E]$$

where μ is the reduced mass of the two-atom system for the Morse potential

$$V(r) = D\left(e^{-2\alpha r^1} - e^{-\alpha r^1}\right), r^1 = \frac{r - r_0}{r}$$

Find the lowest vibrational energy (in MeV) of the molecule to an accuracy of three significant digits. Also plot the corresponding wave function. Take: m = 940x10^6eV/C^2, D = 0.755501 eV, α = 1.44, r_o = 0.131349 Å

Laboratory based experiments:

5. Study of Electron spin resonance- determine magnetic field as a function of the resonance frequency

6. Study of Zeeman effect: with external magnetic field; Hyperfine splitting

7. To study the quantum tunnelling effect with solid state device, e.g. tunnelling current in backward diode or tunnel diode.

Reference Books:

- Schaum's Outline of Programming with C++. J.Hubbard, 2000, McGraw-Hill Publications.
- Numerical Recipes in C: The Art of Scientific Computing, W.H.Press et al., 3rdEdn., 2007, Cambridge University Press.
- Elementary Numerical Analysis, K.E.Atkinson, 3 r dEdn. , 2007, Wiley India Edition.
- A Guide to MATLAB, B.R. Hunt, R.L. Lipsman, J.M. Rosenberg, 2014, 3rd Edn., Cambridge University Press
- Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB:
- Scientific and Engineering Applications: A. VandeWouwer, P. Saucez, C. V. Fernández.2014 Springer ISBN: 978-3319067896
- Scilab by example: M. Affouf2012ISBN: 978-1479203444
- Scilab(A Free Software to Matlab): H. Ramchandran, A.S. Nair. 2011 S. Chand and Company, New Delhi ISBN: 978-8121939706
- Scilab Image Processing: Lambert M. Surhone. 2010Betascript Publishing ISBN: 978-6133459274A
- Quantum Mechanics, Leonard I. Schiff, 3rdEdn. 2010, Tata McGraw Hill.
- Quantum Mechanics, Bruce Cameron Reed, 2008, Jones and Bartlett Learning.

Skill Enhancement Course (SEC) (Credit: 02 each)

SEMESTER V

Course code: DME29601/ DME29602/ DME29603/ DME29604
Credits: Theory – 02 **Theories: 30 Lectures**

COURSE OUTCOME:

After the completion of the course, Students will be able to

CO1.Understand the characteristics of fossil fuel

CO2.Learn in detail with application of wind energy

CO3.Specify in detail with application of ocean energy and hydro energy

CO4.Identify the characteristics of geothermal energy

CO5.Deliberate the characteristics of electromagnetic energy

CO6.Deliberate the characteristics of piezoelectric energy harvesting

RENEWABLE ENERGY AND ENERGY HARVESTING: SEC 1A

Fossil fuels and Alternate Sources of energy: Fossil fuels and Nuclear Energy, their limitation, need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity. **(03 Lectures)**

Solar energy: Solar energy, its importance, storage of solar energy, solar pond, non convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems. **(06 Lectures)**

Wind Energy harvesting: Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies. **(03 Lectures)**

Ocean Energy: Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices. **(03 Lectures)**

Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power, Ocean Bio-mass. **(02 Lectures)**

Geothermal Energy: Geothermal Resources, Geothermal Technologies. **(02 Lectures)**

Hydro Energy: Hydropower resources, hydropower technologies, environmental impact of hydro power sources. **(02 Lectures)**

Piezoelectric Energy harvesting: Introduction, Physics and characteristics of piezoelectric effect, materials and mathematical description of piezoelectricity, Piezoelectric parameters and modeling piezoelectric generators, Piezoelectric energy harvesting applications, Human power **(04 Lectures)**

Electromagnetic Energy Harvesting: Linear generators, physics mathematical models, recent applications **(02 Lectures)**

Carbon captured technologies, cell, batteries, power consumption **(02 Lectures)**

Environmental issues and Renewable sources of energy, sustainability. **(01 Lecture)**

Demonstrations and Experiments

1. Demonstration of Training modules on solar energy, wind energy, etc.
2. Conversion of vibration to voltage using piezoelectric materials
3. Conversion of thermal energy into voltage using thermoelectric modules.

Reference Books:

- Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi
- Solar energy - M P Agarwal - S Chand and Co. Ltd.
- Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd.
- Godfrey Boyle, "Renewable Energy, Power for a sustainable future", 2004, Oxford University Press, in association with The Open University.
- Dr. P Jayakumar, Solar Energy: Resource Assesment Handbook, 2009
- J.Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).
- http://en.wikipedia.org/wiki/Renewable_energy

SEMESTER V

Course code: DME29801/ DME29802/ DME29803/ DME29804
Credits: Theory – 02 **Theories: 30 Lectures**

COURSE OUTCOME:

After the completion of the course, Students will be able to

CO1.Deliberate the details of photons

CO2.Understand the classification and characteristics of Atomic and nuclear physics

CO3.Write down the classification and characteristics of nuclear techniques

CO4.Write down the characteristics of radiation safety management

CO5.Identify in detail with application of radiation detection

RADIATION SAFETY: SEC 1B

Basics of Atomic and Nuclear Physics: Basic concept of atomic structure; X rays characteristic and production; concept of bremsstrahlung and auger electron, The composition of nucleus and its properties, mass number, isotopes of element, spin, binding energy, stable and unstable isotopes, law of radioactive decay, Mean life and half life, basic concept of alpha, beta and gamma decay, concept of cross section and kinematics of nuclear reactions, types of nuclear reaction, Fusion, fission. **(06 Lectures)**

Interaction of Radiation with matter: Types of Radiation: Alpha, Beta, Gamma and Neutron and their sources, sealed and unsealed sources, **Interaction of Photons** – Photoelectric effect, Compton Scattering, Pair Production, Linear and Mass Attenuation Coefficients, **Interaction of Charged Particles:** Heavy charged particles - Beth-Bloch Formula, Scaling laws, Mass Stopping Power, Range, Straggling, Channeling and Cherenkov radiation. Beta Particles- Collision and Radiation loss (Bremsstrahlung), **Interaction of Neutrons**- Collision, slowing down and Moderation. **(07 Lectures)**

Radiation detection and monitoring devices: Radiation Quantities and Units: Basic idea of different units of activity, KERMA, exposure, absorbed dose, equivalent dose, effective dose, collective equivalent dose, Annual Limit of Intake (ALI) and derived Air Concentration (DAC).

Radiation detection: Basic concept and working principle of gas detectors (Ionization Chambers, Proportional Counter, Multi-Wire Proportional Counters (MWPC) and Gieger Muller Counter), Scintillation Detectors (Inorganic and Organic Scintillators), Solid States Detectors and Neutron Detectors, Thermo luminescent Dosimetry. **(07 Lectures)**

Radiation safety management: Biological effects of ionizing radiation, Operational limits and basics of radiation hazards evaluation and control: radiation protection standards, International Commission on Radiological Protection (ICRP) principles, justification, optimization, limitation, introduction of safety and risk management of radiation. Nuclear waste and disposal management.Brief idea about Accelerator driven Sub-critical system (ADS) for waste management. **(05 Lectures)**

Application of nuclear techniques: Application in medical science (e.g., MRI, PET, Projection Imaging Gamma Camera, radiation therapy), Archaeology, Art, Crime detection, Mining and oil. *Industrial Uses:* Tracing, Gauging, Material Modification, Sterization, Food preservation. **(05 Lectures)**

Experiments:

1. Study the background radiation levels using Radiation meter

Characteristics of Geiger Muller (GM) Counter:

2) Study of characteristics of GM tube and determination of operating voltage and plateau length using background radiation as source (without commercial source).

3) Study of counting statistics using background radiation using GM counter.

4) Study of radiation in various materials (e.g. KSO4 etc.). Investigation of possible radiation in different routine materials by operating GM at operating voltage.

5) Study of absorption of beta particles in Aluminum using GM counter.

6) Detection of α particles using reference source & determining its half life using spark counter

7) Gamma spectrum of Gas Light mantle (Source of Thorium)

Reference Books:

1. W.E. Burcham and M. Jobes – Nuclear and Particle Physics – Longman (1995)

2. G.F.Knoll, Radiation detection and measurements

3. Thermoluninescense Dosimetry, Mcknlay, A.F., Bristol, Adam Hilger (Medical Physics Handbook 5)

4. W.J. Meredith and J.B. Massey, "Fundamental Physics of Radiology". John Wright and Sons, UK, 1989.

5. J.R. Greening, "Fundamentals of Radiation Dosimetry", Medical Physics Hand Book Series, No.6, Adam Hilger Ltd., Bristol 1981.

6. Practical Applications of Radioactivity and Nuclear Radiations, G.C. Lowental and P.L. Airey, Cambridge University Press, U.K., 2001

7. W.R. Hendee, "Medical Radiation Physics", Year Book – Medical Publishers Inc. London, 1981

SEMESTER V

Course code: DME30001/ DME30002/ DME30003/ DME30004
Credits: Theory – 02 **Theories: 30 Lectures**

COURSE OUTCOME:

After completion of the course the student is able to

CO1.Deliberate in details with examples basic of measurement

CO2.Specify in depth electronic voltmeter

CO3.Understand in depth Cathode ray oscilloscope

CO4.Specify the characteristics of Impedance Bridge

CO5.Specify the classification and characteristics of digital multimetre

CO6.Identify the characteristics of signal generator

BASIC INSTRUMENTATION SKILLS: SEC 1C

Basic of Measurement: Instruments accuracy, precision, sensitivity, resolution range etc. Errors in measurements and loading effects. **Multimeter:** Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance. **(04 Lectures)**

Electronic Voltmeter: Advantage over conventional multimeter for voltage measurement with respect to input impedance and sensitivity. Principles of voltage, measurement (block diagram only). Specifications of an electronic Voltmeter/Multimeter and their significance.**AC millivoltmeter:** Type of AC millivoltmeters: Amplifier- rectifier, and rectifier- amplifier. Block diagram ac millivoltmeter**,** specifications and their significance. **(04 Lectures)**

Cathode Ray **Oscilloscope:** Block diagram of basic CRO. Construction of CRT, Electron gun, electrostatic focusing and acceleration (Explanation only– nonmathematical treatment), brief discussion on screen phosphor, visual persistence & chemical composition. Time base operation, synchronization. Front panel controls. Specifications of a CRO and their significance.

(06 Lectures)

Use of CRO for the measurement of voltage (dc and ac frequency, time period. Special features of dual trace, introduction to digital oscilloscope, probes. Digital storage Oscilloscope: Block diagram and principle of working. **(03 Lectures)**

Signal Generators and Analysis Instruments: Block diagram, explanation and specifications of low frequency signal generators. pulse generator, and function generator. Brief idea for testing, specifications. Distortion factor meter, wave analysis. **(04 Lectures)**

Impedance Bridges & Q-Meters: Block diagram of bridge. working principles of basic (balancing type) RLC bridge. Specifications of RLC bridge. Block diagram & working principles of a Q-Meter. Digital LCR bridges. **(03 Lectures)**

Digital Instruments: Principle and working of digital meters. Comparison of analog & digital instruments. Characteristics of a digital meter. Working principles of digital voltmeter.

(03 Lectures)

Digital Multimeter: Block diagram and working of a digital multimeter. Working principle of time interval, frequency and period measurement using universal counter/frequency counter, time- base stability, accuracy and resolution. **(03 Lectures)**

The test of lab skills will be of the following test items:

1. Use of an oscilloscope.
2. CRO as a versatile measuring device.
3. Circuit tracing of Laboratory electronic equipment,
4. Use of Digital multimeter/VTVM for measuring voltages
5. Circuit tracing of Laboratory electronic equipment,
6. Winding a coil / transformer.
7. Study the layout of receiver circuit.
8. Trouble shooting a circuit
9. Balancing of bridges

Laboratory Exercises:

1. To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance.
2. To observe the limitations of a multimeter for measuring high frequency voltage and currents.
3. To measure Q of a coil and its dependence on frequency, using a Q- meter.
4. Measurement of voltage, frequency, time period and phase angle using CRO.
5. Measurement of time period, frequency, average period using universal counter/frequency counter.
6. Measurement of rise, fall and delay times using a CRO.
7. Measurement of distortion of a RF signal generator using distortion factor meter.
8. Measurement of R, L and C using a LCR bridge/ universal bridge.

Open Ended Experiments:

1. Using a Dual Trace Oscilloscope
2. Converting the range of a given measuring instrument (voltmeter, ammeter)

Reference Books:

- A text book in Electrical Technology - B L Theraja - S Chand and Co.
- Performance and design of AC machines - M G Say ELBS Edn.
- Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
- Logic circuit design, Shimon P. Vingron, 2012, Springer.
- Digital Electronics, SubrataGhoshal, 2012, Cengage Learning.
- Electronic Devices and circuits, S. Salivahanan& N. S.Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill
- Electronic circuits: Handbook of design and applications, U.Tietze, Ch.Schenk, 2008, SpringerElectronic Devices, 7/e Thomas L. Floyd, 2008, Pearson India

SEMESTER V

Course code: DME30201/ DME30202/ DME30203/ DME30204
Credits: Theory – 02 **Theories: 30 Lectures**

COURSE OUTCOME:

After the completion of the course, Students will be able to

CO1.Specify the details of sources and detector

CO2.Deliberate the classification and characteristics of experiments on lasers

CO3.Specify the details of experiments on semiconductor sources

CO4.Write down in details with examples Fourier optics

CO5.Specify the classification and characteristics of photonic and holography

CO6.Specify the characteristics of photonic

APPLIED OPTICS: SEC 1I

(i) Sources and Detectors **(09 Lectures)**

Lasers, Spontaneous and stimulated emissions, Theory of laser action, Einstein's coefficients, Light amplification, Characterization of laser beam, He-Ne laser, Semiconductor lasers.

Experiments on Lasers:

a. Determination of the grating radial spacing of the Compact Disc (CD) by reflection using He-Ne or solid state laser.

b. To find the width of the wire or width of the slit using diffraction pattern Obtained by a He-Ne or solid state laser.

c. To find the polarization angle of laser light using polarizer and analyzer

d. Thermal expansion of quartz using laser

Experiments on Semiconductor Sources and Detectors:

a. V-I characteristics of LED

b. Study the characteristics of solid state laser

c. Study the characteristics of LDR

d. Photovoltaic Cell

e. Characteristics of IR sensor

(ii) Fourier Optics **(06 Lectures)**

Concept of Spatial frequency filtering, Fourier transforming property of a thin lens

Experiments on Fourier Optics:

a. Fourier optic and image processing

1. Optical image addition/subtraction
2. Optical image differentiation
3. Fourier optical filtering
4. Construction of an optical 4f system

b. Fourier Transform Spectroscopy

Fourier Transform Spectroscopy (FTS) is a powerful method for measuring emission and absorption spectra, with wide application in atmospheric remote sensing, NMR spectrometry and forensic science.

Experiment:

To study the interference pattern from a Michelson interferometer as a function of mirror separation in the interferometer. The resulting interferogram is the Fourier transform of the power spectrum of the source. Analysis of experimental interferograms allows one to determine the transmission characteristics of several interference filters. Computer simulation can also be done.

(iii) Holography **(06 Lectures)**

Basic principle and theory: coherence, resolution, Types of holograms, white light reflection hologram, application of holography in microscopy, interferometry, and character recognition

Experiments on Holography and interferometry:

1. Recording and reconstructing holograms
2. Constructing a Michelson interferometer or a Fabry Perot interferometer

3. Measuring the refractive index of air
4. Constructing a Sagnac interferometer
5. Constructing a Mach-Zehnder interferometer
6. White light Hologram

(iv) Photonics: Fibre Optics (09 Lectures)

Optical fibers and their properties, Principal of light propagation through a fibre, The numerical aperture, Attenuation in optical fibre and attenuation limit, Single mode and multimode fibres, Fibre optic sensors: Fibre Bragg Grating

Experiments on Photonics: Fibre Optics

a. To measure the numerical aperture of an optical fibre
b. To study the variation of the bending loss in a multimode fibre
c. To determine the mode field diameter (MFD) of fundamental mode in a
Single-mode fibre by measurements of its far field Gaussian pattern
d. To measure the near field intensity profile of a fibre and study its refractive
Index profile
e. To determine the power loss at a splice between two multimode fibre

Reference Books:

- Fundamental of optics, F. A. Jenkins & H. E. White, 1981, Tata McGraw hill.
- LASERS: Fundamentals & applications, K.Thyagrajan & A.K.Ghatak, 2010,Tata McGraw Hill
- Fibre optics through experiments, M.R.Shenoy, S.K.Khijwania, et.al. 2009, Viva Books
- Nonlinear Optics, Robert W. Boyd, (Chapter-I), 2008, Elsevier.
- Optics, Karl Dieter Moller, Learning by computing with model examples, 2007, Springer.
- Optical Systems and Processes, Joseph Shamir, 2009, PHI Learning Pvt. Ltd.
- Optoelectronic Devices and Systems, S.C. Gupta, 2005, PHI Learning Pvt. Ltd.
- Optical Physics, A.Lipson, S.G.Lipson, H.Lipson, 4th Edn., 1996, Cambridge Univ. Press

The marks distribution for the final practical examination is as follows:

Formula/Formulae with explanation of symbols	**04 marks**
Diagram/Circuit diagram and tabular column	**08 marks**
Experimental setup+ taking readings	**08 marks**
Graph and Calculations	**05 marks**
Final result and units	**05 marks**
Record	**05 marks**
Total for the practical examination	**35 marks**

Question Paper Pattern for DSC and DSE theory papers of 04 credits

From the academic year 2017-2018 onwards

Time: 3 hours **Max. Marks: 70**

Part A:

I. Answer all the questions (Multiple choice questions) **1 x 4 = 4 marks**

(One question should be selected from 15 lectures)

Part B:

II. Answer any seven questions. **2 x 7 =14 marks**

Ten questions should be set

(At least two questions should be selected from 15 lectures)

Part C:

III. Answer any four questions. **4 x 10 = 40 marks**

Six questions should be set

(At least one question should be set out of fifteen lectures)

Part D:

IV. Answer any three out of four questions **4 x 3 = 12 marks**

(One problem should be selected from 15 lecturers)

Question Paper Pattern for SEC theory paper of 02 credits

Time: 2 hours **Max. Marks: 35**

Part A:

I. Answer any Five Questions out of eight. **1 x 5 = 05 marks**

(Six questions from15 lectures.)

Part B:

II. Answer any Three Questions out of five. **10 x 03 = 30marks**

(Five questions from 30 lectures)

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE
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B N ROAD, MYSURU- 570 025

NEP-UG Syllabus
For B.A Programmes

- **History, Political Science (HP)**
- Journalisum,Political science**(JP)**

2021-22
2022-23 onwards

DEPARTMENT OF POLITICAL SCIENCE

NEP Syllabus for BA-HP& JP2021-2022
(I sem-II sem)

Sem	Course No C1/C2	combination	Course Code	Title of the course	Course Type	Credit Pattern L:T:P	Total Credit	Teaching hrs/week	Evaluation Pattern			
									C1	C2	C3	Total Marks
I/II					DSC/AECC/SEC							
I	C1	HP	FHA47032	Basic concepts of Political science	DSC1	3:0:0	3	3	20	20	60	100
I	C1	JP	FHA47035	Basic concepts of Political science	DSC1	3:0:0	3	3	20	20	60	100
I	C2	HP	FHA48032	Political theory	DSC2	3:0:0	3	3	20	20	60	100
I	C2	JP	FHA48035	Political theory	DSC2	3:0:0	3	3	20	20	60	100
I			FHA860	Human Rights	OE1	3:0:0	3	3	20	20	60	100
			FHA870	Administration in India								
II	C1	HP	FHB47032	Western Political Thought	DSC3	3:0:0	3	3	20	20	60	100
II	C1	JP	FHB47035	Western Political Thought	DSC3	3:0:0	3	3	20	20	60	100
II	C2	HP	FHB48032	Indian National Movement and Constitutional Development	DSC4	3:0:0	3	3	20	20	60	100
II	C2	JP	FHB48035	Indian National Movement and Constitutional Development	DSC4	3:0:0	3	3	20	20	60	100
II			FHB860	India Polity: Issues and Concerns	OE2	3:0:0	3	3	20	20	60	100
			FHB 870	International Relations								

Proposed Structure for Political Science Discipline

Semester I				
Course	**Paper**	**Credits**	**No. of Teaching Hours/Week (L+T+P)**	**Total Marks/ Assessment**
DSC-1	**Basic Concepts in Political Science**	**3**	**3+1+0=4**	**100 (60+40)**
DSC-2	**Political Theory**	**3**	**3+1+0=4**	**100 (60+40)**
OE	**1. Human Rights**	**3**	**3+1+0=4**	**100 (60+40)**
	2. Administration in India	**3**	**3+1+0=4**	**100 (60+40)**
Semester II				
DSC-3	**Western Political Thought**	**3**	**3+1+0=4**	**100 (60+40)**
DSC-4	**Indian National Movement and Constitutional Development**	**3**	**3+1+0=4**	**100 (60+40)**
OE	**1. Indian Polity: Issues and Concerns**	**3**	**3+1+0=4**	**100 (60+40)**
	2.International Relations	**3**	**3+1+0=4**	**100 (60+40)**

Structure for Political Science Discipline

Semester III				
Course	**Paper**	**Credits**	**No. of Teaching Hours/Week**	**Total Marks/ Assessment**
DSC-5	**Indian Government and Politics**	**3**	**3**	**100 (60+40)**
DSC-6	**Parliamentary Procedures in India**	**3**	**3**	**100 (60+40)**
OE-3	**3.1 Gender and Politics**	**3**	**3**	**100 (60+40)**
	3.2 Understanding Gandhi	**3**	**3**	**100 (60+40)**
	3.3 Citizen, Citizenship and the Indian Constitution	**3**	**3**	**100 (60+40)**
Semester IV				
DSC-7	**Ancient Indian Political Ideas and Institutions**	**3**	**3**	**100 (60+40)**
DSC-8	**Modern Political Analysis**	**3**	**3**	**100 (60+40)**
OE-4	**4.1 Good Governance in India**	**3**	**3**	**100 (60+40)**
	4.2 Understanding Dr.B. R. Ambedkar	**3**	**3**	**100 (60+40)**
	4.3 Political Journalism	**3**	**3**	**100 (60+40)**
Ability Enhancement Compulsory Courses (AECC)	**Constitution of India**	**2**	**2**	**50(30+20)**

Political Science Model Curriculum (III & IV Semester)

Name of the Degree Program: BA/BSc/BCom/BBA/BCA… Without Practical Course

Discipline Core: Political Science

Total Credits for the Program:

Starting year of implementation: 2021-22

Program Outcomes:

By the end of the program the students will be able to:

- Not only upgrade the learning of Political Science as a contemporary discipline but also to inculcate the Indian political ethos and the moral standards of functioning of political institutions in India. These in fact, brought laurels to our acumen in politics and Kautilya's Arthashatra stands as a proof of this.
- Understand voluminously about the dimensions of Indian Government, its Parliamentary Procedures, the concerns of Gender in Politics, Gandhian Philosophy andanunderstandingofthecitizensdutiesandresponsibilitiesinthe3rdsemester.
- Understand the papers such as Ancient Indian Political Ideas and Institutions throws light on the wisdom of Indian Political Thought bringing along its side the Modern Political Analysis which is skill based paper.
- Understand the papers which are hy bridised like Political Journalism and focused papers like Good Governance and Understanding Dr.B.R.Ambedkar which will bring to the fore facts and normative ways of running governments.

  Thus, these semesters represent both knowledge and skill components and making it contemporary in its content. Learning among the students will thus makeit interesting and lively.

Assessment:

Weightage for assessments (in percentage)

Type of Course	Formative Assessment / IA	Summative Assessment
Theory	**40**	**(60+40) =100**
Practical	**-**	**-**
Projects	**-**	**-**
Experiential Learning (Internships etc.)	**-**	**-**
AECC	**20**	**(30+20)=50**

Formative Assessment		
Assessment Occasion/ type		**Weightage in Marks**
C-1	**Assessment Test-1**	10
	Seminar/Presentation/Group Discussion /Assignment/ Quiz	10
C-2	**Assessment Test-2**	10
	Assignment/ Book reviews / Reports on field visits / Seminars	10
Total		**40**

SEMESTER -I

BASIC CONCEPTS IN POLITICAL SCIENCE

DSC-1

Course Title: **BASIC CONCEPTS IN POLITICAL SCIENCE**	
Total Contact Hours: **45**	Course Credits: **3**
No. of Teaching Hours/Week: **3+1=4(L+T)**	Duration of ESA/Exam: **3Hours**
Formative Assessment Marks: **40**	Summative Assessment Marks: **60+40=100**

Course Objective:

Develop an understanding about the nature and philosophy of Political Science and its interface with society. Enable the students to develop qualities of responsible and active citizens in a democracy.

Learning Outcome:

At the end of the course the students shall understand -

- Political Science, theoretically and will gain knowledge to explain and analyze politics at large.
- The dynamics of politics.
- To inculcate the democratic spirit

Unit	**Contents of Course- 1**	**45 Hours**
Unit-I	**Chapter -1** Meaning, Nature, Scope and Importance of Political Science, Approaches – Philosophical, Historical, Observational, Comparative and Experimental. Emergence of Political Science as a Discipline. **Chapter- 2** Meaning and Elements of State, Difference between State and Government, State and Society, State and Association, Theories on Origin of State- Historical Theory, Divine Rights Theory, Social Contract Theory, Marxist and Gandhian Theory of State **Chapter-3** Civil Society- Meaning and Importance**.**	**15 Hours**
Unit-II	**Chapter-4** Meaning, Characteristics, and Kinds of Sovereignty.	**15 Hours**
	Chapter-5: Austin's Concept of Sovereignty and Pluralistic Critique, Pluralistic Theory of Sovereignty, Challenges to the State Sovereignty in the age of Globalization. **Chapter-6,** Law meaning, Sources, Relations between Law and Liberty , law and Justice.	

Unit- III	**Chapter-7** Liberty: Meaning and Kinds; Positive andNegative **Chapter-8** Equality: Meaning and Kinds (Social, Economicand Political) **Chapter-9** Power and Justice: Meaning and kinds, Political Obligation: Nature AND Importance, Grounds of Political Obligation.	**15 Hours**

Exercise:

1.List out the modern elements of State
2.List out the countries and identify the issues related to equality
3.Identify an issue and discuss the role of civil society

Suggested Readings:

1. Political Theory: Ideas & Concepts, S. Ramswamy, Delhi,Macmillan, 2002.
2. Modern Political Theory, S. P. Verma, New Delhi, Vikas, 1983.
3. Principles of Modern, Political Science, JC Johri, Sterling Publishers Pvt. Ltd. 1995.
4. Principles of Political Science, AC Kapur, New Delhi, Sultan Chand and Sons, 2004.
5. Principles of Political Science, N.N Agarwal, Vidya Bhushan, Vishnoo Bhawan, R. Chand & Co, New Delhi, 1998.
6. Political Science Theory, S.C Pant, Prakashan Kendra, Lucknow, 1998.
7. Political Science Theory, S. N Dubey, Lakshmi Narain Agarwal, Agra, 2002.
8. Principle of Modern Political Science, J C Johari, Sterling Publications, New York, 2009.
9. Principles of Political Science, Anup Chand Kapur, S Chand & Co Ltd, 2010.

Pedagogy:

The course shall be taught through the Bridge Courses, Lecture, Tutorial, Interactive Sessions, Self-guided Learning Materials, Open Educational Recourses (OER) as reference materials, Practical Exercises, Assignments, Seminars, Group Discussions and Week-end Counseling Classes.

Formative Assessment		
Assessment Occasion/ type		**Weightage in Marks**
C-1	**Assessment Test-1**	10
	Seminar/Presentation/Group Discussion /Assignment/ Quiz	10
C-2	**Assessment Test-2**	10
	Assignment/ Book reviews / Reports on field visits / Seminars	10
Total		**40**

POLITICAL THEORY

DSC-2

Course Title: **POLITICAL THEORY**	
Total Contact Hours: **45**	Course Credits: **3**

Course Outcome:

This course aims to introduce certain key aspects of conceptual analysis in political theory and the skills required to engage in debates surrounding the application of the concepts.

Learning Outcomes:

At the end of the course the students shall understand -

- The nature and relevance of Political Theory.
- The different concepts like Liberty, Equality, Justice and Rights.
- To reflect upon some of the important debates in Political Theory.

Unit	Contents of Course- 2	45 Hours
Unit-I	**Chapter-1** Meaning, Nature and Importance of Political Theory, **Chapter-2** Modern Approaches- Behavioral, Post-Behavioral, David Easton's Political System and Marxian Approach **Chapter-3** Relevance of Political Theory, Decline and Resurgence of Political Theory	**15 Hours**
Unit-II	**Chapter-4** Liberalism: J.S Mill **Chapter-5** Neo- Liberalism: John Rawls **Chapter-6** Libertarianism: Robert Nozick	**15 Hours**
Unit- III	**Chapter-7** Communitarianism and Multiculturalism: Indian perspective, Colonial Discourse and Post Colonialism, Post Colonial Response and its Limitations **Chapter-8** Proponents of Secularism – Nehru, Gandhi, Moulana Azad. **Chapter-9-** Dmocracy and Liberalism- Dr.B.R.Ambedker, Lohia, Jaya Prakash Narayan**.** .	**15 Hours**

Exercise:

- Write about the Myth and Reality on Communitarianism in India
- Compare the concept of Liberty, Equality and Justice to the Modern world
- Write the understanding of secularism in India

Suggested Readings:

1. Ahmed. V, Theory: Classes, Nations Literatures.: Verso, London, 1992.
2. Arendt. H., On Revolution, Viking, New York, 1963
3. Ahmed. V, Theory: Classes, Nations Literatures.: Verso, London, 1992.

HUMAN RIGHTS

Open Elective OE-1

Course Title: **HUMAN RIGHTS**	
Total Contact Hours: **45**	Course Credits: **3**

Course Objective:

This course aims to introduce the students to basic concepts and practices of Human Rights in the global and local domain. This course also exposes them to certain recent issues confronting the Human Rights debates.

Learning Outcomes:

After completing this course students will be able to-

- Explain the basic concept of Human Rights and its various formulations.
- Have necessary knowledge and skills for analyzing, interpreting, and applying the Human Rights standards and sensitize them to the issues.
- Develop ability to critically analyse Human Rights situations around them.

Unit	Contents of Course- OE-1	45Hours
Unit-I	**Chapter-1** Meaning, nature, scope and Classification of Human Rights **Chapter-2** The Human Rights of First generation (Civil and Political Rights), Second generation (Economic, Social andCultural Rights), Third generation (Collective Rights) and Fourth generation (Subjective Rights) **Chapter-3** Universal Declaration of Human Rights, RTI as Human Right.	**15Hours**
Unit-II	**Chapter-4** Human Rights and Fundamental Rights, Fundamental Rights and Fundamental Duties in India **Chapter- 5** National Human Rights Commission (NHRC) - Composition and its function **Chapter-6** Karnataka State Human Rights Commissions (KSHRCs) – Composition and its functions	**15Hours**
Unit-III	**Chapter -7** National Commission for SCs/STs, Minorities' Commission, Women' Commission **Chapter-8** Major issues and concerns of Human Rights- Discrimination and violence against women, children, Dalits and Minorities, Child Labour and Bonded Labour **Chapter-9** Challenges to Human Rights	**15Hours**

Suggested Readings:

1. Baxi Upendra (ed.), The Right to be Human, Lancer International, Crawford, New Delhi, 1987.
2. James(ed.), The Rights of People, Oxford, New York, 1988.
3. Craston, M. What are Human Rights, Bodely Head, London, 1973
4. Rhond L.Callaway&JulieHarrelson- Stephen,"InternationalHuman Rights

ADMINISTRATION IN INDIA

Open Elective OE-2

Course Title: **ADMINISTRATION IN INDIA**	
Total Contact Hours: **45**	Course Credits: **3**

Course Objective:

This course aims to introduce the students to basic aspects of Administration in India. This course also exposes them to the working of Administrative system in India.

Learning Outcomes:

After completing this course students will be able to-

- Acquire General Knowledge required to competitive Examinations
- To Have necessary knowledge and skills, Competency required for understanding Conceptual and Practical dimensions of Administrative process in India.

Unit	Contents of Course- OE-2	45 Hours
Unit-I	**Chapter-1** Meaning, Feature and Functions of Civil Service. **Chapter-2** Growth of Civil service in India, kinds of Civilservices in India and Concept of Lateral Entry into Civil Services. **Chapter-3 UPSC,** Staff Selection Commission, DPAR – Composition, Powers and Function.	**15 Hours**
Unit-II	**Chapter-4** Central Administration, PMO, Central Secretariat, Cabinet Secretary- role, Powers and Function. Chapter- 5 Ministry of Personnel and Personal Grievances**,** Ministry of Home affairs, Ministry of Defense, Ministry of Finance, powers and function **Chapter-6** State Administration – State secretariat and Chief Secretary. Role, Power and Function.	**15 Hours**
Unit-III	**Chapter -7** Deputy commissioner, role Powers and Functions, administrative Organization below the District level. **Chapter-8** Controlover the Administration-Legislative, Executive, Judicial and Popular **Chapter-9** Good Governance and E-Governance - Meaning, features and Importance, Bhoomi, Panchatantra , sakala, Khajane.	**15 Hours**

Exercise:

- Seminar and Group Discussion on Administration and Its kinds.
- Students can be asked to go for field visit to know the working of Local Bodies andE-Governance Initiative.

Suggested Readings:

1. Central Administration – A. Avasthi
2. Indian Administration – S.R.Maheswari

SEMESTER -II

WESTERN POLITICAL THOUGHT
DSC-3

Course Title: **WESTERN POLITICAL THOUGHT**	
Total Contact Hours: **45**	Course Credits: **3**

Course Objective: The Syllabus is designed to understand Political Philosophy, traditions that evolved in Europe from Ancient to the beginning of modern era. To examine the contributions of the Greek, Medieval and early Modern thinker's Philosophical thought.

Learning Outcomes:

At the end of the course the students shall understand -

- And get an introduction to the Schools of Political Thought and Theory making in theWest.
- And introduce the richness and variations in the political perceptions of WesternThinkers.
- And familiarize themselves to the Thought and Theory of Western Philosophy.

Unit	Contents of Course-3	45 Hours
Unit-I	**Chapter -1** Salient Features of the Greek Political Thought, **Plato:** Theory of Justice, Philosopher King, **Aristotle:** State and Its Classification, Theory of Revolution **Chapter -2** Salient Features of Medieval - Political Thought, Christian Tradition, **St. Thomas Aquinas:** Church v/s State, St**. Augustine:** Theory of Two Swords **Chapter -3**, **Machiavelli:** On Politics and State Craft, Views on ends and means	**15 Hours**
Unit-II	**Chapter -1 Hobbes**: Theory of Sovereignty, **Locke**: Social Contract and Theory of Government, Tolerance; **Rousseau**: Social Contract, General Will **Chapter -2 Bentham: Theory of Utilitarianism** **Chapter -3 J.S. Mill: Views on Liberty**	**15 Hours**
Unit- III	**Chapter -1 .** Karl Marx – Historical Materialism,Class Struggle, Surples theory AndRevolution. Classless and stateless society **Chapter -2** Jurgen Habermas- Communicative action, Public Sphere, Theory of truth and knowledge **Chapter -3** Noam Chomsky- Responsibility ofIntellectuals, Manufacturing consent.	**15 Hours**

Exercise:

- Compare Greek State with the Roman state and make points
- Imagine the present situation with that of Contractualist's Social Contract Theory and write the summary
- Can we have a classless society in the modern world? Comment

Suggested Readings:

1. A. Hacker, Political Theory: Philosophy, Ideology, Science New York, Macmillan, 1961.
2. G.H. Sabine. A History of Political Theory. New Delhi: Oxford and IBH, 1937

INDIAN NATIONAL MOVEMENT AND CONSTITUTIONAL DEVELOPMENT

DSC-4

Course Title: **INDIAN NATIONAL MOVEMENT AND CONSTITUTIONAL DEVELOPMENT**	
Total Contact Hours: **45**	Course Credits: **3**

Course Objective:

- To familiarize the students with the ideas of Nationalism and contemplate on how colonial rule was overthrown by the Indian Nationalists.
- To acquaint the students with the problems of Independent India.
- To enable the students to understand the role of India in World affairs and the contributions ofgreat men towards freedom.

Learning Outcome:

At the end of the course the students shall -

- Understand how the colonial rule was overthrown by the Indian nationalists.
- Appreciate the ideals and values of Gandhi that resulted in freedom.
- Examine the problem of Independent India and the role played by great leaders in solvingthem.

Unit	Contents of Course-4	45 Hours
Unit-I	**Chapter-1** Indian National Movement: Features, The Liberal, The Extremist and Revolutionary Phase **Chapter-2** The Gandhian Phase: Non-Cooperation movement,Civil Disobedience Movement and the Quit India **movement.** **Chapter-3** Political Issues during National movement- Swaraj, Reservation, Gandhian Swadeshi Concept.	**15 Hours**
Unit-II	**Chapter-4** Morley-Minto Reform Act of 1909, Montague Chelmsford Act of 1919: main provisions and Dyarchy, Simon Commission, The Nehru Report. **Chapter-5-** Round Table Conferencess, Government of IndiaAct of 1935: main provisions:, provincial Autonomy and federal system **Chapter-6-** Cabinet Mission Plan, Indian Independence Act of 1947: main provisions. Constituent Assembly Debates on	**15 Hours**
Unit-III	**Chapter-7** Citizenship andState Structure **Chapter-8** Minority Rights, Fundamental Rights. **Chapter-9** Language and National Integration. (The above three should be discussed in the context of Constituent Assembly Debates)	**15 Hours**

INDIAN POLITY: ISSUES AND CONCERNS
Open Elective OE-2

Course Title: **INDIAN POLITY AND CONCERNS**	
Total Contact Hours: **45**	Course Credits: **3**

Course Objective: To make the students aware on different issues that exists in Indian polity. Through this paper students need to understand the emerging issues and their causes to theIndian Democracy.

Learning Outcome:

At the end of the course the students shall -

- Understand the reasons behind the causes of these issues and also the constitutional provisions that existed.
- Familiarize with the debates that emerged.
- Be able to suggest the measures to control such issues.

Unit	Contents of Course-OE-2	45 Hours
Unit-I	**Chapter-1 National Integration and Social Harmony** - Meaning and importance of National Integration and Essentialsof National Integration. **Chapter-2 Society and Politics in India**: Caste, Class, Ethnicity and Gender, role and Impact on Indian Polity. **Chapter-3 Language**- Role and Constitutional Provisions,Issues	**15 Hours**
Unit-II	**Chapter-4** Religion and Traditions - Role and Constitutional Provisions **Chapter-5** Development and Inclusiveness: Issues and Concerns **Chapter-6** Regionalism – Reasons for the Growth, Forms and Measures	**15 Hours**
Unit-III	**Chapter-7** Corruptions- Causes and Measures **Chapter-8** Terrorism- Types, Causes and Measures **Chapter-9** Celebrating Diversity – Consensus and Challenges	**15 Hours**

Suggested Readings:

1. M. Galanter, 'The Long Half-Life of Reservations', in Z. Hasan, E. Sridharan and R. Sudarshan (eds.) India's Living Constitution: Ideas, Practices, Controversies, New Delhi: Permanent Black, 2002.

International Relations

Open Elective OE- 2

Course Title: **International Relations**	
Total Contact Hours: **45**	Course Credits: **3**

Course Objective:

This course aims to introduce the students to basic concepts , Institutions and Issues of Global Politics. This course also exposes them to the Understanding OF Power Politics of Regional and Global level.

Learning Outcomes:

After completing this course students will be able to-

- Understand and reflect on basic concepts ,Institutions and Issues of International Relations Global Politics
- Develop and deepen the sense of Cosmopolitanism.
- To acquire General knowledge for Competitive exam

Unit	Contents of Course- OE-4	45 Hours
Unit-I	**Chapter-1** Meaning, Nature, scope and Importance of International Relations. **Chapter-2** Key Concepts- National Power, National interest, National Security, Diplomacy, Balance of Power, Collective security, Deterrence. **Chapter-3** India and her Neighbors- Pakistan and China.	**15 Hours**
Unit-II	**Chapter-4** World Organizations- UN, Principles and Objectives, Major Organs, Working of UN, Achievements and Failures. **Chapter- 5** UNESCO, WHO, ILO, WB. Chapter-6Regionalism in World Politics- Meaning and Importance- SAARC,ASEAN,EU, OPEC, SHANGHAI COOPERATION Organization , BRICS,	**15 Hours**
Unit-III	**Chapter -7** Global Issues- Poverty, Development, Environment **Chapter-8** Military alliances- NATO,SEATO,NSG,QUAD (India, America ,Japan, Australia), **Chapter-9** Pacific settlement of International Disputes.	**15 Hours**

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Suggested Readings:

1. Palmer and Perkins-International Relations.
2. H.J Morgenthau, Politica among Nations.
3. Mahendra Kumar, Theoretical Aspects of International Relations.
4. Prakash Chandra, International politics.

SEMESTER -III

DSC-5

INDIAN GOVERNMENT AND POLITICS

Course Objective:

The course will explain the functioning of the Indian government and the performance of both the union and the state governments. It discusses the philosophy of our constitution and the commitment of the Indian state to its citizenry. It will help the students to develop interest in politics and grasp the dynamics/nuances of the politics, dynamics of leadership and the role of socio-economic, religious and lingual issues.

Learning Outcome:

At the end of the course the students shall -

- Learn how the governments both at the union as well state level operates and what are its challenges.
- Understand the characteristics of power structures in India and the response of the political parties to the socio-political dynamics.
- Measure and understand the effects of judicial decisions on policy making and social development in India.

Unit	Contents of Course-5	45 Hours
Unit-I	**Chapter-1**: Indian Politics: Approaches to study of State and politics in India (Liberal, Marxist and Gandhian). **Chapter-2:** Constituent Assembly- Composition and Major Debates regarding the Structure of Indian State. **Chapter-3:** Preamble and Salient Features of Indian Constitution.	**15 Hours**
Unit-II	**Chapter-4:** The Union Executive: The President, Vice- President, Prime Minister and the Council of Ministers**.** **Chapter-5:**Parliament: Powers and Functions of Lok Sabha and Rajya Sabha, Relationship between the two Chambers, Amendment Process and Major Amendments (42nd, 73rd, 74th , 86th , 101st). **Chapter-6:** Judiciary and Judicial Review, Appellate Authority.	**15 Hours**
Unit-III	**Chapter-7:** Nature of Indian Political System, Union-State Relations (Commissions and Committees), President's Rule: Processes and politics. **Chapter-8:** Political parties and party system in India Coalition Politics and Elections in Indian Politics. **Chapter-9:** Issues in Indian Democracy: Casteism, Communalism, Regionalism, Criminalization, Social and Distributive Justice.	**15 Hours**

Exercise:

- Debate on the 'basic structure of Indian Constitution' and the need for changes in the constitution,functioningoftheConstitution-CasesregardtoGovernorandPresident'sRule.
- List out the major amendments to the constitution, Commission and committee to review power sharing.
- Examine the functioning of various political parties,its inclusive approaches,influenceof dynasties on their performance.

Suggested Readings

1. Iqbal Narain, State Politics in India, Meenakshi Prakashan, New Delhi,1967.
2. Rajani Kothari, Politics in India, Orient Longman,1970.
3. D.Basu,AnIntroductiontotheConstitutionofIndia,NewDelhi, PrenticeHall,1980.
4. GranvilleAustin,TheIndianConstitution:CornerStoneofaNation,OxfordUniversity Press, India,1966.
5. C.P.Bhambhari,TheIndian State,FiftyYears,NewDelhi,Shipra,1997.

V. Pylee, Constitutional Government in India, Bombay, Asia Publishing House,1977

6. J. C.Johri, Indian Government and Politics, Vol. 1, Shoban Lal and Company, India, 2012.
7. Weiner, Party Politics in India, Princeton University Press,1957.
8. A. G. Noorani, Constitutional Questions in India: The President, Parliament and the States, Delhi, Oxford University Press,2000.
9. A.S.Narang,IndianGovernmentandPolitics,GeetanjaliPublishingHouse,NewDelhi, 1996.
10. Bidyut Chakrabarty & Rajendra Kumar Pandey, Indian Government and Politics, SAGE, New Delhi,2008
11. D.D.Basu,AnIntroductiontotheConstitutionofIndia,25th Edition,LexisNexis,India,
12. M.P. Singh & Rekha Saxena, Indian Politics: Contemporary issues and Concerns, Prentice Hall of India, Delhi,2008.
13. M. V.Pylee,AnIntroductiontotheConstitutionofIndia,NewDelhi, Vikas,1998.

NirjaGopalJayal&PratapBhanu Mehta,TheOxfordCompaniontoPoliticsinIndia

DSC-6

PARLIAMENTARY PROCEDURES IN INDIA

Course Objective:

The course attempts to make the students familiar with legislative practices in India with anorientation to equip them with the adequate skills of participation in deliberative processes and democratic decision making. This aims at providing the basic understanding of the constitutional provisions relating to parliamentary procedures and the accessories of the same. This will help the students to understand the working of democracy through an institutional mechanism.

Learning Outcome:

At the end of the course the students shall -

- Aim at understanding the procedural aspects of parliamentary system of governments.
- Learn about the privileges of people's representatives and match it with their performance.
- Understandtheworkingofcommittees,budgetaryas pectsanddeliberativemechanism within the parliament.

Unit	Contents of Course-6	45 Hours
Unit-I	**Chapter-1:** Elections to the Legislatures: Parliament and State Legislatures. **Chapter-2**: Powers, Functions of People's Representatives - Members of Parliament and State Legislature. **Chapter-3:** Legislative Procedures of the Parliament: Articles 107-122.	
Unit-II	Chapter-4: Kinds of Bills: Ordinary Bills, Money Bills,Finance Bills, Private Member Bills. Chapter-5: Drafting of the Bill, First Reading and Departmental Standing Committee, Second Reading, Third Reading, Passage of the Bill, Consentby the President,Gazette Notifications. Chapter-6: Parliamentary Committees: Composition and Functioning (Departmental Standing Committees, Select Committees, Joint Parliamentary Committees, Public Accounts Committee on Privilege Business, Advisory Committee, Ethics Committee).	15 Hours
Unit-III	Chapter-7: Motions and Hours in the House : Question Hour, Zero Hour, Half an Hour Discussion, Calling Attention Motion, Adjournment Motion, Privilege motion, Censure motion, 'No-confidence' motion, Cut motion. Chapter-8: Parliamentary Questions: Types, Starred and Un starred Questions, Questions Addressed to Private Members and Short Notice Questions. Chapter-9: Parliamentary Privileges: Constitutional Provisions, Codification of Privileges, Privileges of Parliamentarians and Legislators, Breach of Privilege**.**	15 Hours

Exercise:

- The college can organise mock parliaments and teach students the etiquettes of parliamentary behaviour.
- Canorganisedebatesonthecodificationofprivilegesandmatchitwiththeperformance of people'srepresentatives.
- Can organise special lectures by inviting officers/bureaucrats to deliberate on the procedural aspects of democracy.

Suggested Readings

1. M.N.KaulandS.L.Shakdher,PracticeandProcedureofParliament,Metropolitan,New Delhi,1968.
2. SubhashC.Kashyap,OurParliament,NationalBookTrust,NewDelhi,2021.
7. SH.Belavadi,TheoryandPracticeofParliamentaryProcedureinIndia,1988.
8. Dr. K. S. Chauhan, Parliament Powers Functions And Privileges, LexisNexis, India, 2013.
9. Ajit Ranjan Mukharjea, Parliamentary Procedure in India, Oxford University Press, 1958.
10. M N. Kaul, Parliamentary Institutions and Procedures, National Publishing House, 1978.
11. Jalan, India's Politics, Penguin, New Delhi,2007.
12. Abbas, H., Kumar, R. & Alam M. A., Indian Government and Politics, Pearson, New Delhi,2011.
13. Chakravarty, B. & Pandey, K. P, Indian Government and Politics, Sage, New Delhi, 2006.
14. K.Sanyal,StrengtheningParliamentaryCommittees,PRS,CentreforPolicy Research, New Delhi,2011.

GENDER AND POLITICS

Open Elective- OE- 3.1

Course Objective:

The course provides an overview of political participation of women in general and specifically in India. It enables students to understand the issues related to women leadership, participation and governance and how they have progressively become integrated into political science to inform and shape contemporary social sciences. It helps in sensitizing the patriarchal society to improve the relationship between men and women removing the obstacles of exploitation, violation of her rights, bringing into focus the need for the education and empowerment.

Learning Outcomes:

At the end of the course the students shall -

- Answer how ideologies have shaped the women in politics
- Bring awareness of the relevance of gender issues in politics.
- Through discussions on women and governance understand the ground realities about politics in relation to women.

Unit	Contents of Course-OE-3.1	45 Hours
Unit-I	**Chapter-1:** Defining Gender, Significance of Gender Studies, Difference between Gender Studies and Women Studies, Feminist Perspectives **Chapter-2:** Gender Imbalance in Political Representation and Electoral Process, Gender Discrimination in Indian Politics – including LGBTQ, Feminist Critique of Politics. **Chapter-3:** Governance and Gender Structures, Gender Budgeting and Gender Issues in Governance.	**15 Hours**
Unit-II	Chapter-4: Gender and Empowerment Process: Education, Economic, Political and Socializing and sensitizing gender issues. Chapter-5: Gender Differentiation in Political Parties and Leadership, Challenging Gender Stereotypes in Socio-Political sphere. Chapter-6: Capacity Building and Role of Women in Karnataka Politics, Women Representation in Local Governments.	15 Hours
Unit-III	**Chapter-7:** Women and Poverty, Women and Health, Women and wealth creation, Violence against Women, Chapter-8: Women and Literature, Women and the Media, Women and the Environment. Chapter-9: Women and Societal Challenges: Dowry, Domestic Violence, Girl Child - Programmes for Empowerment of Women, Educating **children and socio-religious taboos including patriarchy.**	**15 Hours**

Exercise:

- Conduct one day workshop and make an assessment of role of women inpolitics.
- Collage making, short films and video watching can be done by the students and measures can be discussed to minimise the gendergap.
- Students can make field visits to understand the persistent of patriarchal values and traditions.

Suggested Readings

1. P.K.SwaibandS.N.Tripathy,"UnequalTreatmenttoWomenandGender",Bias,Sonali Publications, New Delhi,2006.
2. Malashrilal, Chandra Mohan, Enakshi K.Sharma, Devika Khanna Narula and Amrit Kaur Basra, "Gender and Diversity", Rawat Publications, Jaipur,2015.
3. Andrew Heywood, "Global Politics", Palgrave Macmillan Publication, New York, 2014.
4. Kranti Rana, "Modern Working Women and the Development Debate", Kanishka Publishers, New Delhi, 1998.
5. Dr.Tanuja Trivedi, "Encyclopedia of Women's Empowerment", Janapada Prakashan, New Delhi,2012.
6. Bhaswati Das and VimalKhawas, "Gender Issues in Development –Concerns for the 21st century", Rawat Publications, New Delhi,2009.
7. U. Kalpagam,"GenderandDevelopmentinIndia:CurrentIssues",RawatPublication, 2011.
8. B.N.Singh,"RuralWomenandEducation,"vistaInternationalPublishingHouse,Delhi, 2016.

9.MeeraKosambi,"WomenwritingGender",PermanentBlockPublication,NewDelhi,

UNDERSTANDING GANDHI
Open Elective – OE- 3.2

Course Objective:

The course objective is to bring to the attention of the younger generation the core elements of Gandhian thought and Gandhi's approach to the key issues of contemporary India. This paper covers a wide range of issues including politics, economics, social reconstruction, religion and issues of sustainable development which provides insight into the idea of what Gandhi propagated as a political thinker. His ideas of Hindu-Muslim relations or critique of modern society, Swadeshi etc., makes Gandhi relevant to the current political discourses.

Learning Outcome:

At the end of the course the students shall -

- Be able to explain the idea of truth and non-violence which is the foundation of Gandhian Philosophy.
- KnowthepositionofGandhionissueslikeHindu-Muslimrelations,genderquestion, cow protection, caste and untouchability questions.
- Answer his reason for his choice of Swadeshi and his critique of modern Civilization

Unit	Contents of Course- OE-3.2	45 Hours
Unit-I	**Chapter-1:** Background Influences: Historical: South Africa, Intellectual: Thoreau, Ruskin and Tolstoy. **Chapter-2:** Gandhian Experiments: Satyagraha, Non-Violence, Truth, Movements led by Gandhi- Champaran, Bardoli, Khilafat, Non-Cooperation, Salt Satayagraha. **Chapter-3:** Social Movements- Ahmedabad Mill Strike, Vaikom Satyagraha, Forest, Health and Naturopathy, Sustainable Development.	**15 Hours**
Unit-II	Chapter-4: Gandhi as a Leader: Gandhi as a model, Gandhian Methodology: Prayer, Consensus Building and Fasting. Chapter-5: Gandhian Views on Politics: Role of Ethics, Morality, Religion and Service. Chapter-6: Gandhi's critique on English Parliament, Gandhi on Nation and Nationalism.	15 Hours
Unit- III	Chapter-7: Gandhion Swadeshi and Swaraj, Critique on Modern Civilization, Modern Education and Machines. Chapter-8: Gandhion Violence (Doctrine of the Sword) Gandhi and Sins, Gandhi's views on Women and Sustainable Development. Chapter-9 Gandhias Political Strategist, Gandhi's Views on Hindu-Muslim Unity, Untouchability .	15 Hours

Exercise:

- Students shall have a group reading of Gandhiji's texts like Hindswarj, My Experiment with truth, Sarvodaya,etc,
- Shall conduct the group discussion on the significance of Satyagraha, Sustainable Development, Swadeshi,etc.
- By reviewing literatureonGandhiancritiquesstudentscandiscussthestrengthsand weakness of Gandhian Philosophy and his relevance in 21stcentury.

Suggested Readings

1. Lal, V, The Gandhi Everyone Loves to Hate, Economic and Political Weekly, 43(40), 2008, pp. 55-64.

CITIZEN, CITIZENSHIP AND THE INDIAN CONSTITUTION

Open Elective OE- 3.3

Course Objective:

This course aims at understanding the concept of citizenship. This course supports to develop an understanding of mindfulness, empathy and compassion and use these as tools to enhance one's emotional wellbeing and social relationships within a society. It further helps nation building by inculcating responsible citizenship among the students.

Learning Outcome:

At the end of the course the students shall -

- Take part in social reconstruction as responsible individuals and will learn to develop own identities.
- Demonstratepro-socialbehaviourtowardsothers,includingthosebelongingtoadifferentrace, ethnicity, culture, colour, gender or nationality.
- Understand and appreciate rights and privacy of other fellow citizens.

Unit	Contents of Course- OE- 3.3	45 Hours
Unit-I	**Chapter-1**:**Concept of Citizen:** Subject- Slave-Citizen: a Comparison. **Chapter-2: Citizenship in India: Milestones-** Citizenship and Partition of India (Nehru and Liyaqat Ali Khan Pact) The Citizenship Act, 1955, The Citizenship (Amendment) Act, 1986, The Citizenship (Amendment) Act, 2003 and 2005, National Register of Citizens (NRC) with reference to North - East **Chapter-3:Citizens and Constitutional Provisions:** Fundamental Rights and Duties, Socio-Economic and Cultural Rights	**15 Hours**
Unit-II	Chapter-4: Citizenship Issues in India: Laws for Immigrants, Laws for Migrants and Asylum seekers, Process of acquiring Citizenship. Chapter-5: Dual Citizenship: Needs and Demands- Impact of Globalization, Advantages of Dual Citizenship. Chapter-6: IPC and Citizens Rights: First Information Report, Arrest, Detention, Bail Provisions, Sedition Act, Citizen and Civic Culture.	15 Hours
Unit-III	Chapter-7: Citizen and His Responsibility: Constitutional Provisions, Right to Privacy. Chapter-8: Citizen and Discrimination: Caste, Gender (LGBTQ), language, Race, Color, Place of Birth. Chapter-9: Protection of Citizens: Women and Property Rights, Rights of Forest Dwellers, and Displaced People (War, Natural Calamities and Rehabilitation) and Universal Declaration of Human Rights.	15 Hours

Exercise:

- Students and teachers collectively work towards building communication network among vulnerable citizens who have no knowledge about their own rights.
- Through activities they may form empowering groups and support immigrants/ migrants

resolve their legal issues with authorities like police and government.

They may visit courts, police stations, regional passport offices and spread the laws relating to migrants, immigrants regarding their rights.

Suggested Readings

1. MarcusRaskin,'NationBuildingandCitizenship:Studiesofour Changingorder' Rutledge India, New Delhi,1996.
2. Atul Kolhi, 'Democracy and Discontent: India's growing crises of Governability, Cambridge University Press,1991.
3. Atul Kolhi, The success of India Democracy, Cambridge University Press,2001.
4. Savitaha Rao, India's Positive Citizen Building- A Great Nation One Action At A Time, Wings Publishing, Bangalore,2020.
5. AnupamaRoy,'MappingCitizenshipinIndia',(OxfordIndia shortintroductions),Oxford University Press, New Delhi,2012.
6. Nirag Gopal Jayal, 'Citizenship and its Discontents', Harvard University Press,2013.
7. Ornit Shani, 'How India become a democratic citizenship and making of the Universal Franchise', Cambridge University Press, New Delhi,2017.
8. Koenig Lion, 'Cultural Citizenship in India; Politics Power and Media', Oxford University Press, New Delhi,2016.
9. Blog.mygov.in/we-the-people-we-the-citizen.
10. Subrata .K. Mitra, 'Citizenship as cultural flow, structure agency and flow', e-Book, 2013, springerlink.

ANCIENT INDIAN POLITICAL IDEAS AND INSTITUTIONS

DSC - 7

Course Objectives:

The paper aims at developing an understanding of the Social and political philosophy of ancient India to assess the modern notions about socio-political arrangements. Further it helps to analyze the process of decolonizing Indian minds related to India's glorious past. The objective thus being to throw light on the indigenous political theory esandtheirrelevancetochangingtimes.

Learning Outcome:

At the end of the course the students shall -

- Reflect on the native concepts like Dharma, Rajadharma, Nyaya, Viveka etc., in the light of their modern connotations.
- Understand the role of texts and stories in the Indian context by reflecting upon our own experiences.
- Revisit our own socio-political structures through the textual and non-textual sources from the early Indian period in order to quell the European representation of Indian Society and heritage.

Unit	Contents of Course- DSC 7	45 Hours
Unit-I	**Chapter-1:Sources ofEarly Indian Thought:** Sources and Limitations: Pre and Post Colonial. **Chapter-2: Perspectives:** Orientalists, Nationalists, Marxian (Asiatic Mode of Production) andGandhiji on Varnashrama Dharma. **Chapter-3**:**Indian Culture**: M a x M u l l e r , S w a m i V i v e k a n a n d a , Dr. Radhakrishan	**15 Hours**
Unit-II	**Chapter-4: Socio-Political Ideas in the Early Indian Thought:** Dharma,Rajadharma, Dandaniti, Nyaya, Vaisheshika, Shunya, Ratnin Ceremony, Varnadharma, and Ashramadharma. **Chapter**-5: **Kingship**: Origin, Nature and Structure. **Chapter-6**: **Functions of Institutions**: Sabha, Samiti, Vidhata, Paura-Janapada.	**15 Hours**
Unit- III	**Chapter-7**: **Ganasanghas:** Nature, Structure, Functions **Chapter-8: Ramayana (Valmiki)**: Ramarajya, **Chapter-9: Mahabharata (Vyasa):** Rajadharma in Shantiparva, Idea of war and Peace –values in Thirukural, Manu Smruthi (Caste)	**15 Hours**

Exercise:

- Closereadingsessionstobeorganisedtounderstandtheancienttextinitsoriginalcontext by way of discussions.
- Students shall visit the nearby historical places and collect artifacts, stories, and other relics with the help of the native people.
- Students shall respond to accommodate the important criticisms of Ramayana and

Mahabharata by its criticsand enact dramas and costumes.

Suggested Readings

1. Alterkar A.S, State andGovernment in Ancient India, Motilal Banarsidass, Chowk Banaras, 1949.
2. R.S. Sharma, Early Indian Social and Political Thought and Institutions (Aspects of the Political Ideas and Institutions in Ancient India, Motilal Banarsidass, Delhi,1991.
3. Jayaswal K.P, Hindu Polity, Bangalore Printing and Publishing Co. LTD, Bangalore,1943.
4. Goshal U.N, History of Hindu Political Theory, Oxford University Press, Culcutta,1923.
5. Kangle R.P, Kautilya's Arthasastra, Motilal Banarsidass Publishers Pvt.Ltd, New Delhi, 1986.
6. BhandarkarD.D,SomeAspectsofAncientIndianCulture,Madras,UniversityofMadras, 1940.
7. Romila Thaper. From Lineage to State, Oxford University Press, United Kingdom,1984.
8. R.S.Sharma, Shudaras in Ancient India, Motilal Banarsidass, Delhi,1957.
9. Sharma,R. S India's, Ancient Past, Oxford University Press, New Delhi,2006.
10. Sharma,R. S, Rethinking India's Past, Oxford University Press, New Delhi,2010.
11. Kraedar Lawarence, "Formation of the state", Prentice Hall, United State,1968.
12. Kosambi.D.D,"IntroductiontotheStudyofIndianHistory",Popular Prakashan,Mumbai, 1956.
13. Said Edward, Orientalism, Pantheon Books, USA,1978.
14. Misra Vibhuti Bhushan, From the Vedas to the Manusamhita, City/Country Brill Academic, United States,1982.
15. Sircar D.C, Studies in the Religious life of Ancient and Medieval India, Motilal Banarsidass, Delhi,1971.
16. Aiyangar K.R, Ancient Indian Polity, Oriental Books Agency,Poona, 1941.
17. Pargiter R, Ancient Indian Historical Tradition, Oxford University Press, London,1922.
18. Levin G.M, Bongard, A Complex Study of Ancient India – Multidisciplinary Approach, American Oriental Society, USA,1989.
19. Kumar S, "Role of State in Ancient India Economy", Ramanand Vidya Bhawan, Delhi, 1986.
20. Sircar D.C, Political and Administrative System of Ancient and Medieval India. Motilal Banarsidass, Delhi,1975.
21. Maity S. K and Upendra Thakur, Indological Studies, Abhinav Publications, New Delhi, 1991.
22. Mukherjee Shobha, The Republican trends in Ancient India. Munshiram Manoharial Publishers Private Limited, New Delhi,1989.
23. Bandyopadhya N.C, Development of Hindu Polity and Political Theories, Munshiram Manoharlal Publishers, New Delhi,1980.

MODERN POLITICAL ANALYSIS

DSC-8

Course Objective: The objective is to equip students to develop insights into political institutional functioning keeping in insight both the normative and empirical ways of understanding. This paper also throws light on value laden functioning and value neutral aspects of systems output that will help students to understand and evaluate Governments. It aims at scientifically assessing the functioning of the government as result oriented institutions.

Learning Outcome:

At the end of the course the students shall -

- Understand the key concepts of Political Institutional working and science withinthem.
- BefamiliarwiththePhenomenonofpoliticsandvariousexplanationsrelatingtotheinfluences that mould the decision making process.
- Help the students to visualize the working of political institutions and the process of decision making through diagrammatic presentations.

. Unit	Contents of Course: DSC-8	45 Hours
Unit-I	**Chapte-1** Genesis and Emergence of Modern Political Analysis, Modern Political Analysis -Meaning, Nature, Scope and Goals **Chapter-2** Political System-Types, similarities and differences, classification. **Chapter-3** Approaches – Traditional- Philosophical, Historical Institutional, Modern- Behavioral, Systems, Game.	**15 Hours**
Unit-II	**Chapter-4** Talcott Parson's General Systems theory- Pattern of Inter Relationship, Hierarchical order, Integration. **Chapter-5** David Easton's Input-Output model of Political System, Features, Functions and Critical Evaluation. **Chapter-6** Power-Meaning, significance, and measurement, difference between Power, Authority, Legitimacy and Influence, Harold Lasswell's contribution.	**15 Hours**
Unit- III	**Chapter-7** Almondon Structural – Functional Analysis Karl Deutsch's Communication Theory. **Chapter-8** Richard C Snyder's Decision Making Theory, **Chapter - 9** Political Development **-** Concept of Political Development - its variables, Theory of Lucian Pye.	**15 Hours**

Exercise:

- The department can lead the students to a nearby political institution and explain to them the process of administrative decision making.
- The department may invite functionaries of these institutions to deliberate upon issues of redundancy and simplifying administration.
- Assignments can be given to the students to innovate methods of simplification of administrative procedures in offices of Governments and offer consultancy.

Suggested Readings

1. Almond, G. and Coleman. J.S. "The politics of the Developing Areas", Princeton University Press, Princeton NJ,1960.
2. Almond, G.A. and Verba, S, "The Civic Culture: political Attitudes and Democracy in Five Nations", Princeton NJ, Princeton University Press,1963.
3. Amin, S, "Accumulation on an old Scale: A Critique of the Theory of Underdevelopment", Monthly Review Press, New York,1974.

Open Elective OE - 4.1

Good Governance in India

Course Objective:

The course directed to familiarize the student to understand the elements of Good Governance which has the effect on day today life. The purpose is to show to them that states are changing their approach to Administration giving importance to stakeholders. Some of the programs mentioned in the syllabi exemplifies the same. The aim is to help students to link the theory in the class room with realities in the outside world.

Learning Outcome:

At the end of the course the students shall -

- Understand the difference between traditional form of Administration and the concept of Governance
- Get aperspectiveofchangingmodesofGovernancewiththeexamplesdrawnfromcentral and state Governments.
- Appreciate the participation of citizens in day to day Administration through a charter and other programmes like Sakala, Bhoomietc,.

Unit	Contents of Course: OE-4.1	45 Hours
Unit-I	**Chapter- 1** Meaning, Characteristics, Elements, Growth and need for Good Governance. **Chapter-2** Theories and Concepts of Governance- Public Choice and Public Value Theory,Good Governance and Globalization. **Chapter-3** Corporate Governance- Networking and collaborative Governance.	**15 Hours**
Unit-II	**Chapter-4** Public Service Guarantee Act 2011: Features, Provisions and Impact, Right to Information Act- Meaning, Characteristics and Importance. **Chapter-5** E-Governance - Meaning, Characteristics, Importance and E Governance Policy, ICT and Governance. **Chapter-6** Citizens Charter, Digital India, Gender and Governance.	**15 Hours**
Unit- III	**Chapter-7** Sakala Project, BhoomiYojana, SWAYAM and eKissan, eCourt. **Chapter-8** People's Participation and Role of Civil Society, Ethics and Accountability in Governance. **Chapter-9** Challenges before good governance in India.	**15 Hours**

Exercise:

- Students and the department can undertake survey regarding causes and consequences of failed administration.
- Through activities they can visit their respective villages and prepare papers regarding the working of programmes like Sakala, Bhoomietc,.
- The department may invite officers connected to Governance projects and have interaction with the students.

UNDERSTANDING Dr. B.R. AMBEDKAR

Open Elective OE -4.2

Course Objective:

This course is designed to familiarize the students with arguments and position of Dr. B.R. Ambedkar on key social, political, constitutional and democratic issues in India and enable them to critically examine his perceptions. Besides the constitutional questions and fight for the oppressed communities which are largely popular in academic and political discourses, has been designed to make students to understand his ideas. On the partition of the country and the Indian historiography his views have been valuable and this paper intends to bring to the reach of the students.

Learning Outcome:

At the end of the course the students shall -

- Be able to understand his life, mission, vision and his key role in the making of the Indian Constitution.
- Beabletoappreciateandsensitizehisviewsondemocracy,citizenship,freedom,equality equal treatment and justice.
- Understand his views on the some of the important debates like Aryan Invasion Theory, Uniform Civil Code, Islam and partition of India.

. **Unit**	**Contents of Course OE 4.2**	**45 Hours**
Unit-I	**Chapter: 1**- Dr. B. R. Ambedkar's Journey of Life and Experiences. **Chapter: 2**- Dr. B. R. Ambedkar's perception on Hindu Social Order, Caste and Untouchability (refer Annihilation of Caste). **Chapter-3-** Dr. B. R. Ambedkar's Initiatives: Mahad Satyagraha, Kalaram Temple Entry Movement.	**15 Hours**
Unit-II	**Chapter: 4**- Dr. B. R. Ambedkar and Round Table Conference: His Memorandum, Communal Award and Poona Pact. **Chapter: 5**- Dr. B. R. Ambedkar's contribution as the Chairman of the Drafting Committee. **Chapter 6** - Dr. B. R.Ambedkar's deliberations on key issues in the Constituent Assembly (Article 40, Article 370, Uniform Civil Code, Hindu Code Bill, and on reservation)	**15 Hours**
Unit- III	**Chapter: 7-**Dr. B. R.Ambedkar's Political Ideas: Democracy, Citizenship, Equality, Freedom and Justice. **Chapter: 8:** Dr. B. R. Ambedkar's views: on Islam, Buddhism, on Religious Conversion, on Aryan InvasionTheory. **Chapter: 9-**Dr. B. R.Ambedkar and Language Question, Dr. B. R.Ambedkar on Education and Women Empowerment and Nationalism.	**15 Hours**

Exercise:

- Students and teachers collectively debate on the issues of Reservation, Constitutional provisions of reservation, reservation within reservation, creamy layer theory,etc,.
- Give assignments to students to visit colonies of Scheduled Caste and Scheduled Tribes and discuss it in the group about the perception that they have carried.
- Debate on the need for social reform, inclusiveness, changing the cultural and religious outlook among the Indian citizens keeping the view inhuman practice like un touchability, exploitation. And further visit courts, police stations, etc, to understand conflict resolution mechanisms.

1. Ambdekar, B.R. "What Congress and Gandhi have Done Untouchables"http://www.ambedkar.org/ambcd/41A.What%20Congress%20and%20Gandhi%20Preface.htm.
2. Ambedkar Annihilation of Caste, Navayana, 11th Edition,2015.
3. Dhanjaya Keer, Dr.Ambedkar-Life and Mission, Popular Prakashana, Bombay,1964.
4. Valerian Rodrigues, Essential Writings on Ambedkar, OUP, New Delhi,2003.
5. MarcusRaskin,'NationBuildingandCitizenship:Studiesofour Changingorder' Rutledge India, New Delhi,1996.
6. Atul Kolhi, 'Democracy and Discontent: India's growing crises of Governability, Cambridge University Press,1991.
7. Atul Kolhi, The Success of Indian Democracy, CambridgeUniversity Press, 2001.
8. Savitaha Rao, India's Positive Citizen Building- A Great Nation One Action At A Time, Wings Publishing, Bangalore,2020.
9. Nirag Gopal Jayal, 'Citizenship and its Discontents', Harvard University Press,2013.
10. Koenig Lion, 'Cultural Citizenship in India; politics power and media', Oxford University Press, New Delhi,2016.
11. Subrata K. Mitra, 'Citizenship as cultural flow; structure agency and flow', e-Book, Springer link,2013.
12. Sharma, A, Dr. B.R. Ambedkar on the Aryan Invasion and the Emergence of the Caste System in India, Journal of the American Academy ofReligion, 73(3), 2005, pp. 843-870.
13. Ambedkar, B. R. (1946). Pakistan or The Partition of India, In Narke, H. (2nd ed.),2014.
14. Dr. B. R. Ambedkar Writing and Speeches, Vol. 8. Delhi: Dr. Ambedkar Foundation, Ministry of Social Justice & Empowerment, Govt. ofIndia.

    Available at: https://mea.gov.in/Images/attach/amb/Volume_08.pdf.
15. Misra, J., & Mishra, J. Dr. B.R. Ambedkar and The Constitution - Making In India, Proceedings of the Indian History Congress, 1991, 52, pp.534-541

POLITICAL JOURNALISM

Open Elective OE- 4.3

Course Objective:

The objective is to equip students to develop insights into political reporting with an understanding of writing skills supported by grammatical strength and economy of words. Further to provide a broad overview of the nuances of interpreting the political phenomena that takes place in political institutions starting from the grass roots to the parliament.

Learning Outcome:

At the end of the course the students shall -

- Understand the skills of reporting and research insights about the system and its structural contours focusing on Politics.
- Carry out political reporting covering Government and Governance, campaigns and candidates, tactics and strategies and policy issues in the public arena.
- Develop writing and interpretative skills.

. Unit	Contents of Course- OE-4.3	45 Hours
Unit-I	**Chapter-1:** Defining Political Journalism, Traditional and Modern views about State and Politics. **Chapter-2**: Understanding of Political Development: Caste, Religion, Linguistic and Party Perspectives. **Chapter-3:** Defining the Role of Mass Media- Print, Electronic **and Web (Social Media).**	**15 Hours**
Unit-II	**Chapter-4: Political Culture- Shared Beliefs,Values, Ideologies and Norms, Process of Socialisation.** **Chapter-5: Political Participation –Modes of participation, Political Apathy.** **Chapter- 6: Methods of Political Journalism- Interviews, Political Debates, Commentary on Legislations.**	**15 Hours**
Unit-III	**Chapter-7: Communication-Defining Communication, Shaping Public Opinion, Encoding and Decoding.** **Chapter-8: Skills of Writing - Vocabulary, Epitomizing, Punctuation.** **Chapter-9: Report Writing-Journalistic Writing Skills, Yellow Journalism, Use of Facts and Figures and Interpretations.**	**15 Hours**

Exercise:

- Conducting classroom Common seminars on Media and Politics
- Making students to read and write newspaper headlines focusing on politics**,**
- Visit to media houses and talks with senior political newsroom heads.

Suggested Readings

1. Iorio, Sharon Hartin. Qualitative Research In Journalism, Erlbaum Associates, London,2004.
2. Merritt, Davis, Public Journalism And Public Life, Erlbaum Associates, London,2004.

INDIAANDINDIAN CONSTITUTION

AbilityEnhancementCompulsoryCourses(AECC)	
CourseTitle:**INDIAANDINDIANCONSTITUTION**	
TotalContactHours:**45**	CourseCredits:3
No.ofTeachingHours/Week:3	DurationofESA/Exam:2**Hours**
FormativeAssessmentMarks:40	SummativeAssessmentMarks:**60+40=100**

CourseObjective

Thepurpose ofthecourseis tohelp studentstolearnand explainthejourneyof Indiaasarepublic. They will, through this paper learn to contextualise the depth of India as a nation with its diverse socio-political culture, its philosophical traditions, values and Ideals. It will give them knowledge to expound the breadth of freedom struggle in various parts of India, its significance in nation buildingand the sacrifices madeboth byits leaders and followers. It will help themto demonstrate theirknowledgeregardingtheeffortsmadeatworkingtowards aconstitutionas India'sconscience cherishing the values of Justice, Liberty, Equality and Fraternity. Consequently it will enable students to contextualisethe powers and functions of various officesunder the Constitution. It will help them determine the role and responsibilities of citizens as enshrined in the Constitution, offering insights in to the contributions of personalities like Gandhiji, Dr B.R.Ambedkar and Jawahar Lal Nehru, Bal Gangadhar Tilak, the values tolerence, equality of treatment, scientific secularism and swarajya and the processes of policymaking keeping national wellbeing in the forefront. This paper will enable students to illustrate how vibrant our Constitution is, how farsightedwereitsmakersandhowefficientarethevariousinstitutionsthatarefunctioningunder it.

Learningoutcomes

Uponcompletionofthiscoursestudentswillbeableto—

- Explainthephilosophyandthestructureoftheconstitution.
- Measurethepowers,functionsandlimitationsofvariousofficesundertheConstitution.

- Demonstratethevalues,idealsandtheroleofConstitutioninademocraticIndia.

Unit	ContentsofCourse:	45 Hours
Unit-I	**BackgroundtothestudyofIndianConstitution****	
	Chapter 1: Philosophical and Political foundations of India: Dharma and Danda, Buddhist,liberal (Raja Rammohun Roy) and Subaltern (Ranajit Guha)* Colonial impact on Indian society,** Nationalist perspective (Swamy Vivekananda andSri Aurobindo).	**6 Hours**
	Chapter 2: Political values and Ideals during freedom struggle: NonViolence,Tolerance,SatyagrahaandSwadeshi(Gandhi), Swarajya(Tilak),IntegralHumanism(DeenDayalUpadhyay)and Voluntarism (Vinoba Bhave).	**5 Hours**
	Chapter3:PoliticalContributionofRegionalfreedomstruggle: Kittur Rani Chennamma, Hardekar Manjappa, Madikeri Peasants, Halagali Bedas.	**4 Hours**
Unit-II	**ConstitutionalDevelopmentanditsPhilosophy**	
	Chapter- 4: Historical background of Constitutional development in India - Developments between 1857 to1952 (only Acts during this period must be taught), Composition and debates of Constituent Assembly (in brief), working of committees.	**5 Hours**
	Chapter 5: Philosophy and features of Indian Constitution - Preamble*, Salient features**, Constitutionalism, Dr B.R. Ambedkar and Nehru'scontribution in the making of the Constitution.	**5 Hours**
	Chapter- 6: Working of the Constitution - Fundamental Rights, Union-State and Inter-State Relations (Art. 263, Inter-State disputesand trade and commerce), important Amendments to the Constitution**, Parliamentary Committees* (Standing, Ad hoc and Departmental).	**5Hours**

Unit-III	**ConstitutionalInstitutionsandCitizen'srole** **Chapter 7: Parliamentary and Constitutional Institutions:** Legislature* (Upper and Lower house), Executive (composition and powers), Judiciary (High Court and Supreme Court, its composition and jurisdiction), Comptroller and Auditor General, Inter-State Council, Election Commission. **Chapter 8: Role and Responsibilities of Citizens under Indian Constitution:** Concept of Citizenship, Citizenship Amendment Act, Fundamental Duties, Right to Information Act, Civil Society.* **Chapter 9: Goals and Policies of National Development enshrined in the Constitution:** Concept of National Development, Unity and Integrity of the nation, Goals of Educational Policies*,Role of teachers and students in Nation Building**.	**6 Hours** **4 Hours** **5 Hours**

(**Note-This is a compulsory, foundational and value additional course to be taught to students at the graduate level under NEP 2020. The paper is expected to impart the structure and functional aspects of constitution while giving them the background of a diverse country like India and the nuances of its social fabric and the why of such an elaborate constitution. The introductory chapter therefore is designed to familiarise students about their country and culture before they understand their constitution).

(Please note: The question paper pattern is indicative of the way a teacher needs to teach this paper. The pedagogical choice of a teacher helps to make an impact of his/her teaching on the student. Activity based and experiential teaching methods help student centric learning process - these are tips to make this paper more meaningful- the ultimate choice is left to the teacher)

Exercise:

- DepartmentcandebateontheroleofConstitutioninthedevelopmentofIndia.
- StudentscanempiricallyevidencetheeffectivenessofconceptslikeFreedom,Equality, Justice,RightsandDutiesbyconductingempiricalstudies.
- Caninviteexpertstodeliverspeciallectureonvariousprovisionsandamendmentsofthe ConstitutionlikethefunctioningofElectionCommission,Article246,356etc.

ImportantNotes:

Chapter1:

* These are introductory courses. Teachers should give a brief introduction to these for a better understanding of thephilosophical and political foundations of Indian society taking suggested thinkers as examples (Max 2hrs).

**Hereteachersshould brieflyteachaboutthe contributionsand impactofBritishand Arabsasinvaders, Mughalsas settlers (Max 2hrs).

Chapter2:

*Thesearetobetaughtbrieflyasconceptsagainstthebackdropoffreedomstruggle

Chapter3:

*BOScanalterthischaptertobringinthepersonalitiesandmovementsintheirregionwhohavemadeanimpacton freedomstruggle.

Chapter5:

*While teaching the preamble please cover secularism and its criticism keeping in mind the neutrality of state in matters of religion and bring in the discussion regarding the differences in the usage of the terms like Religion, Dharma,Pantha(□□□) ,*Matha(□□),*Caste,*Jatyathithate*andthemeaningofscientificsecularismasexpoundedby Nehru.

** In the salient features the teachers must teach at least 10 features of the constitution like Written constitution, Parliamentary form of government, Quasi federalism, Directive Principles of State Policy, Amendment procedure, Universal adult franchise, Integrated citizenship, Independent judiciary,Judicial Review, Emergency provisions and Three tier system of governance etc. The BOS has the discretion in selecting the salient features.

Chapter6:

*Inthecommitteestheyshouldteachthenatureofthesecommittees,their types,categoriesandsubcategories.

** In this the teacher should teach the amendments like 42nd, 73rd, 74th, 101st, etc which have major impact on the working of the Constitution. The BOS has the discretion in selecting the amendments but must ensure that they have a earring on the working of the constitution.

Chapter7:

*Hereteachersareexpectedtoteachtheinstitutionsingeneralandcontextualisethemtostateandcentral governments.

Chapter8:

*In this the teacher should discuss issues like paying taxes, exercising vote, discouraging corruption, Knowledge oflaws that govern them.

Chapter9:

*TeacherscantouchuponKothariCommission,NEP(1986and2020whileteachingEducationalPolicies)
**Teachers can touch upon the teacher taught relations (vedantic tradition), teacher as a role model, student as future citizen, the need for ethical and moral responsibility among them etc.,

SuggestedReadings:

1. AiyangarK.R.1941.“*AncientIndianPolity”*.OrientalBokksAgency.Poona.

2. Altekar A.S. 1949. "*State and Government in Ancient India*". Motilal Banarsidass Chowk, Banaras
3. AndreBeteille,1965.Caste,class,andPower.Berkley:UniversityofCaliforniaPress.
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FormativeAssessment	
AssessmentOccasion/type	**WeightageinMarks**
AssessmentTest-1	10
Seminar/Presentation/GroupDiscussion	10
AssessmentTest-2	10
Assignment	10
Total	**40**

I.TermEndExaminationforIndiaandIndianConstitution(IIC)

Paper willbeformaximumof60marks.The minimummarkstopasstheexaminationis40%(24 marks).

Note: DurationofExaminationfor**IndiaandIndianConstitution**(IIC)is**2hours.**

Questionpaperpatternfor**IndiaandIndianConstitution**–

Section A: Multiple Choice Questions
Section B: Short Answer Questions
SectionC:MediumAnswerQuestions
Section D: Long Answer Questions

SectionA:MultipleChoiceQuestions

AllQuestionsareCompulsory(10x1=10)

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

SectionB:ShortAnswerQuestions (5x5=25)

AnsweranyFivequestions.Answerthefollowingquestionsinnotmorethan3-5sentences.

11.
12.
13.
14.
15.
16.
17.

SectionC:MediumAnswerQuestions (1x10=10)

AnsweranyOnequestion.Answerthefollowingquestioninnotmorethan500words

18.

19.

SectionD:LongAnswerQuestions (1x15=15)

AnsweranyOnequestion.Answerthefollowingquestioninnotmorethan800words

20.

21.

Department of Political science
Pattern of Question Paper

1. International Assessment
   Each paper will have an internal assessment component for **40** marks out of the maximum **100** marks
2. **Theory Examination** **Max.Marks 60**
   Theory question paper pattern
   Theory question paper for Itoiv Semester (2 papers) will have 1 parts

Question Paper Pattern
Theory (3 Credits)

Time :2 Hours **Max.Marks:60**

Anwer any five questions each question carries 10 marks

1…….
2……
3…….
4……
5……
6……..
7……
8…….
9…….

10……

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE
(AUTONOMOUS)
B.N. ROAD, MYSURU-570025

DEPARTMENT OF POLITICAL SCIENCE

UG Syllabus
CHOICE BASED CREDIT SYSTEM
For B.A.Programmes

- History,Economics,Political science(HEP)
- Kannada, Economics,Political science(KEP)

➢ Jouranalisam,Politicalscience,English(JPE)

2019-20

ELE26022/25/26

V Semester
Discipline Specific Elective (DSE1A)
Themes on Comparative Political Theory

Course Outcome:

On completion of the Course, students will:

CO1 Understand in details with application, if applicable, democracy and governance

CO2 Understand in details with application, if applicable, Indian political thought

CO3 Specify in depth Indian political thought

CO4 Identify the classification and characteristics of western political thought

CO5 Understand in details with examples western political thought

CO6 Understand in depth local government

CO7 Learn the details of regulatory institutions

CO8 Identify the classification and characteristics of lobbying institutions

Unit I

a. Distinctive features of Indian political thought
b. Kautilya on State
c. Tilak and Gandhi on Swaraj

Unit II

a. Ambedkar and Lohia on Social Justice
b. Nehru and Jayaprakash Narayan on Democracy
c. John Locks on Rights

Unit III

a. Distinctive features of western political thought
b. Aristotle on citizenship
c. plato –ideal state

Unit IV

a. J.J. Rousseous on Inequality
b. J.S. Mill on liberty and democracy

c. H.J.Laski- Rights,Liberty,Equality

Reference:

- Dallmayr F – Comparative Political Theory
- Sparks, Oh and Isaacs s – Political Theory its in context
- Zelliot E – Political Thought in Modern India

ELE26222/25/26

V- SEMESTER
Discipline Specific Elective (DSE1B)
Legislative support

Course Outcome:

On completion of the Course, students will:

CO1 Understand in depth legislative support
CO2 Write down the details of legislative process
CO3 Write down the details of legislative committees
CO4 Learn in details with examples legislative committees
CO5 Identify in details with application, if applicable, budget process

Unit I **a.** Parliament, composition Power and functions,
b.State legislature -composition Power and functions,
.c.Rural and urban local self government from Zilla parishads / municipal corporation to panchayat

Unit II **a.** law making process in parliament
b.Role of the Standing Committee in reviewing a Bill, Legislative Consultations, amendments to a Bill, the framing of Rules and Regulations.

Unit III a. meaning ,nature and scope financial administration
b. Importance of financial administration
c.Budget- preparation
Enactment
execution

Unit IV. a. Importance of Accounting Auditing

b.The comptroller and auditor general of India-powers and functions
c. public accounts committee, estimate committee

Essential Readings:

- Avasthi and maheshwaripublic administration
- Madhavan, M R & N Wahi financing of election campaigns
- Vanka, S primer on MPLADS centre for policy research
- Karla, H Public engagement with the legislative process
- Agerwalo.P and T V Somanathan, "Public Policy Making in India: Issu

ELF26022/25/26

VI SEMESTER(DSE1A)

MODERN GOVERNMENTS (U.K U,S.A.SWISS)

Course Outcome:
On completion of the Course, students will:
CO1 Understanding the world politics
CO2 Enlighting the world governmental system
CO3 Develop comparative study on governmental systems

Unit I UNITED KINGDOM

a. Evolution, features of UK Constitution and role of conventions
b. Parliament- Composition powers and functions
c. Crown-prime minister-powers and functions

Unit II

a. Judiciary in UK- Composition and jurisdiction
b. Role of political parties in UK

Unit III : UNITED STATES OF AMERICA

a. Features of USA Constitution
b.Congress - Composition powers and functions
c.President-Election, Role powers and functions

Unit IV:

a. Judiciary in USA- Composition and jurisdiction
b. political parties in USA

Unit IV: SWISS

a. Features of Swiss Constitution

b.Fedaral Assembly-Composition powers
c.Fedaral Council-Composition powers
d.Fedaral Tribunal-Composition powers
e.Devices of Direct Democracy in Swiss

Reference:

- A.C Kapoor - Select constitution
- H.t.Ramakrishna - Adunikasarakaragalu
- U.Gurumurthy - Adunikasarakaragalu
- Vidyabhushan and- World Constitution
- Vishnu Bagavan

ELF26222/25/26

VI Semester
Skill Enhancement Course (DSE1B):
Public Administration Concepts& Theories

Course Outcome:

On completion of the Course, students will:

CO1 Learn in depth Administration and Public Policy
CO2 Specify the details of administrative theories
CO3 Learn the classification and characteristics of administrative theories
CO4 Deliberate the details of public policy
CO5 Deliberate in details with examples public policy in India
CO6 Identify the characteristics of public policy in India

Unit I Public Administration

a. Meaning, Scope and Significance
b. Public & Private Administration
c. Approaches to Public Administration

Unit II Administrative Theories

a. Classical Theory & Human Relations Theory
b. Scientific Theory
c. Rational decision making theory

Unit III. Management

a. Meaning, importance and principles
b. Features and functions of management
c. Chief executive –functions and is role

Unit IV. contempory issues in administration

a. Meaning and modes of corruption

b.Good governance

c.E-governance

Reference:

- Awasthi A and Maheshwari - Public Administration
- BasuRumki, Public Administration - Concepts and Theories
- Henry N - Public Administration and Public Affairs
- Mouzelis N P - The Ideal type of Bureaucracy
- Mooney - The Principles of Organization
- Esman M T - Politics & Development Administration

ELE26242/25/26

Generic Elective: Interdisciplinary Reading Gandhi

Course Outcome:

On completion of the Course, students will:

CO1 Specify the details of reading Gandhi

CO2 Deliberate in depth Gandhi and hind swaraj

CO3 Learn the details of Gandhi's views on nationalism

CO4 Understand the details of Gandhi's views on communal unity

CO5 Understand in details with examples Gandhi's views on women

Unit I:Introduction

a. Biography (a brief)

b.Commentaries on hind swaraj

c. Truth –non-violance

d.Satyagrha

e. Modernity

Unit II:

a.State and religion

b.Nationalism

c Communal Unity

d .Women's Question

e.Untouchability

f.Crapt of ramarajya

g.Economicalidias

Reference:

A.J. Parel(1997)- Introduction,M.KGandi , Hinda swaraj and other writings

B Parekh, -Gandhi(1997)

D.hardiman, -Gandhi in his time and ours(2003)

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ದೂರವಾಣಿ ಸಂಖ್ಯೆ : 2419677/2419361
ಫ್ಯಾಕ್ಸ್: 0821-2419363/2419301
e-mail : registrar@uni-mysore.ac.in
www.uni-mysore.ac.in

ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ
ಸ್ಥಾಪನೆ : 1916

ವಿಶ್ವವಿದ್ಯಾನಿಲಯ ಆಡಳಿತ ಸೌಧ
ಕ್ರಾಫರ್ಡ್ ಭವನ, ಮೈಸೂರು-570005

ಸಂಖ್ಯೆ:ಮಾ.6/152/NEP/2020-21 ದಿನಾಂಕ: 26-10-2021

ಅಧಿಸೂಚನೆ

ವಿಷಯ:- ಬಿ.ಎ- ಸಂಸ್ಕೃತ ಅಧ್ಯಯನ ಪಠ್ಯಕ್ರಮ ಮತ್ತು ಪರೀಕ್ಷಾ ವಿಧಾನವನ್ನು NEP- 2020 ಅನುಸಾರ 2021-22ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಜಾರಿಗೆ ತರುವ ಬಗ್ಗೆ.

ಉಲ್ಲೇಖ:- 1. ದಿನಾಂಕ: 27/28-09-2021 ರಂದು ಜರುಗಿದ ಸಂಸ್ಕೃತ ಅಧ್ಯಯನ ಮಂಡಳಿ ಸಭೆಯ ನಿಷ್ಠಾವನ್ನು.
2. ದಿನಾಂಕ: 13-10-2021 ರಂದು ಜರುಗಿದ ಕಲಾ ನಿಕಾಯ ಸಭೆಯ ನಿಷ್ಠಾವನ್ನು.
3. ದಿನಾಂಕ: 22-10-2021 ರಂದು ಜರುಗಿದ ಶೈಕ್ಷಣಿಕ ಮಂಡಳಿಯ ನಡಾವಳಿ.

*****

ದಿನಾಂಕ: 27/28-09-2021 ರಂದು ಜರುಗಿದ ಉಲ್ಲೇಖ (1)ರ ಸಂಸ್ಕೃತ ಅಧ್ಯಯನ ಮಂಡಳಿ (ಸ್ನಾತಕ) ಬಿ.ಎ ಸಂಸ್ಕೃತ ಅಧ್ಯಯನ ವಿಷಯಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ ಪಠ್ಯಕ್ರಮ ಮತ್ತು ಪರೀಕ್ಷಾ ವಿಧಾನವನ್ನು NEP-2020ರ ಅನುಸಾರ ರೂಪಿಸಿ **2021-22** ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಜಾರಿಗೆ ತರಲು ನಿಷ್ಠಾರನ್ನು ಮಾಡಿರುತ್ತದೆ.

ಉಲ್ಲೇಖಿತ (2 & 3) ರ ದಿನಾಂಕ 13-10-2021 ಮತ್ತು 22-10-2021 ರಂದು ಕ್ರಮವಾಗಿ ನಡೆದ ಕಲಾ ನಿಕಾಯ ಹಾಗೂ ವಿದ್ಯಾ ವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಗಳು ಮೇಲಿನ ಪ್ರಸ್ತಾವನೆಗಳನ್ನು ಅನುಮೋದಿಸಿರುವುದರಿಂದ ಈ ಅಧಿಸೂಚನೆ ಹೊರಡಿಸಲಾಗಿದೆ.

ಸಂಸ್ಕೃತ ಅಧ್ಯಯನ ಮಂಡಳಿ (ಸ್ನಾತಕ) ಪಠ್ಯಕ್ರಮಗಳು ಮತ್ತು ಪರೀಕ್ಷಾ ವಿಧಾನಗಳನ್ನು **www.uni-mysore.ac.in** ನಿಂದ ಪಡೆಯಬಹುದಾಗಿದೆ.

ಕುಲಸಚಿವರು
ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ
ಮೈಸೂರು.

ಟಿಪ್ಪಣಿ:-

1. ವಿಶ್ವವಿದ್ಯಾನಿಲಯಕ್ಕೆ ಸಂಯೋಜನೆಗೊಳಪಟ್ಟ ಎಲ್ಲಾ ಕಾಲೇಜುಗಳ ಪ್ರಾಂಶುಪಾಲರುಗಳಿಗೆ- ಅಗತ್ಯ ಕ್ರಮಕ್ಕಾಗಿ
2. ಕುಲಸಚಿವರು (ಪರೀಕ್ಷಾಂಗ), ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ, ಮೈಸೂರು.
3. ಡೀನರು, ಕಲಾ ನಿಕಾಯ, ರಾಜ್ಯಶಾಸ್ತ್ರ ಅಧ್ಯಯನ ವಿಭಾಗ, ಮಾನಸಗಂಗೋತ್ರಿ, ಮೈಸೂರು.
4. ಅಧ್ಯಕ್ಷರು, ಸಂಸ್ಕೃತ ಅಧ್ಯಯನ ವಿಭಾಗ/ಮಂಡಳಿ, ಮಾನಸಗಂಗೋತ್ರಿ, ಮೈಸೂರು.
5. ನಿರ್ದೇಶಕರು, ಕಾಲೇಜು ಅಭಿವೃದ್ಧಿ ಮಂಡಳಿ, ಮೌಲ್ಯಭವನ ಕಟ್ಟಡ, ಮಾನಸಗಂಗೋತ್ರಿ, ಮೈಸೂರು.

6. ಡೀನರು, ಕಲಾ ನಿಕಾಯ, ರಾಜ್ಯಶಾಸ್ತ್ರ ಅಧ್ಯಯನ ವಿಭಾಗ, ಮಾನಸಗಂಗೋತ್ರಿ, ಮೈಸೂರು.
7. ನಿರ್ದೇಶಕರು, ಪಿ.ಎಂ.ಇ.ಬಿ., ಮಾನಸಗಂಗೋತ್ರಿ, ಮೈಸೂರು.
8. ನಿರ್ದೇಶಕರು, ಐ.ಸಿ.ಡಿ., ಮಾನಸಗಂಗೋತ್ರಿ, ಮೈಸೂರು– ಇವರಿಗೆ ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯದ ವೆಬ್‌ಸೈಟ್‌ನಲ್ಲಿ ಪ್ರಕಟಿಸಲು ಕೋರಲಾಗಿದೆ.
9. ಕುಲಪತಿಗಳು/ ವಿಶೇಷ ಅಧಿಕಾರಿಗಳು/ ಆಪ್ತ ಸಹಾಯಕರು/ ಕುಲಸಚಿವರು/ ಉಪಕುಲಸಚಿವರು/ ಸಹಾಯಕ ಕುಲಸಚಿವರು/ಅಧೀಕ್ಷಕರು, ಆಡಳಿತ ವಿಭಾಗ/ಸಾಮಾನ್ಯ/ಓಡಿಐ/ಪ್ರಾಧಿಕಾರ ಮತ್ತು ಪರೀಕ್ಷಾ ವಿಭಾಗ, ಪ್ರಾಧಿಕಾರ/ಓಡಿಐ, ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ, ಮೈಸೂರು.
10. ಕಾರ್ಯನಿರ್ವಾಹಕರು, ಆಡಳಿತಶಾಖೆಯ, AC2(S)/ AC-3/ AC-7(a)/ AC-9, ಶೈಕ್ಷಣಿಕ ವಿಭಾಗ, ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ, ಮೈಸೂರು.– ಈ ಸಂಬಂಧ ಮುಂದಿನ ಕ್ರಮವಹಿಸುವಂತೆ ತಿಳಿಸಲಾಗಿದೆ.
11. ರಕ್ಷಾ ಕಡತಕ್ಕೆ.

SVN

Undergraduate Curriculum for 2021-22 as per NEP

I Semester - BA/B Music/ BFA/BPA/BSW

Ability Enhancement Compulsory Courses – 3 Credits

Sanskrit Poetry, Grammar and Comprehension (L+T+P) (3+1+0)	Marks
Unit-1 Introduction to Classical Sanskrit Poetry – Samskrita Sahitya Parampare - By Dr.M.Shivakumara Swamy (Page 1-24) **Unit-2** Selected shlokas from Valmiki Ramayana – Balakanda – Sarga 1 – 1 to 60 shloka **Unit-3** • Vocabulary building - Samskrita Vyavahara Sahastri (page1-18) • Karaka prakarana – Samskrita Gadya Padya Vallari – (Page 201-204) • Comprehension - Shevadhi-2 (page 133)	60
Internal Assessment	40
Total	100

Learning Objectives:

a. It gives introduction to Sanskrit poetry.
b. It inspires to read the Ramayana.
c. It helps to build the foundation for Sanskrit vocabulary.
d. It supports the formation of sentences in Sanskrit.
e. It assists in comprehension skills.

Learning Outcomes:

1. The student gets motivated to compose poems.
2. The student imbibes the noble qualities.
3. The student develops conviction in scriptures.
4. The student learns Sanskrit speaking skills.
5. The student will be confident in learning new texts of Sanskrit.

Recommended Learning Resources

Printed Text Books

1. Samskrita Sahitya Parampare - By Dr.M.Shivakumara Swamy, Bharavi Publication, Bengaluru. RPT 1987 (Page 1-24)
2. Srimad Ramayana – Valmiki.
3. Samskrita Vyavahara Sahastri – Samskrita Bharati, (Delhi-Bengalur) Page 1-18.
4. Samskrita Gadya Padya Vallari – (Page 201-204), Government of Karnataka, Karnataka Textbook Society (R) Bengaluru. RPT -2012-13.
5. Shevadhi-2 – Government of Karnataka, Bengaluru. RPT-2019. Page 133.

Digital Resources: www.archieve.org
https://www.wikipedia.org/

I Semester - BSc/BSc FAD and all other Science and Home Science Courses

Ability Enhancement Compulsory Course – 3 Credits

Sanskrit Poetry, Grammar and Comprehension (L+T+P) (3+1+0)	**Marks**
Unit-1 Introduction to Classical Sanskrit Poetry – Samskrita Sahitya Parampare - By Dr.M.Shivakumara Swamy (Page 1-24) **Unit-2** Selected portions from Raghuvamsham I Sarga (1-50 Shlokas) **Unit-3** • Vocabulary building Samskrita Vyavahara Sahastri (page1-18) • Karaka prakarana – Samskrita Gadya Padya Vallari – (Page 201-204) • Comprehension Shevadhi-2 (page 133)	60
Internal Assessment	40
Total	100

Learning Objectives:

1. It gives introduction to Sanskrit poetry.
2. It inspires to read the Raghuvamsham Mahakavyam.
3. It helps to build the foundation for Sanskrit vocabulary.
4. It supports the formation of sentences in Sanskrit.
5. It assists in comprehension skills.

Learning Outcomes:

1. The student gets motivated to compose poems.
2. The student imbibes the noble qualities.
3. The student develops conviction in scriptures.
4. The student learns Sanskrit speaking skills.
5. The student will be confident in learning new texts of Sanskrit.

Recommended Learning Resources

Printed Text Books

1. Samskrita Sahitya Parampare - By Dr.M.Shivakumara Swamy, Bharavi Publication, Bengaluru. RPT 1987 (Page 1-24)
2. Raghuvamsha Mahakavya - Kalidasa.
3. Samskrita Vyavahara Sahastri – Samskrita Bharati, (Delhi-Bengalur) Page 1-18.
4. Samskrita Gadya Padya Vallari – (Page 201-204), Government of Karnataka, Karnataka Textbook Society (R) Bengaluru. RPT -2012-13.
5. Shevadhi-2 – Government of Karanataka, Bengaluru. RPT-2019. Page 133.

Digital Resources: www.archieve.org

https://www.wikipedia.org/

I Semester - B Com

Ability Enhancement Compulsory Course – 3 Credits

Sanskrit Poetry, Grammar and Comprehension (L+T+P) (3+1+0)	Marks
Unit-1 Introduction to Classical Sanskrit Poetry – Samskrita Sahitya Parampare - By Dr.M.Shivakumara Swamy (Page 1-24) **Unit-2** Selected portions from Kumarasambhavam Sarga 5 (1-40 Shlokas) **Unit-3** • Vocabulary building - Samskrita Vyavahara Sahastri (page1-18) • Karaka prakarana – Samskrita Gadya Padya Vallari – (Page 201-204) • Comprehension - Shevadhi-2 (page 133)	60
Internal Assessment	40
Total	100

Learning Objectives:

1. It gives introduction to Sanskrit poetry.
2. It inspires to read the Kumarasambhava Mahakavyam.
3. It helps to build the foundation for Sanskrit vocabulary.
4. It supports the formation of sentences in Sanskrit.
5. It assists in comprehension skills.

Learning Outcomes:

1. The student gets motivated to compose poems.
2. The student imbibes the noble qualities.
3. The student develops conviction in scriptures.
4. The student learns Sanskrit speaking skills.
5. The student will be confident in learning new texts of Sanskrit.

Recommended Learning Resources

Printed Text Books

1. Samskrita Sahitya Parampare - By Dr.M.Shivakumara Swamy, Bharavi Publication, Bengaluru. RPT 1987 (Page 1-24)
2. Kumarasambhava Mahakavya - Kalidasa.
3. Samskrita Vyavahara Sahastri – Samskrita Bharati, (Delhi-Bengalur) Page 1-18.
4. Samskrita Gadya Padya Vallari – (Page 201-204), Government of Karnataka, Karnataka Textbook Society (R) Bengaluru. RPT -2012-13.
5. Shevadhi-2 – Government of Karanataka, Bengaluru. RPT-2019. Page 133.

Digital Resources: www.archieve.org
https://www.wikipedia.org/

I Semester - B B A and other Management Courses

Ability Enhancement Compulsory Course – 3 Credits

Sanskrit Poetry, Grammar and Comprehension (L+T+P) (3+1+0)	**Marks**
Unit-1 Introduction to Classical Sanskrit Poetry – Samskrita Sahitya Parampare - By Dr.M.Shivakumara Swamy (Page 1-24) **Unit-2** Selected portions from Bhagawad Gita Chapter 3 (1-43 Shlokas) **Unit-3** • Vocabulary building Samskrita Vyavahara Sahastri (page1-18) • Karaka prakarana – Samskrita Gadya Padya Vallari – (Page 201-204) • Comprehension Shevadhi-2 (page 133)	60
Internal Assessment	40
Total	100

Learning Objectives:

1. It gives introduction to Sanskrit poetry.
2. It inspires to read the complete Bhagawad Gita.
3. It helps to build the foundation for Sanskrit vocabulary.
4. It supports the formation of sentences in Sanskrit.
5. It assists in comprehension skills.

Learning Outcomes:

1. The student gets motivated to compose poems.
2. The student imbibes the noble qualities.
3. The student develops conviction in scriptures.
4. The student learns Sanskrit speaking skills.
5. The student will be confident in learning new texts of Sanskrit.

Recommended Learning Resources

Printed Text Books

1. Samskrita Sahitya Parampare - By Dr.M.Shivakumara Swamy, Bharavi Publication, Bengaluru. RPT 1987 (Page 1-24)
2. Srimad Bhagawadgita – Vyasa.
3. Samskrita Vyavahara Sahastri – Samskrita Bharati, (Delhi-Bengalur) Page 1-18.
4. Samskrita Gadya Padya Vallari – (Page 201-204), Government of Karnataka, Karnataka Textbook Society (R) Bengaluru. RPT -2012-13.
5. Shevadhi-2 – Government of Karanataka, Bengaluru. RPT-2019. Page 133.

Digital Resources: www.archieve.org

https://www.wikipedia.org/

I Semester - BCA/BHM & other courses

Ability Enhancement Compulsory Course – 3 Credits

Sanskrit Poetry, Grammar and Comprehension (L+T+P) (3+1+0)	Marks
Unit-1 Introduction to Classical Sanskrit Poetry – Samskrita Sahitya Parampare - By Dr.M.Shivakumara Swamy (Page 1-24) **Unit-2** Selected Shlokas from Neetishataka of Bartruhari (1-40 Shlokas) **Unit-3** • Vocabulary building Samskrita Vyavahara Sahastri (page1-18) • Karaka prakarana – Samskrita Gadya Padya Vallari – (Page 201-204) • Comprehension Shevadhi-2 (page 133)	60
Internal Assessment	40
Total	100

Learning Objectives:

1. It gives introduction to Sanskrit poetry.
2. It inspires to read the complete Neetishataka.
3. It helps to build the foundation for Sanskrit vocabulary.
4. It supports the formation of sentences in Sanskrit.
5. It assists in comprehension skills.

Learning Outcomes:

1. The student gets motivated to compose poems.
2. The student imbibes the noble qualities.
3. The student develops conviction in scriptures.
4. The student learns Sanskrit speaking skills.
5. The student will be confident in learning new texts of Sanskrit.

Recommended Learning Resources

Printed Text Books

1. Samskrita Sahitya Parampare - By Dr.M.Shivakumara Swamy, Bharavi Publication, Bengaluru. RPT 1987 (Page 1-24)
2. Neetishataka – Bhartruhari.
3. Samskrita Vyavahara Sahastri – Samskrita Bharati, (Delhi-Bengalur) Page 1-18.
4. Samskrita Gadya Padya Vallari – (Page 201-204), Government of Karnataka, Karnataka Textbook Society (R) Bengaluru. RPT -2012-13.
5. Shevadhi-2 – Government of Karanataka, Bengaluru. RPT-2019. Page 133.

Digital Resources: www.archieve.org

https://www.wikipedia.org/

Curriculum for II Semester Courses 2021-22

II Semester - BA/B Music/ BFA/BPA/BSW

Ability Enhancement Compulsory Course – 3 Credits

Sanskrit Prose, Grammar and Translation (L+T+P) (3+1+0)	Marks
Unit-1 Introduction to Sanskrit Gadya Literature - Samskrita Bhashashastra Mattu Sahitya Charitre – Dr K Krishnamurthy, Vidwan Ranganathasharma and Vidwan H.K.Siddagangaiah. (page 591-638) **Unit-2** Bharata Sangraha – By Lakshmana Suri – Vana Parva and Virata Parva. **Unit-3** Identifying Namapadas – Samskrit Shabdachandrika (page 1 to 12) Identifying Sandhi – "Sandhihi" – G.Mahabaleshwara Bhat (Page 1-31) Translation from Sanskrit to Kannada/English (Unseen Sentences)	60
Internal Assessment	40
Total	100

Learning Objectives:

1. It gives introduction to Sanskrit prose.
2. It inspires to read the complete Bharata Sangraha.
3. It helps to gain the knowledge about various forms of nouns.
4. It supports the formation of sentences in Sanskrit.
5. It assists in translation skills.

Learning Outcomes:

1. The student gets motivated to make out similar works in Sanskrit literature.
2. The student imbibes the noble qualities depicted in Sanskrit literature.
3. The student acquires grammatical skills.
4. The student learns Sanskrit speaking skills.
5. The student will be confident in learning new texts of Sanskrit.

Recommended Learning Resources

Printed Text Books

1. Bharata Sangraha - Lakshmanasuri.
2. Samskrit Shabdachandrika (page 1 to 12) – Vidwan N.Ranganatha Sharma, Vidyabharati Grantha mala -3, Sringeri. 1995.
3. "Sandhihi" – G.Mahabaleshwara Bhat (Page 1-31) Samskrita Bharati, Bengaluru. RPT-2017.

Digital Resources: www.archieve.org
https://www.wikipedia.org/

II Semester - BSc/BSc FAD and all other Science and Home Science Courses

Ability Enhancement Compulsory Course – 3 Credits

Sanskrit Prose, Grammar and Translation (L+T+P) (3+1+0)	**Marks**
Unit-1 Introduction to Sanskrit Gadya Literature - Samskrita Bhashashastra Mattu Sahitya Charitre – Dr K Krishnamurthy, Vidwan Ranganathasharma and Vidwan H.K.Siddagangaiah. (page 591-638) **Unit-2** Bharata Sangraha – By Lakshmana Suri – Adi parva and Sabha Parva. **Unit-3** • Identifying Namapadas – Samskrit Shabdachandrika (page 1 to 12) • Identifying Sandhi – "Sandhihi" – G.Mahabaleshwara Bhat (Page 1-31) • Translation from Sanskrit to Kannada/English (Unseen Sentences)	60
Internal Assessment	40
Total	100

Learning Objectives:

1. It gives introduction to Sanskrit prose.
2. It inspires to read the complete Bharata Sangraha.
3. It helps to gain the knowledge about various forms of nouns.
4. It supports the formation of sentences in Sanskrit.
5. It assists in translation skills.

Learning Outcomes:

1. The student gets motivated to make out similar works in Sanskrit literature.
2. The student imbibes the noble qualities depicted in Sanskrit literature.
3. The student acquires grammatical skills.
4. The student learns Sanskrit speaking skills.
5. The student will be confident in learning new texts of Sanskrit.

Recommended Learning Resources

Printed Text Books

1. Bharata Sangraha - Lakshmanasuri.
2. Samskrit Shabdachandrika (page 1 to 12) – Vidwan N.Ranganatha Sharma, Vidyabharati Grantha mala -3, Sringeri. 1995.
3. "Sandhihi" – G.Mahabaleshwara Bhat (Page 1-31) Samskrita Bharati, Bengaluru. RPT-2017.

Digital Resources: www.archieve.org

https://www.wikipedia.org/

II Semester -B Com

Ability Enhancement Compulsory Course – 3 Credits

Sanskrit Prose, Grammar and Translation (L+T+P) (3+1+0)	Marks
Unit-1 Introduction to Sanskrit Gadya Literature - Samskrita Bhashashastra Mattu Sahitya Charitre – Dr K Krishnamurthy, Vidwan Ranganathasharma and Vidwan H.K.Siddagangaiah. (page 591-638) **Unit-2** Bharata Sangraha – By Lakshmana Suri – Udyoga parva and Bhishma parva. **Unit-3** • Identifying Namapadas – Samskrit Shabdachandrika (page 1 to 12) • Identifying Sandhi – "Sandhihi" – G.Mahabaleshwara Bhat (Page 1-31) • Translation from Sanskrit to Kannada/English (Unseen Sentences)	60
Internal Assessment	40
Total	100

Learning Objectives:

1. It gives introduction to Sanskrit prose.
2. It inspires to read the complete Bharata Sangraha.
3. It helps to gain the knowledge about various forms of nouns.
4. It supports the formation of sentences in Sanskrit.
5. It assists in translation skills.

Learning Outcomes:

1. The student gets motivated to make out similar works in Sanskrit literature.
2. The student imbibes the noble qualities depicted in Sanskrit literature.
3. The student acquires grammatical skills.
4. The student learns Sanskrit speaking skills.
5. The student will be confident in learning new texts of Sanskrit.

Recommended Learning Resources

Printed Text Books

1. Bharata Sangraha - Lakshmanasuri.
2. Samskrit Shabdachandrika (page 1 to 12) – Vidwan N.Ranganatha Sharma, Vidyabharati Grantha mala -3, Sringeri. 1995.
3. "Sandhihi" – G.Mahabaleshwara Bhat (Page 1-31) Samskrita Bharati, Bengaluru. RPT-2017.

Digital Resources: www.archieve.org

https://www.wikipedia.org/

II Semester - B B A and other Management Courses

Ability Enhancement Compulsory Course – 3 Credits

Sanskrit Prose, Grammar and Translation (L+T+P) (3+1+0)	Marks
Unit-1 Introduction to Sanskrit Gadya Literature - Samskrita Bhashashastra Mattu Sahitya Charitre – Dr K Krishnamurthy, Vidwan Ranganathasharma and Vidwan H.K.Siddagangaiah. (page 591-638) **Unit-2** Kadambari – By Banabhatta – Shukanasopadesha and Chandrapeeda Vidyabhyasa. **Unit-3** • Identifying Namapadas – Samskrit Shabdachandrika (page 1 to 12) • Identifying Sandhi – "Sandhihi" – G.Mahabaleshwara Bhat (Page 1-31) • Translation from Sanskrit to Kannada/English (Unseen Sentences)	60
Internal Assessment	40
Total	100

Learning Objectives:

1. It gives introduction to Sanskrit prose.
2. It inspires to read the complete Kadambari of Banabhatta.
3. It helps to gain the knowledge about various forms of nouns.
4. It supports the formation of sentences in Sanskrit.
5. It assists in translation skills.

Learning Outcomes:

1. The student gets motivated to make out similar works in Sanskrit literature.
2. The student imbibes the noble qualities depicted in Sanskrit literature.
3. The student acquires grammatical skills.
4. The student learns Sanskrit speaking skills.
5. The student will be confident in learning new texts of Sanskrit.

Recommended Learning Resources

Printed Text Books

1. Kadambari - Banabhatta.
2. Samskrit Shabdachandrika (page 1 to 12) – Vidwan N.Ranganatha Sharma, Vidyabharati Grantha mala -3, Sringeri. 1995.
3. "Sandhihi" – G.Mahabaleshwara Bhat (Page 1-31) Samskrita Bharati, Bengaluru. RPT-2017.

Digital Resources: www.archieve.org
https://www.wikipedia.org/

II Semester - BCA/BHM & other courses

Ability Enhancement Compulsory Course – 3 Credits

Sanskrit Prose, Grammar and Translation (L+T+P) (3+1+0)	Marks
Unit-1 Introduction to Sanskrit Gadya Literature - Samskrita Bhashashastra Mattu Sahitya Charitre – Dr K Krishnamurthy, Vidwan Ranganathasharma and Vidwan H.K.Siddagangaiah. (page 591-638) **Unit-2** Dashakumaracharitam – Dandi – Chapter 1 - Poorvapeethika **Unit-3** • Identifying Namapadas – Samskrit Shabdachandrika (page 1 to 12) • Identifying Sandhi – "Sandhihi" – G.Mahabaleshwara Bhat (Page 1-31) • Translation from Sanskrit to Kannada/English (Unseen Sentences)	60
Internal Assessment	40
Total	100

Learning Objectives:

1. It gives introduction to Sanskrit prose.
2. It inspires to read the complete Dashakumaracharitam.
3. It helps to gain the knowledge about various forms of nouns.
4. It supports the formation of sentences in Sanskrit.
5. It assists in translation skills.

Learning Outcomes:

1. The student gets motivated to make out similar works in Sanskrit literature.
2. The student imbibes the noble qualities depicted in Sanskrit literature.
3. The student acquires grammatical skills.
4. The student learns Sanskrit speaking skills.
5. The student will be confident in learning new texts of Sanskrit.

Recommended Learning Resources

Printed Text Books

1. Dashakumaracharitam – Dandi
2. Samskrit Shabdachandrika (page 1 to 12) – Vidwan N.Ranganatha Sharma, Vidyabharati Grantha mala -3, Sringeri. 1995.
3. "Sandhihi" – G.Mahabaleshwara Bhat (Page 1-31) Samskrita Bharati, Bengaluru. RPT-2017.

Digital Resources: www.archieve.org
https://www.wikipedia.org/

Discipline Specific Core (DSC) - Gadyakavya A1 (3)

I Semester – BA (Basic/ Hons.) – 3 Credits

Gadyakavya **(L+T+P) (3+1+0)**	**Marks**
Unit-1 Dashakumaracharitam – Dandi – Uttarapeethika - Chapter 1 **Unit-2** Dashakumaracharitam – Dandi – Uttarapeethika - Chapter 2 **Unit-3** Dashakumaracharitam – Dandi – Uttarapeethika - Chapter 3	60
Internal Assessment	40
Total	100

Learning Objectives:

1. It inspires to read the complete Dashkumaracharita and so on.
2. It assists in acquiring advanced learning skills.

Learning Outcomes:

1. The student gets motivated to make out similar works in Sanskrit literature.
2. The student imbibes the noble qualities depicted in Sanskrit literature.
3. The student acquires grammatical skills.
4. The student will be confident in learning new texts of Sanskrit.

Recommended Learning Resources

Printed Text Books

Dashakumaracharitam – Dandi

Digital Resources: www.archieve.org

https://www.wikipedia.org/

Discipline Specific Core (DSC) - Padyakavya A2 (3)

I Semester – BA (Basic/ Hons.) – 3 Credits

Padyakavya (L+T+P) (3+1+0)	Marks
Unit-1 Shishupalavadham – Magha – Sarga1 with Mallinatha commentary – 1 to 25 shlokas. **Unit-2** Shishupalavadham – Magha – Sarga1 with Mallinatha commentary – 26 to 50 shlokas. **Unit-3** Shishupalavadham – Magha – Sarga1 with Mallinatha commentary – 51 to 75 shlokas.	60
Internal Assessment	40
Total	100

Learning Objectives:

1. It inspires to read the complete Shishupalavadham and so on.
2. It assists in acquiring advanced learning skills.

Learning Outcomes:

1. The student gets motivated to make out similar works in Sanskrit literature.
2. The student imbibes the noble qualities depicted in Sanskrit literature.
3. The student acquires grammatical skills.
4. The student will be confident in learning new texts of Sanskrit.

Recommended Learning Resources

Printed Text Books

Dashakumaracharitam – Dandi

Digital Resources: www.archieve.org

https://www.wikipedia.org/

Discipline Core (DSC) – Champukavya- A 3(3)

I Semester – BA (Basic/ Hons.) – 3 Credits

Champukavya (L+T+P) (3+1+0)	Marks
Unit-1 Champuramayanam – Bhojadeva – Balakanda – 1 to 40 shlokas **Unit-2** Champuramayanam – Bhojadeva – Balakanda – 41 to 80 shlokas **Unit-3** Champuramayanam – Bhojadeva – Balakanda - 81 to 117 shlokas	60
Internal Assessment	40
Total	100

Learning Objectives:

1. It inspires to read the complete Champuramayanam and so on.
2. It assists in acquiring advanced learning skills.

Learning Outcomes:

1. The student gets motivated to make out similar works in Sanskrit literature.
2. The student imbibes the noble qualities depicted in Sanskrit literature.
3. The student acquires grammatical skills.
4. The student will be confident in learning new texts of Sanskrit.

Recommended Learning Resources

Printed Text Books

Champuramayanam – Bhojadeva

Digital Resources: www.archieve.org

https://www.wikipedia.org/

Discipline Core (DSC) – Nataka- A 4(3)

I Semester – BA (Basic/ Hons.) – 3 Credits

Nataka (L+T+P) (3+1+0)	Marks
Unit-1 Abhijnana Shakuntalam – Kalidasa – Act 1. **Unit-2** Abhijnana Shakuntalam – Kalidasa – Acts 2 & 3. **Unit-3** Abhijnana Shakuntalam – Kalidasa – Act 4.	60
Internal Assessment	40
Total	100

Learning Objectives:

1. It inspires to read the complete Abhijnana Shakuntalam and so on.
2. It assists in acquiring advanced learning skills.

Learning Outcomes:

1. The student gets motivated to make out similar works in Sanskrit literature.
2. The student imbibes the noble qualities depicted in Sanskrit literature.
3. The student acquires grammatical skills.
4. The student will be confident in learning new texts of Sanskrit.

Recommended Learning Resources

Printed Text Books

Abhijnana Shakuntalam – Kalidasa

Digital Resources: www.archieve.org

https://www.wikipedia.org/

Open Elective (OE)

I Semester – BA (Basic/ Hons.) – 3 Credits

Hitopadesha **(L+T+P)(3+1+0)**	**Marks**
Unit-1 Hitopadesha – Mitralabha - Story 1&2 **Unit-2** Hitopadesha – Mitralabha - Story 3 to 5 **Unit-3** Hitopadesha – Mitralabha - Story 6 to 8	60
Internal Assessment	40
Total	100

Learning Objectives:

1. It inspires to read the complete Hitopadesha and so on.
2. It assists in acquiring advanced learning skills.

Learning Outcomes:

1. The student gets motivated to make out similar works in Sanskrit literature.
2. The student imbibes the noble qualities depicted in Sanskrit literature.
3. The student acquires grammatical skills.
4. The student will be confident in learning new texts of Sanskrit.

Recommended Learning Resources

Printed Text Books

Hitopadesha – Mitralabha

Digital Resources: www.archieve.org

https://www.wikipedia.org/

Open Elective (OE)

II Semester – BA (Basic/ Hons.) – 3 Credits

Subhashita (L+T+P)(3+1+0)	Marks
Unit-1 Samayochita Sandarbha Sooktayah – 1 to 30 shlokas **Unit-2** Samayochita Sandarbha Sooktayah – 31 to 60 shlokas **Unit-3** Samayochita Sandarbha Sooktayah – 61 to 100 shlokas	60
Internal Assessment	40
Total	100

Learning Objectives:

1. It inspires to read the complete Hitopadesha and so on.
2. It assists in acquiring advanced learning skills.

Learning Outcomes:

1. The student gets motivated to make out similar works in Sanskrit literature.
2. The student imbibes the noble qualities depicted in Sanskrit literature.
3. The student acquires grammatical skills.
4. The student will be confident in learning new texts of Sanskrit.

Recommended Learning Resources

Printed Text Books

Samayochita Sandarbha Sooktayah – 1 to 100 shlokas – Dr.G.N.Bhat, Canara College, Mangalore.

Digital Resources: www.archieve.org
https://www.wikipedia.org/

Skill Enhancement Course (SEC)

I Semester – BA (Basic/ Hons.) – 2 Credits

Digital Fluency - Sanskrit & Computer Literacy (2) (L+T+P) (1+0+2)	Marks
Basic computer skills in Sanskrit / conversational Sanskrit / Translation / Sanskrit typing	30
Internal Assessment	20
Total	50

Learning Objectives:

1. It inspires to explore Sanskrit sources in internet.
2. It assists in acquiring advanced computer skills.

Learning Outcomes:

1. The student gets motivated to discover new avenues in Sanskrit.
2. The student will be confident in learning new skills relevant to Sanskrit.

Recommended Learning Resources
Printed Text Books:

Digital Resources: www.archieve.org
https://www.wikipedia.org/

Skill Enhancement Course (SEC)

II Semester – BA (Basic/ Hons.) – 2 Credits

Health and Wellness/ Social & Emotional Learning (2) - Yoga & Ayurveda -1 (L+T+P) (1+0+2)	Marks
Yoga – Vivekananda Kendra, Mysuru. Ayurveda – Sushruta Samhita – Part 1 - Chapter 1 -	30
Internal Assessment	20
Total	50

Learning Objectives:

1. It inspires to explore Sanskrit sources in internet.
2. It assists in acquiring advanced computer skills.

Learning Outcomes:

1. The student gets motivated to discover new avenues in Sanskrit.
2. The student will be confident in learning new skills relevant to Sanskrit.

Recommended Learning Resources

Printed Text Books

Yoga – Vivekananda Kendra, Mysuru. 11th edition.

Ayurveda – Sushruta Samhita

Digital Resources: www.archieve.org

https://www.wikipedia.org/

Pedagogy

- Lecture
- Interaction and Deliberation.
- Group Discussion.
- Learning and teaching in the class.
- Creation of a situation.
- Enacting a dramatic scene
- Fieldwork or Assignment.
- Excursion.
- Written examination
- Internal Assessment
- Promoting research activities
- Usage of Multimedia
- Conducting Continuous and comprehensive Evaluation.

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JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE

(Autonomous)

B N ROAD, MYSURU- 570 025

DEPARTMENT OF MATHEMATICS

Syllabus

CHOICE BASED CREDIT SYSTEM

For B.Sc programmes

- **Physics, Mathematics and Chemistry**
- **Physics, Mathematics and Computer Science**
- **Physics, Mathematics and Computer Maintenance**
- **Physics, Mathematics and Electronics**

2019-2020

JSS COLLEGE OF ARTS, COMMERCE & SCIENCE (AUTONOMOUS)

B.N ROAD, MYSORE

DEPARTMENT OF MATHEMATICS

B.Sc Syllabus (CBCS)

LIST OF COURSES WITH CREDIT PATTREN

Year	Semester	DSC/DSE/SEC	Title of the paper	Lecture +Practical hours per week	No. of Credits			Total Credits	Total hours		Maximum Marks in Exam/Assesment				Exam duration
					L	T	P		Th	Pr	Exam	IA		Total	
												C1	C2		
I B.Sc	I	DSC-I Theory	Differential Calculus	04	4	0	0	**6**	60	60	70	15	15	100	3h
		DSC-I Practical		04	0	0	2				35	7.5	7.5	50	
	II	DSC-II Theory	Differential Equations	04	4	0	0	**6**	60	60	70	15	15	100	3h
		DSC-II Practical		04	0	0	2				35	7.5	7.5	50	
II B.Sc	III	DSC-III Theory	Real Analysis	04	4	0	0	**6**	60	60	70	15	15	100	3h
		DSC-III Practical		04	0	0	2				35	7.5	7.5	50	
	IV	DSC-IV Theory	Algebra	04	4	0	0	**6**	60	60	70	15	15	100	3h
		DSC-IV Practical		04	0	0	2				35	7.5	7.5	50	
III B.Sc	V	DSE-I Theory	Linear Algebra / Matrices	04	4	0	0	**6**	60	60	70	15	15	100	3h
		DSE-I Practical	Based on theory	04	0	0	2				35	7.5	7.5	50	
	VI	DSE-II Theory	Complex Analysis / Numerical Methods	04	4	0	0	**6**	60	60	70	15	15	100	3h
		DSE-II Practical	Based on theory	04	0	0	2				35	7.5	7.5	50	
		SEC	Vector calculus	02	2	0	0	**2**	30	-	35	7.5	7.5	50	2h

Scheme of Assessment:

Credits L:T:P	Percentage			Maximum marks in the Exam /Assessment			Exam Duration	
	Th	Pr	IA	Th	Pr	IA	Th	Pr
4:0:2	50	20	30	70	70	30	3h	3h
5:1:0	70	-	30	70	-	30	3h	-
4:0:0	70	-	30	70	-	30	3h	-
2:0:2	35	35	30	50	70	30	2h	3h
3:0:0	70	-	30	70	-	30	3h	-
2:1:0	70	-	30	70	-	30	3h	-
2:0:0	70	-	30	50	-	30	2h	-
0:0:1	-	70	30	-	70	30	-	2h

Note: L-Lecture, T-Tutorial, P-Practical; Th- Theory, Pr-Practical,

I A- Internal Assessment

SEMESTER III

Credits: L: T: P = 4:0:0 **Teaching hours: 4 hours per week**

DSC III : Real Analysis

Unit I: Finite and infinite sets, examples of countable and uncountable sets.Real line, bounded sets, supremum and infimum, completeness property of R, Archimedean property of R, intervals. Concept of cluster points and statement of Bolzano-Weistrass theorem.

Unit II: Real Sequence, Bounded sequence, Cauchy convergence criterion for sequences. Cauchy's theorem on limits, order preservation and squeeze theorem, monotone sequences and their convergence .

Unit III: Infinite series. Cauchy convergence criterion for series, positive term series, geometric series, comparison test, convergence of p-series, Root test, Ratio test, alternating series, Leibnitz's test , Definition and examples of absolute and conditional convergence.

Unit IV: Sequences and series of functions, Point wise and uniform convergence. Mn-test, M-test, Statements of the results about uniform convergence, Power series and radius of convergence.

Reference Books:

1. S.C Malik –Real Analysis
2. S.C.Malik and Savita Arora, *Mathematical Analysis*, 2nd ed. New Delhi, India: New Age international (P) Ltd., 1992
3. Richard R Goldberg, Methods of Real Analysis, Indian ed.
4. Asha Rani Singhal and M .K Singhal, A first course in Real Analysis
5. E.Kreyszig- Advanced Engineering Mathematics, Wiely India Pvt. Ltd.
6. Raisinghania M. D., Laplace and Fourier Transforms S. Chand publications.
7. Principles of Mathematical Analysis- Walter Rudin.
8. Mathematical Analysis- Tom M Apostol

PRACTICAL COMPONENTS –III

Credits: L: T: P = 0:0:2

1. Illustration of convergent, divergent and oscillatory sequences.
2. Plotting of recursive sequences.
3. Study of convergence of sequences through plotting
4. Illustration of convergent, divergent and oscillatory series.
5. To study the convergence and divergence of infinite series by plotting their sequences of partial sums.
6. Using Cauchy's criterion on the sequence of partial sums of the series to determine convergence of series.
7. Cauchy's root test by plotting n^{th} roots.
8. Ratio test by plotting the ratio of n^{th} and $(n+1)^{th}$ terms.
9. Testing the convergence of binomial, exponential and logarithmic series and finding the sum.
10. To find the sum of the series and it's radius of convergence.

SEMESTER IV

Credits: L: T: P = 4:0:0 **Teaching hours: 4 hours per week**

DSC IV: Algebra

Unit I: Definition and examples of groups, examples of abelian and non-abelian groups, the group Zn of integers under addition modulo n and the group U(n) of units under multiplication modulo n. Cyclic groups from number systems, complex roots of unity, cyclic group, groups of symmetries ,the permutation group , Group of quarter nion's.

Unit II: Subgroups, cyclic subgroups, the concept of a subgroup generated by a subset and the commutator subgroup of group, examples of subgroups including the center of a group. Cosets, Index of subgroup, Lagrange's theorem, order of an element, Normal subgroups: their definition, examples, and characterizations, Quotient groups. Homomorphism, Kernal and Image, Isomorphism, Fundamental Theorem of Homomorphism.

Unit III: Definition and examples of rings, examples of commutative and non- commutative rings: rings from number systems, Zn the ring of integers modulo n, ring of real quaternion's, rings of matrices, polynomial rings, and rings of continuous functions. Sub rings and ideals.

Unit IV: Integral domains and fields, examples of fields: Zp, Q, R, and C. Field of rational functions. Homomorphisms', Isomorphism'.

Reference Books :

1. I. N. Herstien – Topics in Algebra.
2. Joseph Gallian – Contemporary Abstract Algebra, Narosa Publishing House, New Delhi, Fourth Edition.
3. G. D. Birkhoff and S Maclane – A brief Survey of Modern Algebra.
4. J B Fraleigh – A first course in Abstract Algebra.
5. Michael Artin – Algebra, 2nd ed. New Delhi, India: PHI Learning Pvt. Ltd., 2011.
6. Vashista, A First Course in Modern Algebra, 11th ed.: Krishna Prakasan Mandir, 1980.
7. R Balakrishan and N.Ramabadran, A Textbook of Modern Algebra, 1st ed. New Delhi, India: Vikas publishing house pvt. Ltd., 1991.
8. University algebra by N.S.Gopalakrishnan

PRACTICAL COMPONENTS-IV

Credits: L: T: P = 0:0:2

1. Verifying whether a given operator is binary or not.
2. To find identity element of a group.
3. To find inverse element of a group.
4. Finding all possible subgroups of a finite group.
5. Examples to verify Lagrange's theorem.
6. Illustrating homomorphism and isomorphism of groups.
7. Verification of normality of a given subgroup.
8. Verifying Cayley's theorem and isomorphism theorems.
9. Examples for finding left and right coset and finding the index of a group.
10. Examples on different types of rings.
11. Examples on integral domains and fields.
12. Examples on subrings, ideals and subrings which are not ideals.
13. Homomorphism and isomorphism of rings – illustrative examples.
14. Solving polynomial equations.
15. Finding the G.C.D of polynomials.
16. Finding units and associates.
17. Test for rational roots.

SEMESTER V

Credits: L: T: P = 4:0:0 **Teaching hours: 4 hours per week**

DSE I: Linear Algebra

Unit I: Vector spaces, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces, Direct sum of two subspaces, Quotient space.

Unit II: Inner Product, Inner Product of any two vectors in V (R), Euclidean Vectorspace, Orthogonal Vectors, Ortho normal Basis, Orthogonal Projection, Orthogonal Compliment.

Unit III: Linear transformations, algebra of linear transformations , matrix representation of a linear transformation, null space, range, rank and nullity of a linear transformation,

Unit IV: Eigen values and Eigen vectors, Characteristic Polynomial. Isomorphism, Auto morphism, theorems, invertibility of non singular linear transformation, change of Basis and similar matrices.

Reference Books:

1. I. N. Herstien – Topics in Algebra.
2. Stewart – Introduction to Linear Algebra
3. S. Kumaresan – Linear Algebra
4. G. D. Birkhoff and S Maclane – A brief Survey of Modern Algebra.
5. N.S.Gopalakrishna – University Algebra
6. Saymour Lipschitz – Theory and Problems of Linear Algebra.
7. B.S Grewal – Higher engineering mathematics.
8. E.Kreyszig – Advanced Engineering Mathematics, Wiely India Pvt. Ltd.
9. J B Fraleigh – A first course in Abstract Algebra.

PRACTICAL COMPONENTS–V

Credits: L: T: P = 0:0:2

1. Vector space, subspace – illustrative examples.
2. Expressing a vector as a linear combination of given set of vectors.
3. Examples on linear dependence and independence of vectors.
4. Basis and Dimension – illustrative examples.
5. Verifying whether a given transformation is linear.
6. Finding matrix of a linear transformation.
7. Problems on rank and nullity.
8. Find characteristics polynomials.
9. To find Eigen values and their multiplicity.
10. Calculation of Eigen vector.
11. Change of basis.
12. Linear transformations to matrices and vice versa.
13. Matrix with respect to change of basis.
14. Orthogonal and orthonormal sets.
15. Gram- Schmidt orthogonalisation of the columns.

SEMESTER V

Credits: L: T: P = 4:0:0 **Teaching hours: 4 hours per week**

DSE I A: Matrices

Unit I: Types of matrices. Rank of a matrix. Invariance of rank under elementary transformations. Reduction to normal form, Solutions of linear homogeneous and non-homogeneous equations with number of equations and unknowns upto four.

Unit II: Matrices in diagonal form. Reduction to diagonal form upto matrices of order 3. Computation of matrix inverses using elementary row operations. Rank of matrix. Solutions of a system of linear equations using matrices. Illustrative examples of above concepts from Geometry, Physics, Chemistry, Combinatorics and Statistics.

Unit III: R1, R2, R3 as vector spaces over R. Standard basis for each of them. Concept of Linear Independence and examples of different bases.Subspaces of R2, R3.

Unit IV: Translation, Dilation, Rotation, Reflection in a point, line and plane. Matrix form of basic geometric transformations. Interpretation of eigen values and eigen vectors for such transformations and eigen spaces as invariant subspaces.

Reference Books:

1. A.I. Kostrikin, Introduction to Algebra, Springer Verlag, 1984.
2. S. H. Friedberg, A. L. Insel and L. E. Spence, Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi, 2004.
3. Richard Bronson, Theory and Problems of Matrix Operations, Tata McGraw Hill, 1989.
4. E.Kreyszig – Advanced Engineering Mathematics, Wiely India Pvt. Ltd
5. B.S Grewal – Higher engineering mathematics

PRACTICAL COMPONENTS-V

Credits: L:T:P = 0:0:2

1. Introduction to matrices and commands connected to the matrices.
2. Addition and subtraction of matrices.
3. Multiplication and transpose of matrices.
4. Power of a matrix.
5. Row reduced echelon form.
6. Rank of a matrix.
7. Adjoint of a matrix.
8. Inverse of a non-singular matrix.
9. Systems of linear equations.
10. Trace of a matrix.

SEMESTER VI

Credits: L:T: P = 4:0:0 **Teaching hours: 4 hours per week**

DSE II: Complex Analysis

Unit I: Complex numbers, Polar and exponential form of complex numbers, Triangular inequality, Geometry of complex numbers, Equations of lines and circles in complex form ,Functions of complex variables, Limits, Limits involving the point at infinity, continuity. Properties of complex numbers, regions in the complex plane, Derivatives, differentiation formulas, Cauchy-Riemann equations, sufficient conditions for differentiability.

Unit II: Analytic functions, examples of analytic functions, exponential function, Logarithmic function, trigonometric function, Harmonic functions, Construction of Analytic functions.

Unit III: Definite integrals of functions. Contours, Contour integrals and its examples, upper bounds for moduli of contour integrals. Cauchy-Goursat theorem, Cauchy integral formula, Cauchy's inequality, Liouville's theorem and the fundamental theorem of algebra. Convergence of sequences and series.

Unit IV: Linear and Bilinear Transformations, Cross ratio of four points , Conformal mapping, Transformations of the form z^2, $\frac{1}{z}$, $sinz$, $cosz$, e^z , $\sinh z$, $\cosh z$ etc , Laurent series and its examples, Poles and residues.

Reference Books:

1. L. V. Ahlfors – Complex Analysis
2. Bruce P. Palica – Introduction to the Theory of Function of a Complex Variable
3. Serge Lang – Complex Analysis
4. Shanthinarayan – Theory of Functions of a Complex Variable
5. S. Ponnuswamy – Foundations of Complex Analysis
6. R. P. Boas – Invitation to Complex Analysis.
7. R V Churchil & J W Brown, Complex Variables and Applications,5th ed.:McGraw Hill Companies., 1989.
8. A R Vashista, Complex Analysis, Krishna Prakashana Mandir, 2012.

PRACTICAL COMPONENTS-VI

Credits: L:T:P = 0:0:2

1. Declaring a complex number and graphical representation.
2. Complex numbers and their representations, operations like addition, multiplication, division, modulus, graphical representations of polar form.
3. To plot the complex functions and analyze the graph

   (i)$f(z)= z$, (ii) $f(z) = z^3$, (iii) $f(z) =(z^4- 1)^{1/4}$
4. Some problems on Cauchy – Riemann equations (polar forms).
5. Implementation of Milne – Thomson method of constructing analytic functions (simple examples).
6. Illustrating orthogonality of the surfaces obtained from the real and imaginary parts of an analytic function.
7. Verifying real and imaginary parts of an analytic function being harmonic (in polar coordinates)
8. Examples connected with Cauchy's integral theorem.
9. To compute the poles and corresponding residues of complex functions.
10. Illustrating the angle preserving property in a transformation.
11. Illustrating the circles are transformed to circles by a bilinear transformation.
12. To perform conformal mapping and bilinear transformations.

SEMESTER VI

Credits: L:T: P = 4:0:0 **Teaching hours: 4 hours per week**

DSE II B: Numerical Methods

Unit I: Algorithms, Convergence, Bisection method, False position method, Fixed point iteration method, Newton's method, Secant method, LU decomposition, Gauss-Jacobi, Gauss-Siedel and SOR iterative methods.

Unit II: Lagrange and Newton interpolation: linear and higher order, finite difference operators. Numerical differentiation: forward difference, backward difference and central Difference. Integration: trapezoidal rule, Simpson's rule, Euler's method.

Reference Books:

1. B. Bradie, A Friendly Introduction to Numerical Analysis, Pearson Education, India, 2007.
2. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, 5th Ed., New age International Publisher, India, 2007.
3. Introduction to Numerical analysis by S.S.Shasthri
4. B.S Grewal – Higher engineering mathematics
5. E.Kreyszig – Advanced Engineering Mathematics, Wiely India Pvt. Ltd

PRACTICAL COMPONENTS-VI A

Credits: L:T:P = 0:0:2

1. Newton Gregory forward interpolation.
2. Lagrange interpolation.
3. Simpson's one-third method.
4. Simpson's three-eighth method.
5. Bisection method.
6. Regula-Falsi method.
7. Newton-Raphson method.
8. Modified Euler's metod.
9. Runge Kutta second order method.
10. Runge Kutta fourth order method.

Vector Calculus

Credits: L:T: P = 2:0:0 **Teaching hours: 2 hours per week**

Skill Enhancement Course (SEC - II)

Unit I: Differentiation and partial differentiation of a vector function. Derivative of sum, dot product and cross product of two vectors.

Unit II: Gradient, divergence and curl, Standard derivations and Exercise ,

Reference Books:

1. Murray R Spiegel – Theory and problems of vector calculus.
2. Shanthinarayan and J N Kapur – A text book of Vector calculus.
3. B.S Grewal – Higher engineering mathematics.
4. Shanthi Narayan and P K Mittal, Differential Calculus, Reprint. New Delhi: S Chand and Co. Pvt. Ltd., 2014.

Question Paper Pattern

Mathematics

Time: 3 Hours **Max. Marks:** 70

Section – A

I. Answer any five questions. **5 x2 = 10**

1.
2.
3.
4.
5.
6.
7.
8.

Section – B

II. Answer any three questions. **3 x 5 = 15**

1.
2.
3.
4.
5.

III. Answer any three questions. **3 x 5 = 15**

1.
2.
3.
4.
5.

IV. Answer any three questions. **3 x 5 = 15**

1.
2.
3.
4.
5.

V. Answer any three questions. **3 x 5 = 15**

1.
2.
3.

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE

(Autonomous)

OOTY ROAD, MYSURU- 570 025

NATIONAL EDUCATION POLICY 2020 INITIATIVES

B.Sc. (Hons) Mathematics,

B.Sc. with Mathematics as a Major/Minor Subject

Syllabus for B.Sc (Hons) programmes

- **Physics and Mathematics**
- **Computer Science and Mathematics**

W.E.F. THE ACADEMIC YEAR 2021-22

DEPARTMENT OF MATHEMATICS

List of Courses with Credit Pattern B.Sc/B.Sc(Hons)

Sem	Programme	Programme Code	Course code	Title of the course	Course type	Credit Pattern L:T:P	Total credit	Teaching hrs/week	Evaluation pattern			
									C1	C2	C3	Total Marks
I	PM	BScPhMa32	FSA43032	Algebra-I and Calculus-I	DSC-Theory	4:0:0	4	4	20	20	60	100
				Theory based practical's on Algebra-I and Calculus-I	DSC-Practical	0:0:2	2	4	10	15	25	50
	CsM	BScCsMa34	FSA43034	Algebra-I and Calculus-I	DSC-Theory	4:0:0	4	4	20	20	60	100
				Theory based practical's on Algebra-I and Calculus-I	DSC- Practical	0:0:2	2	4	10	15	25	50
			FSA840	Mathematical Aptitude-I	OE- Theory	3:0:0	3	3	20	20	60	100
			FSA850	Business Mathematics-I	OE- Theory	3:0:0	3	3	20	20	60	100
				Optional Mathematics-I	OE- Theory	3:0:0	3	3	20	20	60	100
II	PM	BScPhMa32	FSB43032	Algebra-II (Number Theory)and Calculus-II	DSC- Theory	4:0:0	4	4	20	20	60	100
				Theory based practical's on Algebra-II (Number Theory)and Calculus-II	DSC- Practical	0:0:2	2	4	10	15	25	50
	CsM	BScCsMa34	FSB43034	Algebra-II (Number Theory)and Calculus-II	DSC- Theory	4:0:0	4	4	20	20	60	100
				Theory based practical's on Algebra-II (Number Theory)and Calculus-II	DSC- Practical	0:0:2	2	4	10	15	25	50
			FSB840	Mathematical Aptitude-II	OE- Theory	3:0:0	3	3	20	20	60	100
			FSB850	Business Mathematics-II	OE- Theory	3:0:0	3	3	20	20	60	100
				Optional Mathematics-II	OE- Theory	3:0:0	3	3	20	20	60	100

Preamble

The subject wise expert committee to draft model curriculum contents in Mathematics constituted by the Department of Higher Education, Government of Karnataka, Bangalore vide GO No. ED 260 UNE 2019 (PART-1) DATED 13.08.2021 is pleased to submit its partial report on the syllabus for the First Year (First & Second Semesters) B.Sc.(Basic/Honors) Mathematics and detailed Course Structure for B.Sc.(Honors) Mathematics and M.Sc. (One Year) Mathematics.

The committee discussed various models suggested by the Karnataka State Higher Education Council in its joint meetings with the Chairpersons of Board of Studies of all state universities in Karnataka and resolved to adopt Model IIA *Bachelor of Science (Basic/Hons.*) for the subjects with practical's with Mathematics as Major/Minor.

To achieve the core objectives of the National Education Policy 2020 it is unanimously resolved to introduce computer based practical's for the Discipline Core (DSC) courses by using Free and Open Source Software's (FOSS) tools for implementation of theory based on DSC courses as it is also suggested by the LOCF committee that the papers may be taught using various Computer Algebra System (CAS) software's such as Mathematica, MATLAB, Maxima and R to strengthen the conceptual understanding and widen up the horizon of students' self-experience. In view of these observations the subject expert committee suggested the software's Phython /R / Maxima/ Scilab/ Maple/MatLab/Mathematica for hands on experience of implementation of mathematical concepts in computer based lab.

The expert committee suggests the implementation this curriculum structure in all the Departments of Mathematics in Universities/Colleges in Karnataka.

The subject expert committee designed the Course Learning Outcome (CO) to help the learners to understand the main objectives of studying the courses by keeping in mind of the Programme outcomes (PO) of the graduate degree with honors in Mathematics or a graduate degree with Mathematics as a major subject.

As the Mathematics subject is a vast with several branches of specializations, it is difficult for every student to learn each branch of Mathematics, even though each paper has its own importance. Hence the subject expert committee suggests number of elective papers (for both Discipline electives and Open Electives) along with Discipline Core Courses. The BoS in Mathematics of universities may include additional electives based on the expertise of their staff and needs of the students'. A student can select elective paper as per her/his needs and interest.

The subject expert committee in Mathematics suggests that the concerned Department/Autonomous Colleges/Universities to encourage their faculty members to include necessary topics in addition to courses suggested by the expert committee.

Name of the Degree Program : **B.Sc.**
Discipline Course : **Mathematics**
Year of Implementation : **2021-22**

Programme Outcomes (PO): By the end of the program the students will be able to :

PO 1	**Disciplinary Knowledge** : Bachelor degree in Mathematics is the culmination of in-depth knowledge of Algebra, Calculus, Geometry, differential equations and several other branches of pure and applied mathematics. This also leads to study the related areas such as computer science and other allied subjects
PO 2	**Communication Skills**: Ability to communicate various mathematical concepts effectively using examples and their geometrical visualization. The skills and knowledge gained in this program will lead to the proficiency in analytical reasoning which can be used for modeling and solving of real life problems.
PO 3	**Critical thinking and analytical reasoning:** The students undergoing this programme acquire ability of critical thinking and logical reasoning and capability of recognizing and distinguishing the various aspects of real life problems.
PO 4	**Problem Solving** : The Mathematical knowledge gained by the students through this programme develop an ability to analyze the problems, identify and define appropriate computing requirements for its solutions. This programme enhances students overall development and also equip them with mathematical modelling ability, problem solving skills.
PO 5	**Research related skills:** The completing this programme develop the capability of inquiring about appropriate questions relating to the Mathematical concepts in different areas of Mathematics.
PO 6	**Information/digital Literacy**: The completion of this programme will enable the learner to use appropriate softwares to solve system of algebraic equation and differential equations.
PO 7	**Self – directed learning**:The student completing this program will develop an ability of working independently and to make an in-depth study of various notions of Mathematics.
PO 8	**Moral and ethical awareness/reasoning:** : The student completing this program will develop an ability to identify unethical behavior such as fabrication, falsification or misinterpretation of data and adopting objectives, unbiased and truthful actions in all aspects of life in general and Mathematical studies in particular.
PO 9	**Lifelong learning**: This programme provides self directed learning and lifelong learning skills. This programme helps the learner to think independently and develop algorithms and computational skills for solving real word problems.
PO 10	Ability to peruse advanced studies and research in pure and applied Mathematical sciences.

PROGRAMME SPECIFIC OUTCOME:

Bachelor of Science in (i) Physics and Mathematics and

(ii) Computer Science and Mathematics

After completing the graduation in the above discipline, they are able to :

PSO1.Find carrier opertunities in organization , industries/civil service exam/teaching where a high level competence in mathematics and physics is demanded

PSO2.Develop proficiency in the analysis of complex physical problems and the use mathematical or other appropriate technique to solve them

PSO3.Apply for research in mathematics or in physics

PSO4.Apply for research in Mathematics or computer science

PSO5.Find jobs at all levels in corporate field

PSO6. Demonstrate skills in the use of computers for control, data acquisition and data analysis in experimental investigation.

Assessment

UG-Mathematics- CBCS

Weightage for the Assessments (in percentage) for first two semesters

Type of Course	Formative Assessment/ Internal Assessment	Summative Assessment (S.A.)
Theory	40%	60%
Practical	50%	50%
Projects	--	--
Experiential Learning (Internship etc.)	--	--

THEORY EXAMINATION (For Discipline Specific Courses):

UG-Mathematics- CBCS

Internal Assessment

(i) C1 Component: ***20 Marks. This will be based on test for 10 marks and seminar for 10 marks. This should be completed by the 8th week of the semester.***

C2 Component: 20 Marks. This will be based on test for 10 marks and assignment for 10 marks. This should be completed by the 15th week of the semester.

(ii) C3 component (Main Examination of 2 hours duration): 60 Marks. The pattern of the question paper will be as follows:

There will be 04 questions. All questions must be answered. All questions carry 15 marks.

Question 1. This question covers unit I of the syllabus. There will be 5 sub- questions each carrying 5 marks. The student has to answer any three of the 5 sub-questions.

Question 2. This question covers unit II of the syllabus. There will be 5 sub- questions each carrying 5 marks. The student has to answer any three of the 5 sub-question

Question 3. This question covers unit III of the syllabus. There will be 5 sub- questions each carrying 5 marks. The student has to answer any three of the 5 sub-questions.

Question 4. This question covers unit IV of the syllabus. There will be 5 sub- questions each carrying 5 marks. The student has to answer any three of the 5 sub-questions.

PRACTICAL EXAMINATION (For Discipline Specific Courses):

UG-Mathematics- CBCS

(i) Internal Assessment: 25 (10 +10+5)

This will be based on C1-test (10 marks), C2-test (10 marks),Seminar/practical record maintenance (5 marks)). This should be completed by the 15th week of the semester.

(ii) Main Examination (2 hours duration):25 (20 + 5)

There will be 3 questions each carrying equal marks. The student has to answer any two of the 3 questions. Each student will be subjected to viva-voce examination, based on practical syllabus, for 5 marks.

THEORY EXAMINATION (For Open Elective (OE) papers):

(i) Internal Assessment

C1 Component: ***20 Marks. This will be based on test for 10 marks and seminar for 10 marks. This should be completed by the 8th week of the semester.***

C2 Component: 20 Marks. This will be based on test for 10 marks and assignment for 10 marks. This should be completed by the 15th week of the semester.

(ii) C3 component (Main Examination of 2 hours duration): 60 Marks. The pattern of the question paper will be as follows:

There will be 03 questions. All questions must be answered. All questions carry 20 marks.

Question 1. This question covers unit I of the syllabus. There will be 6 sub- questions each carrying 5 marks. The student has to answer any four of the 6 sub-questions.

Question 2. This question covers unit II of the syllabus. There will be 6 sub- questions each carrying 5 marks. The student has to answer any four of the 6 sub-questions.

Question 3. This question covers unit III of the syllabus. There will be 6 sub- questions each carrying 5 marks. The student has to answer any four of the 6 sub-questions.

1. Minimum marks for Securing Credits: 30% in Theory Examination and 40% overall.
2. Minimum credits for getting B.Sc. Degree: As per NEP regulations.
3. Award of certificate/diploma/degree: As per NEP regulations.

SEMESTER – I

Algebra - I and Calculus – I	
Teaching Hours: 4 Hours/Week	**Credits: 4**
Total Teaching Hours: 56 Hours	**Max. Marks: 100 (S.A.-60 + I.A. – 40)**
Course Code	**FSA43032/FSA43034**

Course Learning Outcomes: This course will enable the students to

- Learn to solve system of linear equations.
- Solve the system of homogeneous and non homogeneous linear of *m* equations in *n* variables by using concept of rank of matrix.
- Students will be familiar with the techniques of integration and differentiation of function with real variables.
- Students learn to solve polynomial equations.
- Learn to apply Reduction formulae.

Unit-I: Matrix: Recapitulation of Symmetric and Skew Symmetric matrices, Algebra of Matrices; Row and column reduction to Echelon form. Rank of a matrix; Inverse of a matrix by elementary operations; Solution of system of linear equations; Criteria for existence of non-trivial solutions of homogeneous system of linear equations. Solution of non-homogeneous system of linear equations. Cayley- Hamilton theorem, inverse of matrices by Cayley-Hamilton theorem (Without Proof). **14 Hours**

Unit-II: Theory of equations: Euclid's algorithm, Polynomials with integral coefficients, Remainder theorem, Factor theorem, Fundamental theorem of algebra(statement only), Irrational and complex roots occurring in conjugate pairs, Relation between roots and coefficients of a polynomial equation, Symmetric functions, Transformation, Reciprocal equations, Descartes' rule of signs, Multiple roots, Solving cubic equations by Cardon's method, Solving quartic equations by Descarte's Method. **14 Hours**

Unit-III: Polar Co-ordinates: Polar coordinates, angle between the radius vector and tangent. Angle of intersection of two curves (polar forms), length of perpendicular from pole to the tangent, pedal equations. Derivative of an arc in Cartesian, parametric and polar forms, curvature of plane curve-radius of curvature formula in Cartesian, parametric and polar and pedal forms- center of

curvature, circle of curvature. **14 Hours**

Unit-IV: Successive Differentiation and Integral Calculus-I: nth Derivatives of Standard functions e^{as+b}, a^s, $(ax + b)^n$, $\log(ax + b)$, $\sin(ax + b)$, $\cos(ax+ b)$, $e^{as}\sin(bx + c)$, $e^{as}\cos(bx +c)$, Leibnitz theorem and its applications.

Recapitulation of definite integrals and its properties. Reduction formulae for $\int \sin^n x\,dx$, $\int \cos^n x\,dx$, $\int \sin^n x \cos^N x\,dx$, $\int \tan^n x\,dx$, $\int \cot^n x\,dx$, $\int \sec^n x\,dx$, $\int \operatorname{cosec}^n x\,dx$, $\int x^n \sin x\,dx$, $\int x^n \cos x\,dx$, $\int x^n e^{as}\,dx$, $\int x^n (\log x)^N dx$ with definite limits.

14 Hour

Reference Books:

1. University Algebra - N.S. Gopala Krishnan, New Age International (P) Limited.
2. Algebra – Natarajan, Manicavasagam Pillay and Ganapathy.
3. Theory of Matrices - B S Vatsa, New Age International Publishers.
4. Matrices - A R Vasista, Krishna Prakashana Mandir.
5. Differential Calculus - Shanti Narayan, S. Chand & Company, New Delhi.
6. Applications of Calculus, Debasish Sengupta, Books and Allied (P) Ltd., 2019.
7. Calculus – Lipman Bers, Holt, Rinehart & Winston.
8. Calculus - S Narayanan & T. K. Manicavachogam Pillay, S. Viswanathan Pvt. Ltd., vol. I & II.
9. Schaum's Outline of Calculus - Frank Ayres and Elliott Mendelson, 5th ed. USA: Mc. Graw.
10. Shanthinarayan – Integral Calculus, New Delhi: S. Chand and Co. Pvt. Ltd.
11. Shanthinarayan and P K Mittal, Integral Calculus, Reprint. New Delhi: S. Chand and Co. Pvt. Ltd., 2013

UG

Theory based Practical's on Algebra - I and Calculus-I	
Practical Hours : 4 Hours/Week	**Credits: 2**
Total Practical Hours: 56 Hours	**Max. Marks: 50 (S.A.-25 + I.A.-25)**
Course Code	**FSA43332/FSA43334**

Course Learning Outcomes: This course will enable the students to

- Learn *Free and Open Source Software (FOSS)* tools for computer programming
- Solve problem on algebra and calculus theory studied in **FSA43032/FSA43034** by using FOSS software's.
- Acquire knowledge of applications of algebra and calculus

through FOSS **Practical/Lab Work to be performed in Computer**

Lab (FOSS) Suggested Software's: Maxima/Scilab /Python/R.

Introduction to the software and commands related to the topic.

1. Computation of addition and subtraction of matrices,
2. Computation of Multiplication of matrices.
3. Computation of Trace and Transpose of Matrix
4. Computation of Rank of matrix and Row reduced Echelon form.
5. Computation of Inverse of a Matrix using Cayley-Hamilton theorem.
6. Solving the system of homogeneous and non-homogeneous linear algebraic equations.
7. Finding the nth Derivative of e^{ax}, trigonometric and hyperbolic functions
8. Finding the nth Derivative of algebraic and logarithmic functions.
9. Finding the nth Derivative of $e^{ax}\sin(bx + c)$, $e^{ax}\cos(bx + c)$.
10. Finding the roots of the equation, factoring.
11. Finding the angle between the radius vector and tangent.
12. Finding the curvatures of the given curves.

Open Elective Course

UG-Mathematics- CBCS

(For students of Science stream who have not chosen Mathematics as one of Core subjects)

Optional Mathematics – I	
Teaching Hours : 3 Hours/Week	**Credits: 3**
Total Teaching Hours: 42 Hours	**Max. Marks: 100** **(S.A.-60 + I.A. – 40)**
Course Code	

Course Learning Outcomes: This course will enable the students to

- Learn to solve system of linear equations.
- Solve the system of homogeneous and non homogeneous m linear equations by using the concept of rank of matrix.
- Students will be familiar with the techniques of differentiation of function with real variables.
- Identify and apply the intermediate value theorems and L'Hospital rule.
- Learn to apply Reduction formulae.

Unit-I: Matrices: Recapitulation of Symmetric and Skew Symmetric matrices, Algebra of Matrices; Row and column reduction, Echelon form. Rank of a matrix; Inverse of a matrix by elementary operations; Solution of system of linear equations; Criteria for existence of non-trivial solutions of homogeneous system of linear equations. Solution of non-homogeneous system of linear equations. Cayley- Hamilton theorem, inverse of matrices by Cayley-Hamilton theorem (Without Proof). **14 Hours**

Unit-II: Theory of equations: Euclid's algorithm, Polynomials with integral coefficients, Remainder theorem, Factor theorem, Fundamental theorem of algebra(statement only), Irrational and complex roots occurring in conjugate pairs, Relation between roots and coefficients of a polynomial equation, Symmetric functions, Transformation, Reciprocal equations, Descartes' rule of signs, Multiple roots, Solving cubic equations by Cardon's method, Solving quartic equations by Descarte's Method. **14 Hours**

Unit-III: Polar Co-ordinates: Polar coordinates, angle between the radius vector and tangent. Angle of intersection of two curves (polar forms), length of perpendicular from pole to the tangent, pedal equations. Derivative of an arc in Cartesian, parametric and polar forms, curvature of plane curve-radius of curvature formula in Cartesian, parametric and polar and pedal forms- center of curvature, circle of curvature. **14 Hours**

Reference Books:

1. University Algebra - N.S. Gopala Krishnan, New Age International (P) Limited.
2. Algebra – Natarajan, Manicavasagam Pillay and Ganapathy.
3. Theory of Matrices - B S Vatsa, New Age International Publishers.
4. Matrices – A. R. Vasista, Krishna Prakashana Mandir.
5. Applications of Calculus, Debasish Sengupta, Books and Allied (P) Ltd., 2019.
6. Differential Calculus - Shanti Narayan, S. Chand & Company, New Delhi.
7. Calculus – Lipman Bers, Holt, Rinehart & Winston.
8. Calculus – S. Narayanan & T. K. Manicavachogam Pillay, S. Viswanathan Pvt. Ltd.,vol. I & II.
9. Schaum's Outline of Calculus - Frank Ayres and Elliott Mendelson, 5th ed. USA: Mc. Graw.
10. Shanthinarayan – Integral Calculus, New Delhi: S. Chand and Co. Pvt. Ltd.
11. Shanthinarayan and P K Mittal, Integral Calculus, Reprint. New Delhi: S. Chand and Co. Pvt. Ltd., 2013.

Open Elective

UG-Mathematics- CBCS (For Students of all Streams)

Business Mathematics-I	
Teaching Hours : 3 Hours/Week	**Credits: 3**
Total Teaching Hours: 42 Hours	**Max. Marks: 100 (S.A.- 60 + I.A. – 40)**
Course Code	**FSA850**

Course Learning Outcomes: This course will enable the students to

- Translate the real word problems through appropriate mathematical modellling.
- Explain the concepts and use equations, formulae and mathematical expression and relationship in a variety of context.
- Finding the extreme values of functions.
- Analyze and demonstrate the mathematical skill require in mathematically intensive areas in economics and business.

Unit-I: Algebra – Set theory and simple applications of Venn Diagram, relations, functions, indices, logarithms, permutations and combinations. Examples on commercial mathematics. **14 Hours**

Unit - II: Matrices: Definition of a matrix; types of matrices; algebra of matrices. Properties of determinants; calculations of values of determinants upto third order; Adjoint of a matrix, elementary row and column operations; solution of a system of linear equations having unique solution and involving not more than three variables. Examples on commercial mathematics. **14 Hours**

Unit - III: **Differential Calculus**: Constant and variables, functions, Limits & continuity. Differentiability and Differentiation, partial differentiation, rates as a measure, maxima, minima, Partial Derivatives up to second order; Homogeneity of functions and Euler's Theorem; Total Differentials; Differentiation of implicit function with the help of total differentials, Maxima and Minima; cases of one variable involving second or higher order derivatives; Cases of two variables involving not more than one constraint. **14 Hours**

Reference Books:

1. Basic Mathematics, Allel R.G.A, Macmillan, New Delhi.
2. Mathematics for Economics, Dowling, E.T. , Schaum's Series, McGraw Hill London.
3. Quantitative Techniques in Management, Vohra, N.D., Tata McGraw Hill, New Delhi.
4. Business Mathematics, Soni R.S., Pitamber Publishing House, Delhi.

Open Elective

UG-Mathematics- CBCS

(For Students of all Streams)

Mathematical Aptitude-I	
Teaching Hours : 3 Hours/Week	**Credits: 3**
Total Teaching Hours: 42 Hours	**Max. Marks: 100** **(S.A.- 60 + I.A. – 40)**
Course Code	**FSA840**

Course Learning Outcomes: This course will enable the students to

- have a strong base in the fundamental mathematical concepts.
- grasp the approaches and strategies to solve problems with speed and accuracy
- gain appropriate skills to succeed in preliminary selection process for recruitment

Unit-I: Number System, Types of Numbers, series (AP and GP), Algebraic operations BODMAS, Divisibility, LCM and HCF, Fraction, Simplification. **14 Hours**

Unit-II: Time and Distance, Problems based on Trains, Boats and Streams.

14 Hours

Unit-III: Time, work and wages, Pipes and Cistern, Problems on Clock, Problems on Calendar.

14 Hours

Reference Books:

1. R.S. Aggarwal, "Quantitative Aptitude for Competitive Examinations", Revised Edition, S. Chand and Co. Ltd, New Delhi, 2018.
2. Quantitative Aptitude and Reasoning by R V Praveen, PHI publishers.
3. Quantitative Aptitude : Numerical Ability (Fully Solved) Objective Questions, Kiran Prakashan, Pratogitaprakasan, Kic X, Kiran Prakasan publishers.
4. Quantitative Aptitude for Competitive Examination by Abhijit Guha, Tata Mc Graw hill publications.

SEMESTER – II

Algebra – II {Number Theory) and Calculus – II	
Teaching Hours : 4 Hours/Week	**Credits: 4**
Total Teaching Hours: 56 Hours	**Max. Marks: 100 (S.A.-60 + I.A. – 40)**
Course Code	**FSB43032/FSB43034**

Course Learning Outcomes: This course will enable the students to

- Learn the concept of Divisibility.
- Learn about prime and composite numbers.
- Learn the concept of congruences and its applications.
- Identify and apply the intermediate value theorems and L'Hospital rule.
- Understand the concept of differentiation and fundamental theorems in differentiation and various rules.
- Find the extreme values of functions of two variables.
- Students learn to find areas and volumes using integration.

Unit-I: Number Theory: Division Algorithm, Divisibility, Prime and composite numbers, Euclidean algorithm, Fundamental theorem of Arithmetic, The greatest common divisor and least common multiple. Congruences, Linear congruences, Simultaneous congruences, Euler's Phi-function, Wilson's, Euler's and Fermat's Theorems and their applications. **14 Hours**

Unit-II: Differential Calculus-I: Limits, Continuity, Differentiability and properties. Properties of continuous functions. Intermediate value theorem, Rolle's Theorem, Lagrange's Mean Value theorem, Cauchy's Mean value theorem and examples. Taylor's theorem, Maclaurin's series, Indeterminate forms and evaluation of limits using L'Hospital rule. **14 Hours**

Unit-III: Partial Derivatives: Functions of two or more variables-explicit and implicit functions, partial derivatives. Homogeneous functions- Euler's theorem and extension of Euler's theorem, total derivatives, differentiation of implicit and composite functions, Jacobians and standard properties and illustrative examples. Taylor's and Maclaurin's series for functions of two variables, Maxima-Minima of functions of two variables.

14 Hours

Unit-IV: Integral Calculus-II: *Line integral*: Definition of line integral and basic properties, examples on evaluation of line integrals. *Double integral*: Definition of Double integrals and its conversion to iterated integrals. Evaluation of double integrals by changing the order of integration and change of variables. Computation of plane surface areas using double integrals. *Triple integral*: Definition of triple integrals and evaluation- change of variables, volume as triple integral. **14 Hours**

Reference Books:

1. Differential Calculus, Shantinarayan, S. Chand & Company, New Delhi.
2. Applications of Calculus, Debasish Sengupta, Books and Allied (P) Ltd., 2019.
3. Calculus – Lipman Bers, Holt, Rinehart & Winston.
4. Calculus - Shanthinarayanan & T. K. Manicavachogam Pillay, S. Viswanathan Pvt. Ltd., vol. I & II.
5. Schaum's Outline of Calculus - Frank Ayres and Elliott Mendelson, 5th ed. USA:Mc. Graw Hill, 2008.
6. Integral Calculus, Shanthinarayan, New Delhi: S. Chand and Co. Pvt. Ltd.
7. Integral Calculus, Shantinarayan and P K Mittal, S. Chand and Co. Pvt. Ltd.
8. Text Book of B.Sc. Mathematics, G K Ranganath, S Chand & Company.
9. David M Burton, Elementary Number Theory, 6th edition, McCraw Hill, 2007.
10. Emil Grosswald, Topics from the Theory of Numbers, Modern Birhauser, 1984.
11. Ivan Niven, Herbert S. Zuckerman and Hugh L. Montgomery, An Introduction to the Theory of Numbers, John Willey (New York), 1991

Theory based practical's On Algebra – II (Number Theory) and Calculus – II	
Practical Hours : 4 Hours/Week	**Credits: 2**
Total Practical Hours: 56 Hours	**Max. Marks: 50** **(S.A.-25 + I.A. –25)**
Course Code	**FSB43332/FSB43334**

Course Learning Outcomes: This course will enable the students to

- Learn *Free and Open Source Software (FOSS)* tools for computer programming
- Solve problem on algebra and calculus by using FOSS software's.
- Acquire knowledge of applications of algebra and calculus through FOSS

Practical/Lab Work to be performed in Computer Lab

Suggested Software's: Maxima/Scilab /Phython/R.

1. Programs related to Number Theory.
2. ***Program to verify Mean value theorems.***
3. Program for finding the Taylor's and Maclaurin's expansions of the given functions.
4. Program to verify the Euler's theorem and its extension.
5. Programs to construct series using Maclaurin's expansion for functions of two variables.
6. Program to evaluate the line integrals with constant and variable limits.
7. Program to evaluate the Double integrals with constant and variable limits.
8. Program to evaluate the Triple integrals with constant and variable limits.

Open Elective

UG-Mathematics- CBCS

(For students of Science stream who have not chosen Mathematics as one of the Core subjects)

Optional Mathematics – II	
Teaching Hours : 3 Hours/Week	**Credits:3**
Total Teaching Hours: 42 Hours	**Max. Marks: 100** **(S.A.- 60 + I.A. – 40)**

Course Learning Outcomes: This course will enable the students to

- Learn the concept of Divisibility.
- Learn about prime and composite numbers.
- Learn the concept of congruences and its applications.
- Understand the concept of differentiation and fundamental theorems in differentiation and various rules.
- Find the extreme values of functions of two variables.
- To understand the concepts of multiple integrals and their applications.

Unit-I: Number Theory: Division Algorithm, Divisibility, Prime and composite numbers, Euclidean algorithm, Fundamental theorem of Arithmetic, The greatest common divisor and least common multiple. Congruences, Linear congruences, Simultaneous congruences, Euler's Phi-function, Wilson's, Euler's and Fermat's Theorems and their applications. **14 Hours**

Unit-II: Partial Derivatives: Functions of two or more variables-explicit and implicit functions, partial derivatives. Homogeneous functions- Euler's theorem and extension of Euler's theorem, total derivatives, differentiation of implicit and composite functions, Jacobians and standard properties and illustrative examples. Taylor's and Maclaurin's series for functions of two variables, Maxima-Minima of functions of two variables.

14 Hours

Unit-III: Integral Calculus: *Line integral*: Definition of line integral and basic properties, examples on evaluation of line integrals. *Double integral*: Definition of Double integrals and its conversion to iterated integrals. Evaluation of double integrals by changing the order of integration and change of variables. Computation of plane surface areas, *Triple integral*: Definition of triple integrals and evaluation-change of variables, volume as triple integral.

14 Hours

Reference Books:

1. 1.Differential Calculus, Shanti Narayan, S. Chand & Company, New Delhi.
2. Applications of Calculus, Debasish Sengupta, Books and Allied (P) Ltd., 2019.
3. Calculus – Lipman Bers, Holt, Rinehart & Winston.
4. Calculus - Shanthinarayanan & T. K. Manicavachogam Pillay, S. Viswanathan Pvt. Ltd., vol. I & II.
5. Schaum's Outline of Calculus - Frank Ayres and Elliott Mendelson, 5th ed. USA:Mc. Graw Hill, 2008.
6. Integral Calculus, Shanthinarayan, S. Chand and Co. Pvt. Ltd.
7. Integral Calculus, Shantinarayan and P K Mittal, S. Chand and Co. Pvt. Ltd.
8. Text Book of B.Sc. Mathematics, G K Ranganath, S Chand & Company.
9. David M Burton, Elementary Number Theory, 6^{th} edition, McCraw Hill, 2007.
10. Emil Grosswald, Topics from the Theory of Numbers, Modern Birhauser, 1984.
11. Ivan Niven, Herbert S. Zuckerman and Hugh L. Montgomery, An Introduction to the Theory of Numbers, John Willey (New York), 1991.

Open Elective

(For Students of all streams)

Business Mathematics-II	
Teaching Hours : 3 Hours/Week	**Credits: 3**
Total Teaching Hours: 42 Hours	**Max. Marks: 100** **(S.A.- 60 + I.A. – 40)**
Course Code	**FSB850**

Course Learning Outcomes: This course will enable the students to

- Integrate concept in international business concept with functioning of global trade.
- Evaluate the legal, social and economic environment of business.
- Apply decision-support tools to business decision making.
- Will be able to apply knowledge of business concepts and functions in an integrated manner.

Unit - I: Commercial Arithmetic: Interest**:** Concept of Present value and Future value, Simple interest, Compound interest, Nominal and Effective rate of interest, Examples and Problems Annuity: Ordinary Annuity, Sinking Fund, Annuity due, Present Value and Future Value of Annuity, Equated Monthly Installments (EMI) by Interest of Reducing Balance and Flat Interest methods, Examples and Problems. **14 Hours**

Unit - II: Measures of central Tendency and Dispersion: Frequency distribution: Raw data, attributes and variables, Classification of data, frequency distribution, cumulative frequency distribution, Histogram and give curves. Requisites of ideal measures of central tendency, Arithmetic Mean, Median and Mode for ungrouped and grouped data. Combined mean, Merits and demerits of measures of central tendency, Geometric mean: definition, merits and demerits, Harmonic mean: definition, merits and demerits, Choice of A.M., G.M.and H.M. Concept of dispersion, Measures of dispersion: Range, Variance, Standard deviation (SD) for grouped and ungrouped data, combined SD, Measures of relative dispersion: Coefficient of range, coefficient of variation. Examples and problems. **14 Hours**

Unit - III: Correlation and regression: Concept and types of correlation, Scatter diagram, Interpretation with respect to magnitude and direction of relationship. Karl Pearson's coefficient of correlation for ungrouped data. Properties of correlation coefficient. (with tie and without tie) Concept of regression, Lines of regression for ungrouped data, predictions using lines of regression. Regression coefficients and their properties (without proof). Examples and problems. **14 Hours**

Reference Books:

UG-Mathematics- CBCS

1. Practical Business Mathematics, S. A. Bari New Literature Publishing Company New Delhi
2. Mathematics for Commerce, K. Selvakumar Notion Press Chennai
3. Business Mathematics with Applications, Dinesh Khattar & S. R. Arora S. Chand Publishing New Delhi
4. Business Mathematics and Statistics, N.G. Das &Dr. J.K. Das McGraw Hill New Delhi
5. Fundamentals of Business Mathematics, M. K. Bhowal, Asian Books Pvt. Ltd New Delhi
6. Mathematics for Economics and Finance: Methods and Modelling, Martin Anthony and Norman, Biggs Cambridge University Press Cambridge
7. Financial Mathematics and its Applications, Ahmad Nazri Wahidudin Ventus Publishing APS Denmark
8. Fundamentals of Mathematical Statistics, Gupta S. C. and Kapoor V. K.:, Sultan Chand and Sons, New Delhi.
9. Statistical Methods, Gupta S. P.: Sultan Chand and Sons, New Delhi.
10. Applied Statistics, Mukhopadhya Parimal New Central Book Agency Pvt. Ltd. Calcutta.
11. Fundamentals of Statistics, Goon A. M., Gupta, M. K. and Dasgupta, B. World Press Calcutta.
12. Fundamentals of Applied Statistics, Gupta S. C. and Kapoor V. K.:, Sultan Chand and Sons, New Delhi.

Open Elective

(For Students of all Streams)

Mathematical Aptitude-II	
Teaching Hours : 3 Hours/Week	**Credits: 3**
Total Teaching Hours: 42 Hours	**Max. Marks: 100 (S.A.- 60 + I.A. – 40)**
Course Code	**FSB840**

Course Learning Outcomes: This course will enable the students to

- have a strong base in the fundamental mathematical concepts.
- grasp the approaches and strategies to solve problems with speed and accuracy
- gain appropriate skills to succeed in preliminary selection process for recruitment

Unit-I: Percentage, Average, Problems based on Ages, Ratio and Proportion, Partnership and share, Mixtures. **14 Hours**

Unit-II: Profit, Loss and Discount, Simple Interest, Compound Interest, Shares and Debentures. **14 Hours**

Unit-III: Permutations and Combinations, Probability, True discount and Banker's discount.

14 Hours

Reference Books:

1. R.S. Aggarwal, "Quantitative Aptitude for Competitive Examinations", Revised Edition, S. Chand and Co. Ltd, New Delhi, 2018.
2. Quantitative Aptitude and Reasoning by R V Praveen, PHI publishers.
3. Quantitative Aptitude : Numerical Ability (Fully Solved) Objective Questions, Kiran Prakashan, Pratogitaprakasan, Kic X, Kiran Prakasan publishers.
4. Quantitative Aptitude for Competitive Examination by Abhijit Guha, Tata Mc Graw hill publications.

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE
(Autonomous)

OOTY ROAD, MYSURU- 570 025

DEPARTMENT OF ZOOLOGY

Syllabus for

B.Sc. Hons ZOOLOGY

(UG) I,II,III,IV,V&VI

SEMESTERS

Framed According to the National Educational Policy (NEP 2020)

(2021-2022 AND 2022-2023 Batch Onwards)

Model Curriculum Structure for Degree Program

B. Sc., Hons in Zoology

Name of the Degree Program: B. Sc., Hons

Discipline Core: Zoology Total Credits for the

Program: 50/100/142/184/268Starting year of implementation: 2021-22

PROGRAM OBJECTIVES (POs)

POs1-The Programme offers both classical as well as modern concepts of Zoology in higher education.

POs2-It enables the students to study animal diversity in both local and global environments.

POs3-Tomakethestudy of animals more interesting and relevant to human studies more emphasis is given to branches like behavioural biology, evolutionary biology and economic zoology.

POs4-More of upcoming areas in cellbiology, genetics, molecular biology, biochemistry, genetic engineering and bioinformatics have been also included.

POs5-Equal importance is given to practical learning and presentation skills of students.

POs6-The lab courses provide the students necessary skills required for their employability.**POs7-**Skill enhancement courses in classical and applied branches of Zoology enhance enterprising skills of students.

POs8-The global practices in terms of academic standards and evaluation strategies.

POs9- Provides opportunity for the mobility of the student both within and across the world.

POs 10-The uniform grading system will benefit the students to move across institutions within India to begin with and across countries.

POs11-It will also enable potential employers in assessing the performance of the candidates across the world.

Semester I- Zoology Core Course I Content:

Zoology: Paper-I: Cytology, Genetics & Infectious Diseases.

Course Title/Code: Cytology, Genetics and Infectious Diseases	**Course Credits:** 4
Course Code: FSA470	**L-T-P per week:** 4-0-0
Total Contact Hours: 56	**Duration of ESA:** 3 Hours
Formative Assessment Marks: 40	**Summative Assessment Marks:**60

Course Outcomes (COs):

At the end of the course the student should be able to understand:

CO1. The structure and function of the cell organelles.

CO2. The chromatin structure and its location.

CO3. The basic principle of life, how a cell divides leading to the growth of an Organism and also reproduces to form a new organism.

CO4. How a cell communicates with its neighboring cells.

CO5. The principles of inheritance, Mendel‘s laws and the deviations.

CO6. How environment plays an important role by interacting with genetic factors.

CO7. Detect chromosomal aberrations in humans and study of pedigree analysis.

Content	Hours
Unit -1	14hrs
Chapter 1:Structure and Function of Cell Organelles - I in Animal cell • Ultra structure of animal cell • **Plasma membrane**: Fluid mosaic model, Chemical structure – lipids, Proteins and their role in maintaining structural integrity. Functions of Plasma membrane - Cell permeability, diffusion, passive transport, active transport. • **Endomembrane system:** Protein targeting and sorting, transport, endocytosis and exocytosis. **Chapter 2:Structure and Function of Cell Organelles - II in Animal cell.** • **Endoplasmic reticulum-** Types, Structure and functions. • **Peroxisome &Ribosome**: Types – (Prokaryotic & Eukaryotic), Structure and functions. • **Golgi apparatus** - Structure and functions. • **Lysosomes** - Structure and functions. • **Mitochondria:** Structure and functions. Oxidative phosphorylation; electron transport system • **Cytoskeleton**: Structure and functions of - Microtubules, microfilament intermediate filaments.	
Unit -2	14hrs
Chapter 3:Nucleus and Chromatin Structure. • **Ultra structure of Nucleus and Functions** - Nuclear envelop, Nuclear pore complex, Nucleoplasm. • Ultrastructure of nucleolus and functions. • **Chemical structure** and base composition of DNA and RNA. • **Nucleosome model,** DNA super coiling, Chromatin organization, Structure of chromosomes (Fine structure). Types of DNA and RNA. **Chapter 4: Cell cycle, Cell Division and Cell Signalling.** • Introduction to Cell cycle and its regulation**Cell division:** Mitosis stages and its Significance and Meiosis Stages and its Significance, Apoptosis. • **Signal transduction**: Intracellular signalling and Cell surface receptors, via G-protein linked receptors. • **Cell-cell interaction**: Cell adhesion molecules, Cellular junctions.	
Unit -3	14hrs
Chapter 5: Mendelism and Sex Determination. • **Basic principles of heredity:** Mendel's laws - Monohybrid cross and Dihybrid cross. Complete and Incomplete Dominance (Ex. *Mirabilis jalapa).* Penetrance and Expressivity. • **Genetic Sex Determining Systems** (XX- XY, XX – XO, ZZ – ZW), Environmental Sex Determination (*Bonelia viridis*), Sex Determination and Mechanism in *Drosophila melanogaster (Genic balance theory).* • **Dosage Compensation** - Barr body, Lyon's hypothesis.	

Chapter 6: Extensions of Mendelism, Genes and Environment. • **Extensions of Mendelism**: Multiple Alleles (Inheritance of ABO blood group in Humans and Rh factor), Gene Interaction (Supplementary, Complementary and Epistasis). • **The Interaction between Sex and Heredity**: Sex-Influenced characteristics (Male pattern baldness in humans, horns in sheep) and Sex-Limited Characteristics (Plumage pattern, milk production and Moustache and Beard in Males) • **Cytoplasmic Inheritance** (Kappa particles in *Paramecium*), Genetic Maternal Effects (Shell coiling in *Limnaea*). • **Interaction between Genes and Environment** -Himalayan albino rabbit Environmental Effects on Gene Expression (Norm of reaction), Inheritance of Continuous Characteristics (Polygenic Inheritance - Skin colour in Man).	
Unit -4	14hrs
Chapter 7: Human Chromosomes and Patterns of Inheritance. • **Patterns of Inheritance**: Autosomal dominance (Huntington's chorea, PTC), Autosomal recessive (Sickle cell anemia, Albinism), X-linked recessive (Colour blindness, Hemophilia),X-linked dominant (Vitamin D resistance Ricketts, Coffin Lowry syndrome). • **Chromosomal Anomalies**: Structural (Deletion, Duplication, Inversion, Translocation with examples) and Numerical aberrations (Turner's syndrome, Klinefelter's syndrome). Autosomal anomalies - Down syndrome and Cri-du-chat syndrome. • **Human Karyotyping** and Pedigree analysis (Autosomal dominant, Autosomal recessive, X – linked dominant, X – linked recessive). **Chapter 8: Infectious Diseases.** • **Introduction to Pathogenic Organisms**: Viruses, Bacteria, Fungi, Protozoa and Worms. Structure, Life cycle, Pathogenicity, including diseases, causes, symptoms and control of common parasites: *Trypanosoma, Giardia* and *Wuchereria.*	

Suggested Readings :

1. Lodish et al: Molecular Cell Biology: Freeman & Co, USA(2004).
2. Alberts et al: Molecular Biology of the Cell: Garland(2002).
3. Cooper: Cell: A Molecular Approach: ASM Press(2000).
4. Karp: Cell and Molecular Biology: Wiley (2002). Pierce B. Genetics. Freeman(2004).
5. Lewin B. Genes VIII. Pearson (2004).
6. Watson et al. Molecular Biology of the Gene. Pearson(2004).
7. Thomas J. Kindt, Richard A. Goldsby, Barbara A. Osborne, Janis Kuby- Kuby Immunology. W H Freeman(2007).
8. Delves Peter J., Martin Seamus J., Burton Dennis R., Roitt Ivan M. Roitt's Essential Immunology, 13thEdition. Wiley Blackwell(2017).
9. Principles of Genetics by B. D. Singh
10. Cell-Biology by C. B. Pawar, Kalyani Publications
11. Economic Zoology by Shukla and Upadhyaya

Semester I- Zoology Core Course I

Content: Zoology: Paper-I: Cytology, Genetics & Infectious Diseases.

Semester I

Course Title: Cytology, Genetics and Infectious Diseases	**Course Credits:**2
Course Code: FSA470	**L-T-P per week:** 0-0-4
Total Contact Hours: 56	**Duration of ESA:** 3 Hours
Formative Assessment Marks: 25	**Summative Assessment Marks:**25

Course Outcomes (COs):

At the end of the course the student should be able to:

1. To use simple and compound microscopes.
2. To prepare stained slides to observe the cell organelles.
3. To be familiar with the basic principle of life, how a cell divides leading to the growth of an organismand also reproduces to form new organisms.
4. The chromosomal aberrations by preparing karyotypes.
5. How chromosomal aberrations are inherited in humans by pedigree analysis in families. The antigen-antibody reaction.

Lab Course Content

List of labs to be conducted	56hrs
1. Understanding of simple and compound microscopes.	
2. To study different cell types such as buccal epithelial cells, neurons, striated musclecells using Methylene blue/any suitable stain (virtual/ slaughtered tissue).	
3. To study the different stages of Mitosis in root tip of *Allium cepa*.	
4. To study the different stages of Meiosis in grasshopper testis (virtual).	
5. To check the permeability of cells using salt solution of different concentrations.	
6. Study of parasites in humans (e.g. Protozoans, Helminthes in compliancewithexamples being studied in theory) permanent microslides.	
7. To learn the procedures of preparation of temporary(spicules) or permanentstained slides(Fish scales),with available mounting material.	
8. Study of wild Drosophila melanogaster (male & female) and Mutant Phenotypes of *Drosophila* sp, –White eye, bar eye, sepia eye, vestigial wing & yellow body. (From Cultures or Photographs).	
9. Study of Polytene chromosomes (Chironomus larva or Drosophila larva).	
10. Preparation of Drosophilla and human Karyotype and study (identification) of the chromosomal structural (chriduchat syndrome (Deletion), Fragile X syndrome (duplication) , walker-warburg syndrome (Inversion) and leukemia (translocation) and numerical aberrations (Turner's, Klinefelter's and Down's syndrome) from the pictures provided. (Virtual / Optional).	
11. To prepare family pedigrees. 12. https://www.vlab.co.in 13. https://zoologysan.blogspot.com 14. www.vlab.iitb.ac.in/vlab 15. www.onlinelabs.in 16. www.powershow.com 17. https://vlab.amrita.eduhttps://sites.dartmouth.edu/	

Suggested Readings:

1. Lodish et al: Molecular Cell Biology: Freeman & Co, USA(2004).
2. Alberts et al: Molecular Biology of the Cell: Garland(2002).
3. Cooper: Cell: A Molecular Approach: ASM Press(2000).
4. Karp: Cell and Molecular Biology: Wiley (2002). Pierce B. Genetics. Freeman(2004).
5. Thomas J. Kindt, Richard A. Goldsby, Barbara A. Osborne, Janis Kuby- Kuby Immunology. W HFreeman(2007).
6. Kesar, Saroj and Vasishta N.2007 Experimental Physiology: Comprehensive Manual. Heritage Publishers,NewDelhi.

Scheme of Practical ExaminationI
Semester BSc. Zoology
Cytology, Genetics and Infectious diseases
Course Code: FSA470

Duration: 3 hours **Max. Marks: 25**

1. Identify the spots A, B and C, giving suitable reasons with diagram (Experiment no 1, 2, 3, 4, 6, 8, 9&10)	12M
2. Prepare a whole mount of the given material	03M
3. Preparation of Karyotype	05M
4. Preparation of Pedigree analysis	05M

(The candidate has to submit the duly certified record at the time of practical examination. The record is for the referenceof the examiners, but not for assessment (since it is already assessed for IA)

Assessment:

Weightage for assessments (in percentage)

Type of Course	Formative Assessment / IA Marks	Summative Assessment Marks
Theory	40	60
Practical	25	25

Pedagogy: Written Assignment/Presentation/Seminar

Formative Assessment - Theory	
Assessment Occasion	**Weightage in Marks**
House Examination/Test	C1+C2=10+10=20
Written Assignment/Presentation/Seminar	10+10=20
Total	40

Pedagogy: Written Assignment/Presentation/Record/Seminar

Formative Assessment- Practical	
Assessment Occasion	**Weightage in Marks**
Internal assessment C1	10
Internal assessment C2	10
Class record	05
Total	25

Open Elective Course Content

Semester: I

Course Title: Economic Zoology **Course Code:** FSA920	**Course Credits**:3
Total Contact Hours: 42	**Duration of ESA:** 3 Hours
Formative AssessmentMarks: 40	**Summative AssessmentMarks**: 60

Course Outcomes (COs):

At the end of the course the student will be able to:

COs1- Gain knowledge about silkworms rearing and their products.

COs2- Gain knowledge in Bee keeping equipment and apiary management.

COs3- Acquaint knowledge on dairy animal management, the breeds and diseases of cattle and learn thetesting of egg andmilk quality.

COs4- Acquaint knowledge about the culture techniques of fish and poultry.

COs5- Acquaint the knowledge about basic procedure and methodology of vermiculture.

COs6- Learn various concepts of lac cultivation.

COs7-Students can start their own business i.e. self-employments.

COs8- Get employment in different applied sectors

Course Content

Content	Hrs
Unit I	**14**
Chapter 1. Sericulture: • History and present status of sericulture in India • Mulberry and non-mulberry species in Karnataka and India • Mulberry cultivation • Morphology and life cycle of *Bombyxmori* • Silkworm rearing techniques: Processing of cocoon, reeling • Silkworm diseases and pest control **Chapter 2. Apiculture:** • Introduction and present status of apiculture • Species of honey bees in India, life cycle of *Apisindica* • Colony organization, division of labour and communication • Bee keeping as an agro based industry; methods and equipments: indigenous methods,extraction appliances, extraction of honey from the comb and processing • Bee pasturage, honey and bees wax and their uses • Pests and diseases of bees and their management	
Unit II	**14**
Chapter 3. Live Stock Management: • **Dairy:**Introduction to common dairy animals and techniques of dairy management • Types, loose housing system and conventional barn system; advantages and limitationsof dairy farming • Establishment of dairy farm and choosing suitable dairy animals-cattle • Cattle feeds, milk and milk products • Cattle diseases • **Poultry:** Types of breeds and their rearing methods • Feed formulations for chicks • Nutritive value of egg and meat • Disease of poultry and control measures **Chapter 4. Aquaculture:** • Aquaculture in India: An overview and present status and scope of aquaculture • Types of aquaculture: Pond culture: Construction, maintenance and management; carpculture, shrimp culture, shellfish culture, composite fish culture and pearl culture	
Unit - III	**14**

Chapter 5. Fish culture: • Common fishes used for culture. • Fishing crafts and gears. • Ornamental fish culture: Fresh water ornamental fishes- biology, breeding techniques • Construction and maintenance of aquarium: Construction of home aquarium, materials used, setting up of freshwater aquaria, aquarium plants, ornamental objects, cleaning the aquarium, maintenance of water quality. control of snail and algal growth. • Modern techniques of fish seed production **Chapter 6. Prawn culture:** • Culture of fresh and marine water prawns. • Preparation of farm. • Preservation and processing of prawn, export of prawn. **Chapter 7. Vermiculture:** • Scope of vermiculture. • Types of earthworms. • Habit categories - epigeic, endogeic and anecic; indigenous and exotic species. • Methodology of vermicomposting: containers for culturing, raw materials	
required, preparation of bed, environmental pre-requisites, feeding, harvesting andstorage of vermicompost. • Advantages of vermicomposting. • Diseases and pests of earthworms. **Chapter 8.Lac Culture:** • History of lac and its organization, lac production in India. • Life cycle, host plants and strains of lac insect. • Lac cultivation: Local practice, improved practice, propagation of lac insect, inoculationperiod, harvesting of lac. • Lac composition, processing, products, uses and their pests.	

Suggested Readings:

1. Eikichi, H. (1999). Silkworm Breeding (Translated from Japanese). Oxford & IBH Publishing Co.Pvt. Ltd., New Delhi.
2. Ganga, G. (2003). Comprehensive Sericulture Vol-II: Silkworm Rearing and Silk Reeling.
3. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Mahadevappa, D., Halliyal, V.G., Shankar, D.G. and Bhandiwad, R., (2000). Mulberry Silk
5. Reeling Technology Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
6. Roger, M (1990). The ABC and Xyz of Bee Culture: An Encyclopedia of Beekeeping, KindleEdition.
7. Shukla and Upadhyaya (2002). Economic Zoology, Rastogi Publishers
8. YadavManju (2003). Economic Zoology, Discovery Publishing House.
9. JabdePradip V (2005). Textbook of applied Zoology, Discovery Publishing House, New Delhi.
10. Cherian &Ramachandran Bee keeping in-South Indian Govt. Press, Madras.
11. Sathe, T.V. Vermiculture and Organic farming.
12. Bard. J (1986). Handbook of Tropical Aquaculture.
13. Santhanam, R. A. Manual of Aquaculture.
14. Zuka. R.1 and Hamiyn (1971). Aquarium fishes and plants
15. Jabde, P.V. (2005) Text Book of Applied Zoology: Vermiculture, Apiculture, Sericulture, Lacculture.
16. Animal Disease- Bairagi K. N. Anmol Publications Pvt.Ltd 2014

17. Economics Of Aquaculture - Singh(R.K.P) - Danika Publishing Company 2003
18. Applied and Economic Zoology (SWAYAM) web https://swayam.gov.in/nd2_cec20_ge23/previe w

Assessment

Pedagogy: Chalk and Talk, PPT, Group discussion, Seminar, Field visit

Formative Assessment - Theory	
Assessment Occasion	**Weightage in Marks**
House Examination/Test	C1+C2=10+10=20
Written Assignment/Presentation/Seminar	10+10=20
Total	40

Skill Enhancement Course in Zoology

Course Content

Semester:I

Course Title: Vermiculture **Course Code**: VEC5ZOOP1	**Course Credits:** 2
Total Contact Hours: 56 Hours	**Duration of ESA:** 3 Hrs
Formative Assessment Marks:20	**Summative Assessment Marks:** 30

Course Outcomes (COs):

At the end of the course the student:

COs1- Understands the importance of earthworms in maintaining soil quality. **COs2-** Learns that the vermicomposting is an effective organic solid wastemanagementmethod.

COs3- Gets acquainted with the importance of earthworms in agro-based economic activity.

COs4- Vermicomposting leads to organic farming and healthy food production. **COs5-** Vermicomposting may be taken up as a small scale industry bythe farmers andunemployed youth.

COs6- Get jobs in teaching institutions or vermiculture units as technicians.

COs7- Learn the concept of vermicomposting as bio fertilizers thus student can become and entrepreneur after completion of the course.

Course Content

List of labs to be conducted		56Hrs
1	Collection ofnative earth worm species to study habit and habitat.	
2	Keys to identify different species of earth worm.	
3	Externals and Life cycle of ***Eiseniafetida*** and ***Eudriluseugeniae.***	
4	Dissection of digestive and reproductive system.	
5	Study of vermicomposting equipments and devices.	
6	Preparation of vermibeds and their maintenance.	
7	Study of different vermicomposting methods.	
8	Harvesting, separation of worms, packaging, transport and storage of varmicompost.	
9	Vermi-wash collection and processing.	
10	Small scale earth worm farming for home gardens and studying the effect of vermicompost on garden plants.	
11	Budget and cost scenario of vermiculture (Project).	
12	Diseases and natural enemies of earth worms and their control measures.	
13	Role of vermitechnology in environmental protection.	
14	Economics and Marketing of vermicompost and vermi wash.	
15	Visit to vermiculture farm to acquaint with latest techniques.	

Text Books and references

1. Bhatt J.V. & S.R. Khambata (1959) -Role of Earthworms in Agriculture‖ Indian Council
   of Agricultural Research, New Delhi
2. Edwards, C.A. and J.R. Lofty (1977) -Biology of Earthworms‖ Chapman and Hall Ltd.,
   London.
3. Lee, K.E. (1985) -Earthworms: Their ecology and Relationship with Soils and Land Use‖
   Academic Press, Sydney.
4. Dash, M.C., B.K.Senapati, P.C. Mishra (1980) — Vermsand Vermicomposting‖ Proceedings of the National Seminar on Organic Waste Utilization and Vermicomposting
   Dec. 5-8, 1984, (Part B), School of Life Sciences, Sambalpur University, JyotiVihar, Orissa.
5. Kevin, A and K.E.Lee (1989) — Earthworm for Gardeners and Fisherman‖ (CSIRO,Australia, Division of Soils)
6. Satchel, J.E. (1983) -Earthworm Ecology‖ Chapman Hall, London.
7. Wallwork, J.A. (1983) -Earthworm Biology‖ Edward Arnold (Publishers) Ltd.
   London.

Pedagogy

1. Demonstration
2. Assignment
3. Group discussion
4. Field visit
5. Use of Audio-Visual aids.

Formative Assessment	
Assessment Occasion	**Weightage in Marks**
Class Test	10
Attendance and Assignments	05
Visit to vermicompost unit and report	05
Total	20

Scheme of Practical ExaminationI
Semester BSc. Zoology
Skill Enhancement course: Vermiculture

Duration: 3 hours **Max. marks: 30**

1. Identify and describe the given system of the given specimen/chart 'A' given, with neat labelled diagram. (05 marks)

2. Identify and comment on the spotters B to E (Life cycle/Externals/Devices used in vermicomposting/ Vermicompost types) (5x5=25 marks)

Semester II- Zoology Core Course I

Content: Paper-II: Biochemistry and Physiology

Course Title: Biochemistry and Physiology	**Course Credits:** 4
Course Code: FSB470	**L-T-P per week:** 4-0-0
Total Contact Hours: 56	**Duration of ESA:** 3 Hours
Formative Assessment Marks: 40	**Summative Assessment Marks**:60

Course outcomes:

The student at the completion of the course will learn:

COs1- To develop a deep understanding of structure of biomolecules like proteins, lipids andcarbohydrates.

COs2- How simple molecules together form complex macromolecules.

COs3- To understand the thermodynamics of enzyme catalyzed

reactions. **COs4-** Mechanisms of energy production at cellular and

molecular levels. **COs5-** To understand various functional components of

an organism.

COs6- To explore the complex network of these functional components.

COs7- To comprehend the regulatory mechanisms for maintenance of function in the body.

Content	Hours
Unit I	**14**
Chapter 1. Structure and Function of Biomolecules: • Structure and Biological importance of carbohydrates (Classification with examples Monosaccharides,Disaccharides, Polysaccharides and Glycoconjugates). • Lipids Classification and Biological importance-(saturated and unsaturated Fatty acids, Tri-acylglycerols, Phospho lipids,Glycolipids and Steroids) Clinical importance of Lipids, HDL & LDL ,TG and Cholesterol • Proteins Structure, Classification and General Properties of a-amino acids; Essential and non-essential amino acids, Levels of organization in proteins(Primary, secondary,tertiary and quaternary structure with Haemoglobin as an example) Simple and conjugate proteins.	
Chapter 2. Enzyme Action and Regulation • Nomenclature and classification of enzymes; Cofactors; Specificity of enzyme action. • Isozymes; Mechanism of enzyme action • Enzyme kinetics; Factors affecting rate of enzyme-catalyzed reactions ; Equation of Michaela‘s -Mendon, Concept of Km and V max, Enzyme inhibition • Allosteric enzymes and their kinetics; Regulation of enzyme action.	
Unit 2	**14**
Chapter 3. Metabolism of Carbohydrates and Lipids • Metabolism of Carbohydrates: glycolysis, citric acid cycle, gluconeogenesis, phosphate pentose pathway, Glycogenolysis and Glycogenesis • Lipids- Biosynthesis of palmiticacid; Ketogenesis, β-oxidation and omega – oxidation of saturated fatty acids with even and oddnumber of carbonatoms	
Chapter 4. Metabolism of Proteins and Nucleotides • **Catabolism of amino acids**: Transamination, Deamination, Ureacycle,Nucleotides and vitamins • **Anabolism** -Peptide linkages	
Unit 3	**14**

Chapter 5. Digestion and Respiration in humans • **Digestion**- Structural organization and functions of gastrointestinal tract and associatedglands. • Mechanical and chemical digestion of food; Absorptions of carbohydrates, lipids, proteins, water, minerals and vitamins; Physiology of trachea and Lung. • **Respiration** -Mechanism of respiration, Pulmonary ventilation; Respiratory volumes andcapacities; Transport of oxygen and carbon dioxide in blood, Respiratory pigments, Dissociation curves and the factors influencing it; Control of respiration.	
Chapter 6. Circulation and Excretion in humans • Components of blood and their functions; hemopoiesis • **Blood clotting**: Blood clotting system, Blood groups: Rh-factor, ABO and MN • Structure of mammalian heart • Cardiac cycle; Cardiac output and its regulation, Electrocardiogram, Blood pressure and its regulation • Structure of kidney and its functional unit; Mechanism of urine formation	
Unit IV	**14**
Chapter 7. Nervous System and Endocrinology in humans • Structure of neuron, resting membrane potential(RMP) • Origin of action potential and its propagation across the myelinated and unmyelinated nerve fibers. Types of synapse • **Endocrine glands** - pineal, pituitary, thyroid, parathyroid, pancreas and adrenal;hormones secreted by them. • Classification of hormones; Mechanism of Hormone action.	
Chapter 8. Muscular System in humans • Histology of different types of muscle; Ultra structure of skeletal muscle; Molecular and chemical basis of muscle contraction; Characteristics of muscle twitch; Motor unit, summation and tetanus	

Suggested Readings:

I. Nelson & Cox: Leininger's Principles of Biochemistry: McMillan (2000)
2. Zubay et al: Principles of Biochemistry: WCB (1995)
3. Voet&Voet: Biochemistry Vols l & 2: Wiley (2004)
4. Murray et al: Harper's Illustrated Biochemistry: McGraw Hill (2003) Elliott and Elliott: Biochemistry and Molecular Biology: Oxford University Press
5. Guyton, A.C. & Hall, J.E. Textbook of Medical Physiology, Xl Edition, Hercourt Asia PTE Ltd. /W.B.Saunders Company. (2006).
6. Tortora, G.J. &Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons (2006).
7. Christopher D. Moyes, Patricia M. Schulte. Principles of Animal Physiology. 3rd Edition, Pearson Education (2016).
8. Hill, Richard W., et al. Anima l physiology. Vol. 2. Sunderland, MA: Sinauer Associates, (2004).
9. Chatterjee CC Human Physiology Volume l & 2, 11th edition, CBS Publishers (20 I 6).

Zoology Semester II Core Course Lab Content

Course Title/Code: Biochemistry and Physiology	**Course Credits:** 2
Course Code: FSB470	**L-T-P per week:** 0-0-4
Total Contact Hours: 56	**Duration of ESA:** 3 Hours
Formative AssessmentMarks: 25	**Summative AssessmentMarks:**25

Course Outcomes (COs):

COs1- At the end of the course the student should be able to understand:Basic structure ofbiomolecules through model making. **COs2-** Develop the skills to identify different types of blood cells.

COs3- Enhance basic laboratory skill like keen observation, analysis and discussion.

COs4- Learn the functional attributes of biomolecules in animal body.

COs5- Know uniqueness of enzymes in animal body and their importance through enzyme kinetics

Course Content

List of labs to be conducted	56Hours
1. Preparation of models of nitrogenous bases- nucleosides and nucleotides.	
2. Preparation of models of amino acids and dipeptides.	
3. Preparation of models of DNA and RNA.	
4. Qualitative analysis of Carbohydrates, Proteins and Lipids.	
5. Qualitative analysis of Nitrogenous wastes – Ammonia, Urea and Uric acid.	
6. Separation of amino acids or proteins by paper chromatography.	
7. Determination of the activity of enzyme (Urease)-Effect of [S] and determination ofKm and Vmax.	
8. Determination of the activity of enzyme (Urease) - Effect of temperature and time.	
9. Action of salivary amylase under optimum conditions.	
10. Quantitative estimation of Oxygen consumption by fresh water Crab.	
11. Quantitative estimation of salt gain and salt loss by fresh water.	
12. Estimation of Hemoglobin in human blood using Sahli'shaemoglobinometer	
12. Counting of RBC in blood using Hemocytometer	
13. Counting of WBC in blood using Hemocytometer	
14. Differential staining of human blood corpuscles using Leishman stain	
15. Recording of blood glucose level by using glucometer	
Virtual Labs (Suggestive sites)	
https://www.vlab.co.in https://zoologysan.blogspot.com www.vlab.iitb.ac.in/vlab www.onlinelabs.inwww.powershow.com https://vlab.amrita.edu https://sites.dartmouth.edu	

Text Books

1. Nelson & Cox: Leininger's Principles of Biochemistry: McMillan (2000)
2. Zubay et al: Principles of Biochemistry: WCB (1995)
3. Voet&Voet: Biochemistry Vols l & 2: Wiley (2004)
4. Murray et al: Harper's Illustrated Biochemistry: McGraw Hill (2003) Elliott and Elliott: Biochemistry and Molecular Biology: Oxford University Press
5. Guyton, A.C. & Hall, J.E. Textbook of Medical Physiology, Xl Edition, Hercourt Asia PTE Ltd. /W.B.Saunders Company. (2006).
6. Tortora, G.J. &Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons (2006).
7. Christopher D. Moyes, Patricia M. Schulte. Principles of Animal Physiology. 3rd Edition, Pearson Education (2016).
8. Hill, Richard W., et al. Anima l physiology. Vol. 2. Sunderland, MA: Sinauer Associates, (2004).
9. Chatterjee CC Human Physiology Volume l & 2, 11th edition, CBS Publishers (20 I 6).

Web References:

- Mammalian Physiology– www.biopac.com

TOPICS RECOMMENDED FOR SEMINAR/PROJECT REPORT

1. Biochemical pathways, their evolutionary background and regulation.
2. Blood groups and their importance.
3. Vital enzymes for human body.
4. Essential and nonessential amino acids.
5. Important body lipids.
6. Significance of animal proteins.
7. Role of carbohydrates in animal body.
8. Nature of proteins and nurture of animal body.
9. Role of lipids in structural and functional organization of body.

Scheme of Practical Examination
IISemester BSc. Zoology
Biochemistry and Physiology
Course Code: FSB470

Time: 3 hours **Maximum marks:25M**

1. Biochemistry experiments by lots
   (Carbohydrates, Proteins &Lipids) **6 Marks**
2. Physiology experiments by lots
   (Nitrogenous wastes/ salivary amylase/ activity of urease enzyme). **6 Marks**
3. Differential staining of human blood corpuscles OR Estimation of blood glucose level **5 Marks**
4. Identify the spots A(Haemoglobinometer/ Haemocytometer/ Paper chromatography) **3Marks**
5. Model submission. **5Marks**

The candidate has to submit the duly certified record at the time of practical examination. The record is for the referenceof the examiners, but not for assessment (since it is already assessed for IA)

Assessment:

Weightage for assessments (in percentage)

Type of Course	Formative Assessment / IA Marks	Summative Assessment Marks
Theory	40	60
Practical	25	25

Pedagogy: Written Assignment/Presentation/Seminar

Formative Assessment - Theory	
Assessment Occasion	**Weightage in Marks**
House Examination/Test	C1+C2=10+10=20
Written Assignment/Presentation/Seminar	10+10=20
Total	40

Pedagogy: Written Assignment/Presentation/Record/Seminar

Formative Assessment- Practical	
Assessment Occasion	**Weightage in Marks**
Internal assessment C1	10
Internal assessment C2	10
Class record	05
Total	25

Open Elective Course Content

Semester**: II Zoology**

Course Title: **Parasitology** Course Code: **FSB920**	Course Credits:**3**
Total Contact Hours**: 42**	Duration of ESA: 3 Hours
Formative Assessment Marks: **40**	Summative Assessment Marks:**60**

Course Outcomes (COs):

At the end of the course the students will be able to:

COs1- Know the stages of the life cycles of the parasites and infective stages.

COs2- Develop ecological model to know population dynamics of parasite, establishment of parasite population in host body,adaptive radiations and methods adopted by parasite to combat with the host immune system.

COs3- Develop skills and realize significance of diagnosis of parasitic infection and treatment.

COs4- Understand about diseases caused by Protozoa, Helminthes, Nematodes and Arthropods at molecular level.

COs5- Develop their future career in medical sciences and related administrative services.

Course Content

Content	42Hrs
Unit – 1	
Chapter 1. General Concepts • Introduction, Parasites, parasitoids, host, zoonosis • Origin and evolution of parasites • Basic concept of Parasitism, symbiosis, phoresis, commensalisms and mutualism • Host-parasite interactions and adaptations • Life cycle of human parasites • Occurance, mode of infection and prophylaxis **Chapter 2. Parasitic Platyhelminthes** • Study of morphology, life cycle, pathogenicity, prophylaxis and control measures of • *Fasciolopsisbuski* • *Schistosomahaematobium* • *Taeniasolium* • *Hymenolepis nana* **Chapter 3. Parasitic Protists** • Study of morphology, life cycle, pathogenicity, prophylaxis and control *measures* of • *Entamoebahistolytica* • *Giardia intestinalis*	**14**
• *Trypanosomagambiense* • *Plasmodium vivax*	
Unit – 2	**14**
Chapter 4. Parasitic Nematodes • Study of morphology, life cycle, pathogenicity, prophylaxis and control measures of • *Ascarislumbricoides* • *Ancylostomaduodenale* • *Wuchereriabancrofti* • *Trichinellaspiralis* • Nematode plant interaction ; Gall formation **Chapter 5. Parasitic Arthropods** • Biology, importance and control of • Ticks (Soft tick *Ornithodoros*, Hard tick *Ixodes*) • Mites(*Sarcoptes*) • Lice (*Pediculus*) • Flea (*Xenopsylla*) • Bug (*Cimex*) • Parasitoid (Beetles) **Chapter 6. Parasitic Vertebrates** • Cookicutter Shark • Hood Mocking bird and Vampire bat and their parasitic behavior and effect on host	
Unit – 3	**14**

Chapter 7.Molecular diagnosis & clinical parasitology
• General concept of molecular diagnosis for parasitic infection
• Advantages and disadvantages of molecular diagnosis
• Fundamental techniques used in molecular diagnosis of endoparasites
• Immunoassay or serological techniques for laboratory diagnosis of endoparasites on the basis of marker molecules like G.intestinalis, B. coli, E. histolytica, L. donovani, Malarial parasite using
  • ELISA, RIA
  • Counter Current Immunoelectrophoresis (CCI)
  • Complement Fixation Test (CFT) PCR, DNA, RNA probe	

Suggested Readings:

19. Arora, D. R and Arora, B. (2001) Medical Parasitology. II Edition. CBS Publications andDistributors.
20. E.R. Noble and G.A. Noble (1982) Parasitology: The biology of animal parasites. V Edition, Lea&Febiger.
21. Ahmed, N., Dawson, M., Smith, C. and Wood, Ed. (2007) Biology of Disease. Taylor and FrancisGroup.
22. Parija, S. C. Textbook of medical parasitology, protozoology & helminthology (Text and colour Atlas), II Edition, All India Publishers & Distributers, Medical Books Publishers, Chennai, Delhi.
23. Meyer, Olsen & Schmidt's Essentials of Parasitology, Murray, D. Dailey, W.C. Brown Publishers.
24. K. D. Chatterjee (2009). Parasitology: Protozoology and Helminthology. XIII Edition, CBSPublishers & Distributors (P) Ltd.
25. Gunn, A. and Pitt, S.J. (2012). Parasitology: an Integrated Approach. Wiley Blackwell.
26. Noble, E. R. and G.A.Noble (1982) Parasitology: The biology of animal parasites. V th Edition, Lea&Febiger.
27. Paniker, C.K.J., Ghosh, S. [Ed} (2013). Paniker‘s Text Book of Medical Parasitology. Jaypee, NewDelhi.
28. Parija,S.C.Textbookofmedicalparasitology,protozoology&helminthology(Textan d color Atlas),IIEdition, All India Publishers & Distributers, Medical Books Publishers, Chennai, Delhi.
29. Roberts, L.S and Janovy, J. (2009). Smith & Robert‘s Foundation of Parasitology. 8th. Edn. McGrawHill.
30. Bogitsh, B. J. and Cheng, T. C. (2000). Human Parasitology. 2nd Ed. Academic Press, New York.
31. Chandler, A. C. and Read. C. P. (1961). Introduction to Parasitology, 10th ed. John Wiley andSonsInc.
32. Cheng, T. C. (1986). General Parasitology. 2nd ed. Academic Press, Inc. Orlando.U.S.A.
33. Schmidt, G. D. and Roberts, L. S. (2001). Foundation of Parasitology. 3rd ed. McGraw HillPublishers.
34. Schmidt, G. D. (1989). Essentials of Parasitology. Wm. C. Brown Publishers (Indian print1990,Universal Book Stall).
35. John Hyde (1996) Molecular Parasitology Open University Press.
36. J Joseph Marr and Miklos Muller (1995) Biochemistry and Molecular Biology of Parasites 2 ndEdnAcademic Press.

Pedagogy: Chalk and Talk, PPT, Group discussion, Seminar, Interaction, virtual lab, Lab visit

Formative Assessment	
Assessment Occasion	**Weightage in Marks**
House Examination/Test	**20**
Written Assignment/Presentation/Project / Term Papers/Seminar	**20**
Total	**40**

Skill Enhancement Course Content

Semester: II Zoology

Course Title: Sericulture **Course Code:** VEC5ZOOP2	**Course Credits:** 2
Total Contact Hours: 56 Hours	**Duration of ESA:** 3 Hrs.
Formative Assessment Marks: 20	**Summative Assessment Marks:** 30

Course Outcomes (COs):

At the end of the course the student acquires the following knowledge:

COs1- Sericulture is an agro-based industry which gives economic empowerment to the students.

COs2- Sericulture may be taken up as a small scale industry by the small farmers and unemployedyouth.

COs3-Get jobs in teaching profession, silk board and other Govt. institutions as technicians.Student can be self-employed after successful completion of the course

Course Content

List of Lab to be conducted		42 Hrs
1	Morphology and taxonomy of mulberry.	
2	Raising of saplings – cutting preparation, planting and maintenance of nursery.	
3	Agronomical practices in mulberry cultivation-weeding, manuring, irrigation and harvesting.	
4	Diseases and pests of mulberry.	
5	Silk producing insects – non mulberry and mulberry silk worms.	
6	Life cycle and morphology of ***Bombyxmori.***	
7	Dissection of digestive system and silk glands of ***Bombyxmori.***	
8	Silk worm rearing equipments.	
9	Rearing process – incubation, chawki rearing, late age worm rearing, mounting and harvesting of cocoons.	
10	Silk worm diseases and pests – Grasserie, Flacherie, Muscardine, Pebrine, Uzi fly and Beetles.	
11	Grainages – production of silk worm eggs**.**	
12	Physical and commercial characteristics of cocoons.	
13	Reeling and weaving process – stiffling , cooking , brushing, reeling and re-reeling, different types of looms.	
14	Visit to mulberry farm and sericulture centre.	
15	Economics of silk production (Project)	

Text Books and References

1. Govindan , R.,Narayanswami,T.K and Devaiah, M.C.1998,Principles of silk worm pathology.Ser Publishers ,Banglore.
2. Tazima, Y.1964 -The genetics of the silk worm‖ Logos Press Ltd.London .
3. Tazima Y 1978 The silk worm an important laboratory tool Kodnasha Ltd. Tokyo.
4. Ganga G ,SulochanaChetty J An introduction to sericulture Oxford and IBH Publishing Co.Pvt. Ltd. New Delhi.
5. Ullal and Narasimhanna Hand book of practiclesericulture .
6. FAO Mannuals on sericulture vol . 1-4.
7. Tazima Y 1958 Silkworm egg CSB Publication ,Bombay .
8. Yashimoro Tanaka 1964 Sericology CSB Publication , Bombay.

Pedagogy

1. Demonstration
2. Assignment
3. Group discussion
4. Field Visit.
5. Use of Audio-Visual aids.

Formative Assessment	
Assessment Occasion	**Weightage in Marks**
Class Test	10
Attendance and Assignments	05
Visit to Mulberry Farm and Sericulture centre.	05
Total	20

Model Curriculum Structure for Degree Program B.Sc., Hons in Zoology

Name of the Degree Program: B. Sc., Hons

Discipline Core: Zoology

Total Credits for the Program: 50/100/142/184/268

Starting year of implementation: 2021-22 (I & II sem) ,2022-23 (III &IV sem)

PROGRAM OBJECTIVES (POs)

POs1- The Program offers both classical as well as modern concepts of Zoology in higher education.

POs2- It enables the students to study animal diversity in both local and global environments.

POs3- To make the study of animals more interesting and relevant to human studies more emphasis is given to branches like behavioral biology, evolutionary biology and economic Zoology.

POs4- More of upcoming areas in cell biology, genetics, molecular biology, biochemistry, geneticengineering and bioinformatics have also been included.

POs5- Equal importance is given to practical learning and presentation skills of students.

POs6- The lab courses provide the students necessary skills required for their employability.

POs7- Skill enhancement courses in classical and applied branches of Zoology enhanceenterprising skills of students.

POs8- The global practices in terms of academic standards and evaluation strategies.

POs9- Provides opportunity for the mobility of the student both within and across the world.

POs10- The uniform grading system will benefit the students to move across institutions withinIndia to begin with and across countries.

POs11- It will also enable potential employers in assessing the performance of the candidates across the world.

Semester III- ZoologyCore Course Content
Zoology: Paper-III: Molecular Biology, Bioinstrumentation & Techniques in Biology

Course Title/Code: **Molecular Biology, Bioinstrumentation& Techniques in Biology**	**Course Credits: 4**
Course Code: FSC470	**L-T-P per week:** 4-0-0
Total Contact Hours: 56	**Duration of ESA:** 3 Hours
Formative Assessment Marks: 40	**Summative AssessmentMarks**:**60**

Course Outcomes (COs):

At the end of the course the student should be able to understand:

CO1- After successful accomplishment of the course, the learners will be able to acquire betterunderstanding and comprehensive knowledge regarding most of the essential aspects of Molecular Biology subject which in turn will provide a fantastic opportunity to develop professional skill related to the field of molecular biology.

CO2- The course will mainly focus on the study of principal molecular events of cell incorporating DNA Replication, Transcription and Translation in prokaryotic as well aseukaryotic organisms.

CO3- Acquiring knowledge on instrumentation and techniques in biology.

Content	Hours
Unit I	**14**
Chapter 1: Process of Replication and Transcription • Fine structure of gene (Cistron, Recon, Muton) • DNA polymerase types and function. • Semiconservative model of replication. • Replication in Prokaryotes (Initiation, Elongation, Termination) • RNA polymerases - types and functions • Transcription in prokaryotes and eukaryotes	8
Chapter 2: Process of Translation • Genetic code and its salient features • Translation in prokaryotes and eukaryotes	6
Unit II	**14**
Chapter 3. Regulation of gene expression-I • Regulation of gene expression in prokaryotes- lac operon (inducible) and trp operon(repressible) in *E. coli* • Regulation of gene expression in eukaryotes - Role of chromatin (euchromatin andheterochromatin) in gene expression • Post-transcriptional modification: capping, splicing, polyadenylation • Concept of RNA editing (mRNA), gene silencing, and, RNAi	9
Chapter 4. Regulation of gene expression-II • Post-translational modifications: purpose, advantages, and significance; glycosylation, methylation, phosphorylation, and acetylation. • Intracellular protein degradation (lysosomal autophagy and ubiquitin proteosome pathway).	5
Unit III	14
Chapter 5: Microscopy • Principles and applications of Light microscopy, Dark field microscopy, Phase contrast microscopy, Fluorescence microscopy, Confocal microscopy and Electron microscopy (SEM and TEM**).**	9
Chapter 6: Centrifugation and Chromatography • Centrifugation: Principles, types, and applications (High speed and Ultracentrifugation) • Chromatography : Principle and applications of: TLC, HPLC and GC	5
Unit IV	14
Chapter 7: Biochemical Instrumentation • Colorimetry and Spectrophotometry: Beer-Lambert's law, Absorption spectrum, UV-VL Spectrophotometer. • pH meter, measurement of pH • Principle, applications and safety measures of Radio-tracer techniques - Autoradiography**.**	6

Chapter 8: Molecular Techniques • Principle and applications of Agarose gel-electrophoresis, SDS-PAGE, DNA Sequencing (Sanger's Dideoxy method) • PCR, DNA Fingerprinting, ELISA, Southern & Northern Blotting and Western Blotting.	8

Suggested Readings:

1. Griffiths A J F, H. J. Muller, D. T. Suzuki, R. C. Lewontin and W. M. Gelbart 2000. An introduction to genetic analysis. W. H. Greeman. New York.
2. Lewin, B 2003 Genes VIII. Oxford University Press. Oxford
3. Dale, Jeremy W and Schantz, Malcom V. 2002. From Gene to Genomes. John Wiley and Sons Ltd,NY,USA
4. Das, H.K. 2007. Text book of Biotechnology.Wiley India Pvt. Ltd. New Delhi
5. Freshney, Ian, R. 2006. Culture of Animal Cell (5th edn).Wiley- Liss publications
6. Pandian, T.T. and Kandavel, D.2008. Text Book of Biotechnology. I.K International Publishing House, New Delhi. 47
7. Primrose, S.B., Twyman, R.M., and Old, R.W. 2001. Principle of Gene Manipulation (6th edn). Blackwell Science Ltd, London
8. Singh .B.D. 2006. Biotechnology. Kalyani Publishers, New Delhi
9. Sobti, R. C. and Pachauri, Suparna S. 2009. Essentials of Biotechnology. Ane Books Pvt. Ltd. New Delhi

Semester III- ZoologyCore Course I Content:

Zoology: Paper-III: Molecular Biology, Bioinstrumentationand Techniques in Biology

Course Title: Molecular Biology, Bioinstrumentationand Techniques in Biology	**Course Credits**: **2**
Course Code: FSC470	**L-T-P per week:** 0-0-4
Total Contact Hours: 56	**Duration of ESA:** 3 Hours
Formative Assessment Marks: **25**	**Summative Assessment Marks:25**

Course Outcomes (COs):

At the end of the course the student should be able to:

COs1-At the end of the course, students will be able to understand the applications of biophysics and principle involved in bio-instruments.

COs2-Understand the methodology involved in bio techniques.

COs3- Students can demonstrate knowledge and practical skills of using instruments in biology and medical field.

COs4- They can perform techniques involved in molecular biology and diagnosis of diseases.

Lab Course Content

List of experiments	14 units (1unit- 4hrs)
1. To study the principle and applications of simple, compound and binocular microscopes.	1
2. To study the principle and applications of various lab equipments- Ph meter Electronic balance, Vortex mixer, use of glass pipette andmicropipettes, Laminar air flow Incubator, shaker, Water bath and centrifuge	2
3. To prepare Buffer solutions (Phosphate, Citrate, Tris-HCl buffer)	1
4. To estimate amount of RNA by Orcinol method.	2
5. Demonstration of differential centrifugation to fractionate components in a given mixture.	1
6. To estimate amount of protein by Lowry's method.	2
7. To identify different unknown amino acids using ascending paper chromatography.	1
8. Extraction of DNA from the given animal tissue sample.	2
9. To estimate amount of DNA by di-phenyl amine (DPA) method.	2

Suggested Readings:

1. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter. MolecularBiology of the Cell, 4th edition. New York: Garland Science (2002).
2. Daniel L. Hartl and Maryellen Ruvolo. Genetics: Analysis of Genes and Genomes, 8th Edition. Burlington,Mass.: Jones & Bartlett Learning (2012).
3. Gerald Karp. Cell and Molecular Biology: Concepts and Experiments, 5th Edition. Wiley Publication (2008).
4. Harvey Lodish, Arnold Berk, Paul Matsudaira, Chris A. Kaiser, Monty Krieger, Freeman. Molecular CellBiology, 5th edition. W. H. & Company (2003).
5. James D. Watson, Tania A. Baker, Stephen P. Bell, Alexander Gann, Michael Levine, RichardLosick.Molecular Biology of the Gene, 5th edition. Cold Spring Harbor Laboratory Press (2003).
6. Stryer, Lubert. Biochemistry, 2nd Edition. W. H. Freeman and Company, New York (1981)

Scheme of Practical ExaminationBSc.
Zoology III Semester

Core Subject: Molecular Biology, Bioinstrumentation and Techniques in Biology

Duration: 3 hours **Max. marks: 25**

1. Extraction of DNA from the given animal tissue
   OR
   Estimation of DNA / RNA / Proteins 10M

2. Separate and Identify the given unknown amino acids by using ascending paper Chromatography 07M

3. Identify and give the working principle of the s spotters A and B 4X2-8M

Assessment:

Weightage for assessments (in percentage)

Type of Course	Formative Assessment / IA Marks	Summative Assessment Marks
Theory	40	60
Practical	25	25

Pedagogy: Written Assignment/Presentation/Seminar

Formative Assessment – Theory	
Assessment Occasion	**Weightage in Marks**
House Examination/Test	C1+C2=10+10=20
Written Assignment/Presentation/Seminar	10+10=20
Total	40

Pedagogy: Written Assignment/Presentation/Record/Seminar

Formative Assessment- Practical	
Assessment Occasion	**Weightage in Marks**
Internal assessment C1	10
Internal assessment C2	10
Class record	05
Total	25

Open Elective Course Content

Semester: III

Course Title: **ENDOCRINOLOGY** Course Code: FSC920	Course Credits:**3**
Total Contact Hours**: 42**	Duration of ESA: 3 Hours
Formative Assessment Marks: **40**	Summative Assessment Marks:**60**

Course Outcomes (Cos):

At the end of the course the student should be able to:

Differentiate among endocrine, paracrine and autocrine systems.

COs 1- Describe the different classes and chemical structures of hormones.

COs 2- Identify the glands, organs, tissues and cells that synthesize and secrete hormones, hormone precursors and ass

COs 3- Identify and discuss the integration of the endocrine system in general with focus on specific interactions.

COs 4- Explain the consequences of under- and overproduction of hormones.

Course Content

Content	Hrs.
Unit I	**14**
Chapter 1. About Endocrine glands • Endocrine glands and classifications of hormones. • Characteristics and Transport of Hormones. **Chapter 2. Hypothalamus-Hyphophysis** • Hypothalamus as a neuroendocrine organ • Pituitary – Structure and functions • Chemical nature, mode of action, and functions of pituitary hormones. • Pituitary disorders **Chapter 3. Pineal gland** • Structure and functions of Pineal gland. • Hypo- and hyperactive states of the gland.	
Unit II	**14**
Chapter 4. Thyroid and parathyroid • Histological structure of the glands. • Chemical nature, mode of action, and functions of the hormones. • Hypo-and hyperactive states of the glands. **Chapter 5.: Adrenal cortex and medulla** – • Histological structure of the gland. Chemical nature, and functions of hormones • Hypo- and hyperactive states of the gland. **Chapter 6.** Prostaglandins and their function	
Unit – III	**14**
Chapter 7: Pancreas: • Pancreatic islets - histological structure. • Chemical nature, and function of pancreatic hormones. Hormonalcontrol of blood sugar. • Hyperinsulinism and diabetes mellitus. **Chapter 8: Gastro-intestinal hormones** – Functions and regulation of secretion. **Chapter 9: Different types of Rhythms –** • Ultradian, circadian, infradian. different zeitgebers and their relation with circadian clock • Neural basis of biological clock and role of suprachiasmatic nuclei. Sleep- wakefulness cycle. Time keeping genes. Jet-lag and shift work.	

Text Books & Suggested Readings:

1. William's Text Book of Endocrinology Larsen et al.: An Imprint of Elsevier.
2. Endocrinology, Mac E. Hadley, Pearson Education.
3. The Kidney-An outline of Normal and Abnormal Functions, by H.E. Dewardener, ELBS.
4. Vander's Human Physiology, E.P. Widmaier et al., McGraw-Hill, Higher Education.
5. Concise Medical Physiology by S.K. Chaudhuri, New Central Book Agency.
6. Endocrinology. Vols.I, II and III by L.O. DeGroot. W.B. Saunders Co.
7. The Physiology of Reproduction, Vols.I & II, by E. Knobil and J.D. Neil. Raven Press.
8. Guyton and Hall. Textbook of Medical Physiology. 13th Edition.
9. Histology: A Text and Atlas. Sixth Edition. Ross & Pawlina. Lippincott Williams & Wilkins.
10. Vertebrate Endocrinology by David O. Norris.

Course Books published in English and Kannada may be prescribed by the Universities and

Colleges.Pedagogy: Chalk and Talk, PPT, Group discussion, Seminar.

Formative Assessment	
Assessment Occasion	**Weightage in Marks**
Class Test	10
Attendance and Assignments	05
Visit to Mulberry Farm and Sericulture centre.	05
Total	20

Semester IV- Zoology Core Course IV
Content:

Paper : IV Gene TechnologyImmunology and Computational Biology

Course Title: Gene TechnologyImmunology and Computational Biology	**Course Credits:** 4
Course Code: FSD470	**L-T-P per week:** 4-0-0
Total Contact Hours: 56	**Duration of ESA:** 3 Hrs.
Formative Assessment Marks: 40	**Summative Assessment Marks:**60

Course Outcomes (COs):

At the end of the course the student should be able to:

COs1- Acquaint knowledge on versatile tools and techniques employed in genetic engineering and recombinant DNA techn

COs2- An understanding on application of genetic engineering techniques in basic and applied experimental biology.

COs3- To acquire a fundamental working knowledge of the basic principles of immunology.

COs4- To understand how these principles, apply to the process of immune function.

COs5- Use, and interpret results of, the principal methods of statistical inference and design; helps to communicate the res

Course Content	Hours
Unit I	**14**
Chapter 1: Principles of Gene Manipulation • Recombinant DNA Technology: Introduction, steps involved. • Restriction Enzymes and Ligases and Nucleic acid modifying enzyme. • Gene cloning Vector: Concept of plasmids-pBR322, Lamda phage vectors,cosmids • Gene transfer techniques (Direct and indirect : Transformation, Transfection, Electroporation). • Screening and selection of recombinant colonies	07
Chapter 2: Applications of Genetic Engineering • Transgenic animals (Transgenic cow, Transgenic Fish); Transgenic plants(cry protein); Gene silencing (Knock out and Knock in mouse). • Production of Human Recombinant insulin and • Hybridoma technology: Synthesis and applications of Monoclonalantibodies • Gene Therapy (SCID) • Biosensors and its applications	07
Unit II	**14**
Chapter 3: Introduction to the Immune System • Defence against diseases: Introduction, First and second line of defense, • Types of Ummunity: Innate and acquired immunity; Humoral immunity and cell mediated immunity • Antigen presenting cells (APC's), Role of Band T-lymphocytes (), primary and secondary immune response. • Functional aspects of organs of the Immune system - Thymus and bone marrow, spleen, Lymph Node.	**07**
Chapter 4: Antigens and Antibodies • Antigens and haptens: Properties (foreignness, molecular size, heterogeneity). • B and T cell epitopes. • Structure of IgG and functions of different classes of immunoglobulins. • Major histocompatibility complex - Structure of MHC I & II.	**07**
Unit III	**14**
Chapter 5: Clinical Immunology • Immunity against diseases of viral, bacterial and protozoan infections. • Vaccines: Types and Uses - Immunization schedule for children. • Transplantation immunology: Transplantation of organ- Types, graft rejection and Immuno-suppressors**.**	**07**
Chapter 6: Bioinformatics • Databases: Sequence and structural	**07**

• Sequence analysis (homology): Pairwise and Multiple Sequence alignment- BLAST, CLUSTALW, Sequence alignment-FASTA. • Scope and applications of Bioinformatics.	
Unit IV	**14**
Chapter 7: Biostatistics I • Measures of central tendency: Mean, Median, Mode. ● Data summarizing: Frequency distribution, Graphical presentation - bar diagram, pie diagram, histogram. ● Elementary idea of probability and its applications.	**07**
Chapter 8: Biostatistics II • Measures of dispersion: Range, Standard Deviation, Variance. ● Correlation and Regression. ● Tests of significance: F-test, ANOVA, t-test and Chi square test.	**07**

Topics Suggested for Assignment/ Formative Assessment:

1. Q/A, Short Question, Quiz, MCQ, Assignment etc.

Recommended Books:

1. Primrose &Twyman. Principles of Genome Analysis and Genomics. Blackwell (2003).
2. Hartl& Jones. Genetics: principles &Analsysis of Genes & Genomes. Jones & Bartlett (1998).
3. Sambrook*et al*. Molecular Cloning Vols I, II, III. CSHL (2001).
4. Primrose. Molecular Biotechnology. Panima (2001).
5. Clark & Switzer. Experimental Biochemistry. Freeman (2000)
6. Sudbery. Human Molecular Genetics. Prentice-Hall (2002).
7. Wilson. Clinical Genetics-A Short Course, Wiley (2000).
8. Pasternak. An Introduction to Molecular Human Genetics. Fritzgerald (2000).
9. Biostatistical Analysis (Fourth Edition) by Jerrold H. Zarr, Pearson Education Inc., Delhi
10. Statistical Methods (Eighth Edition) by G. W. Snecdecor and W. G. Cochran, Willey Blackwell
11. Biostatistics (Tenth Edition) by W.W. Daniel and C. L. Cross, Wiley
12. Introductory Biological Statistics (Fourth Edition) by John E. Havel, Raymond E. Hampton and Scott J. Meiners
13. Westhead et al Bioinformatics: Instant Notes. Viva Books (2003)
14. Genetic engineering: Sandhya Mitra BITS, Pilani
15. Principles of Biostatistics Khan and Khanam
16. Transgenic animals: Ranga

Zoology Semester IV Core Course Lab Content

Course Title: Gene Technology Immunology and Computational Biology	**Course Credits:** 2
Course Code: FSD470	**L-T-P per week: 0**-0-4
Total Contact Hours: 56	**Duration of ESA:** 3 Hrs.
Formative Assessment Marks: 40	**Summative Assessment Marks:**60

Course Outcomes (COs):

At the end of the course the student should be able to:

COs1- Accurately, safely and appropriately use all the equipment regularly used in Molecular Biology(DNA manipulation, includ

COs2- Prepare chemical solution and reagents to the precision appropriate to the task.

COs3- Demonstrate knowledge of the biochemical basis underpinning the molecular biologytechniques.

Lab IV Course Content

List of labs to be conducted	Hours
1. Calculate the mean, median, mode and standard deviation (with suitable examples). 2. Measure the height and weight of all students in the class and apply statistical measures (Frequency distribution, Bar diagram, pie diagram, histogram) 3. With Suitable data, apply tests of significance : Chi-square test and student t-test 4. Determination of ABO Blood group and Rh factor. 5. Demonstration of agarose gel electrophoresis for detection of DNA. 6. To study Restriction enzyme digestion using teaching kits (Demonstration only). 7. To detect genetic mutations by Polymerase Chain Reaction (PCR) using teaching kits (Demonstration only). 8. Demonstration of Polyacrylamide Gel Electrophoresis (PAGE) for detection of proteins. 9. To calculate molecular weight of unknown DNA and protein fragments from gel pictures. (https://youtube/mCiCiO0cfbg) 10. To learn nucleotide sequence database. 11. To learn sequence alignment: Pairwise alignment (Protein/ DNA).	

Scheme of Practical ExaminationBSc. Zoology
IV Semester
Zoology Core Subject: Gene Technology

Duration: 3 hours **Max. marks: 25**

1.	Determine the blood group of the given sample and comment	05M
2.	Problem on practical 1&2	06M
3.	Problem on practical 3	06M
4.	Identify and comment on the given spotters A and B (PCR/PAGE/Restriction enzyme kit/FASTA/BLAST/Database)	08M

Assessment:

Weightage for assessments (in percentage)

Type of Course	Formative Assessment / IA Marks	Summative Assessment Marks
Theory	**40**	**60**
Practical	**25**	**25**

Pedagogy: Written Assignment/Presentation/Seminar

Formative Assessment - Theory	
Assessment Occasion	**Weightage in Marks**
House Examination/Test	C1+C2=10+10=20
Written Assignment/Presentation/Seminar	10+10=20
Total	40

Pedagogy: Written Assignment/Presentation/Record/Seminar

Formative Assessment- Practical	
Assessment Occasion	**Weightage in Marks**
Internal assessment C1	10
Internal assessment C2	10
Class record	05
Total	25

Open Elective Course Content
Semester: IV Zoology

Course Title: **Animal Behaviour** Course Code: FSD920	Course Credits:**3**
Total Contact Hours**: 42**	Duration of ESA: 3 Hours
Formative Assessment Marks: **40**	Summative Assessment Marks:**60**
Model Syllabus Authors:	

Course Outcomes (COs):

At the end of the course the students will be able to:

COs1- Examine and critically to evaluate the emergence of ideas that have shaped how we observe andcollect data on

COs2-Understand the main historical ideas that underpin animal behaviour theory

COs3-Critically review hypotheses to explain animal behavior

COs4-Understand different methods for collecting data on animal behavior

COs5-Have advanced their written and oral presentation skills.

Course Content

Content	42Hrs
Unit – 1	
Chapter 1.: Introduction to Animal Behaviour • Brief contributions of Karl Von Frisch, Ivan Pavlov, Konrad Lorenz,NikoTinbergen. • Proximate and ultimate causes of behaviour. **Chapter 2. Patterns of Behaviour** • Stereotyped Behaviors - Orientation and Reflex. • Individual Behavioural patterns: Instinct and Learned Behaviour • Associative learning, classical and operant conditioning, Habituation, Imprinting.	**14**
Unit – 2	**14**
Chapter 3. Social Behaviour: • Social organization in termites and honey bees. • Social behaviour: Altruism. • Conflict behaviour. **Chapter 4. Sexual Behaviour** • Sexual dimorphism, Mate choice in peacock. • Intra-sexual selection (male rivalry in red deer). • Kinship theory: Relatedness & inclusive fitness. • Parental care in fishes (Nest Building & cost benefit)	
Unit – 3	**14**
Chapter 5. Chronobiology • Brief historical developments in chronobiology. • Adaptive significance of biological clocks. • Biological Rhythms **Chapter 6: Communications in animals** • Bioluminescence in deep sea fishes and insects • Territoriality in Monkeys and Dogs • Role of pheromones in animal communication- Insects and Vertebrates, • Communication in Honey bees (Waggle Dance)	

Suggested Readings:

1. Animal Behaviour by Drickamar.
2. John Alcock, Animal Behaviour, Sinauer Associate Inc., USA.
3. Paul W. Sherman and John Alcock, Exploring Animal Behaviour, Sinauer Associate Inc.,Massachusetts, USA.
4. Chronobiology Biological Timekeeping: Jay. C. Dunlap, Jennifer. J. Loros, Patricia J. DeCoursey(ed). 2004, Sinauer Associates, Inc. Publishers, Sunderland, MA, USA
5. Insect Clocks D.S. Saunders, C.G.H. Steel, X., Afopoulou (ed.) R.D. Lewis. (3rdEd) 2002 Barensand Noble Inc. New York, USA
6. Biological Rhythms: Vinod Kumar (2002) Narosa Publishing House, Delhi/ Springer-Verlag,Germany.

Pedagogy: Chalk and Talk, PPT, Group discussion, Seminar, Interaction, virtual lab, Lab visit

Formative Assessment	
Assessment Occasion	**Weightage in Marks**
Class Test	10
Attendance and Assignments	05
Visit to Mulberry Farm and Sericulture centre.	05
Total	20

Choice Based Credit System (CBCS) Syllabus for Undergraduate Zoology subject 2022-23

DISCIPLINE CENTRIC ELECTIVE COURSE

V SEMESTER ZOOLOGY

APPLIED ZOOLOGY

THEORY **(CREDITS 4)**

Unit I 12 hrs

Introduction to Host-parasite Relationship

Host, Definitive host, Intermediate host, Parasitism, Symbiosis, Commensalism, Reservoir, Zoonosis

Epidemiology of Diseases

Transmission, Prevention and control of diseases: Tuberculosis, typhoid

Rickettsiae and Spirochaetes

Brief account of *Rickettsia prowazekii*, *Borrelia recurrentis* and *Treponema pallidum*

Unit II 12 hrs

Parasitic Protozoa

Life history , pathogenicity and preventive measures of *Entamoeba histolytica*, *Plasmodium vivax* ,*Trypanosoma gambiense* and *Leishmania donovani*

Parasitic Helminthes

Life history and pathogenicity of *Ancylostoma duodenale* , *Wuchereria bancrofti,Tape worm* and *Liver fluke.*

Unit III 12 hrs

Insects of Economic Importance

Biology, Control and damage caused by *Helicoverpa armigera*(cottonbal worm)*, Pyrilla perpusilla* (sugar cane leaf hopper) ,*Papilio demoleus* (lime butterfly) *Callosobruchus chinensis(*beetle), and *Tribolium castaneum(*red flour beetle)Lac insect.

Sericulture- Types of silks and distribution.

Apiculture- Types of honey bees, products, byproducts and their usage. Pollination and insects with examples.

Unit IV 12 hrs

Animal Husbandry

Preservation and artificial insemination in cattle; Induction of early puberty and synchronization of estrus in cattle

Poultry Farming

Principles of poultry breeding, Management of breeding stock and broilers, processing and preservation of eggs

Fish Technology

Genetic improvements in aquaculture industry; Induced breeding and transportation of fish seed.

Unit V 12 hrs

A. **Insect Vector Biology**

Introduction to vector biology, economic importance and control of fleas, lice, bugs, mosquitoes, flies and parasitoids. Vector-parasite interaction; host-pathogen interaction.

B. Medical Zoology:

Infectious/ communicable diseases: small pox, hepatitis, AIDS, influenza, SARS, Ebola, tuberculosis, plague, cholera, amoebiasis, malaria, dengue, chikungunya, trypanosomiasis, and elephantiasis.(pathogen. Vector, transmission, symptoms and prevention)

V SEMESTER ZOOLOGY

PRACTICAL –V

APPLIED ZOOLOGY

PRACTICAL **(CREDITS 2)**

1. Study of *Plasmodium vivax, Entamoeba histolytica, Trypanosoma gambiense,* and *Wuchereria bancrofti* and their life stages through permanent slides/photomicrographs or specimens.
2. Study of arthropod vectors associated with human diseases: Pediculus, Culex, Anopheles, Aedes and Xenopsylla.
3. Study of insect damage to different plant parts/stored grains through damaged products/photographs.
4. Identifying feature and economic importance of *Helicoverpa (Heliothis) armigera*, *Papilio demoleus*
5. Demonstration of Plastination techniques by using some dead insects.
6. Maintenance of freshwater aquarium.
7. Collection and mounting of Ants.
8. Animal associations: - Mutualism – Termites and Trichonympha.
9. Commensalism – Echenies and shark.
   Protocooperation – Hermit crab and Sea anemone.
10. Predation – Snake and Frog. Parasitism – Head louse, Bed bug, Mosquito, Ticks, Mites.
11. Identification of mulberry and non mulberry silkworms. Identification of different larvae of silk worm- Using specimens / pictures
12. Identification of food fishes of Karnataka.
13. Field visits to a Vermiculture / Sericulture / fisheries / apiculture / poultry / dairy farm- submission of any 1 Report.
14. Repetition.

SUGGESTED READINGS

1. Arora, D. R and Arora, B. (2001). Medical Parasitology. II Edition. CBS Publications
2. Atwal, A.S. (1986). Agricultural Pests of India and South East Asia, Kalyani
   CBCS Undergraduate Program in Zoology
4. Dennis, H. (2009). Agricultural Entomology. Timber Press (OR).
5. Dunham R.A. (2004). Aquaculture and Fisheries Biotechnology Genetic Approaches.CABI publications, U.K.
6. Hafez, E. S. E. (1962). Reproduction in Farm Animals. Lea & Fabiger Publisher
7. Kumar and Corton. Pathological Basis of Diseases.
8. Park, K. (2007). Preventive and Social Medicine. XVI Edition. B.B Publishers.
9. Pedigo, L.P. (2002). Entomology and Pest Management, Prentice Hall.

V SEMESTER ZOOLOGY

PRACTICAL –V

APPLIED ZOOLOGY

Scheme of Practical Examination

Duration 3 Hours Max Marks: 70

1.	Identification of parasites A to F (6x4) (3 from I and II, 3 from III and IV)	24 Marks
2.	Identify and comment upon animal association G & H(5X2)	10 Marks
3.	Identification of mulberry and non mulberry silkworms I&J(3X2)	06 Marks
4.	Identification of food fishes of Karnataka K&L(3X2)	06 Marks
5.	Identification of different larvae of silk worm- Using specimens / pictures	04 Marks
1.	Report submission	10 Marks
2.	Class record.	10 Marks

SCHEME OF VALUATION FOR PRACTICAL -V

1. Identification –01, Classification-01,Diagram – 01,Comment–01
2. Identification – 01,Diagram – 02, Comment-02
3. Identification –01, Diagram – 01, Comment- 01
4. Identification – 01, Diagram – 01, Comment- 01
5. Identification – 01, Diagram – 01, Comment- 02

DISCIPLINE SPECIFIC ELECTIVE COURSE

V SEMESTER ZOOLOGY

INSECT, VECTORS AND DISEASES

THEORY **(Credits 4)**

Unit I

Introduction to Insects

General Features of Insects, Morphological features, Head – Eyes, Types of antennae, Mouth parts w.r.t. feeding habits

Concept of Vectors : Brief introduction of Carrier and Vectors (mechanical and biological vector),

Reservoirs, Host-vector relationship, Vectorial capacity, Adaptations as vectors, Host Specificity

Unit II

Insects as Vectors

Classification of insects up to orders, detailed features of orders with insects as vectors – Diptera, Siphonaptera, Siphunculata, Hemiptera

Unit III

Dipteran as Disease Vectors

Dipterans as important insect vectors – Mosquitoes, Sand fly, Houseflies;

Study of mosquito-borne diseases – Malaria, Dengue, Chikungunya, Viral encephalitis, Filariasis; Control of mosquitoes

Study of sand fly-borne diseases – Visceral Leishmaniasis, Cutaneous Leishmaniasis, Phlebotomus fever; Control of Sand fly

Study of house fly as important mechanical vector, Myiasis, Control of house fly

Unit IV

Siphonaptera as Disease Vectors

Fleas as important insect vectors; Host-specificity, Study of Flea-borne diseases –Plague, Typhus fever; Control of fleas

Unit V

Siphunculata as Disease Vectors

Human louse (Head, Body and Pubic louse) as important insect vectors; Study of louse-borne diseases –Typhus fever, Relapsing fever, Trench fever, Vagabond's disease, Phthiriasis; Control of human louse

Unit VI

Hempitera as Disease Vectors

Bugs as insect vectors; Blood-sucking bugs; Chagas disease, Bed bugs as mechanical vectors, Control and prevention measures

V SEMESTER ZOOLOGY

PRACTICAL –V

INSECT VECTORS AND DISEASES

PRACTICAL (CREDITS 2)

1. Study of different kinds of mouth parts of insects
2. Study of following insect vectors through permanent slides/ photographs:
Aedes, Culex, Anopheles, *Pediculus humanus capitis, Pediculus humanus corporis, Phithirus pubis, Xenopsylla cheopis, Cimex lectularius, Phlebotomus argentipes, Musca domestica,* through permanent slides/ photographs
3. Study of different diseases transmitted by above insect vectors
Submission of a project report on any one of the insect vectors and disease transmitted

SUGGESTED READINGS

1. Imms, A.D. (1977). *A General Text Book of Entomology*. Chapman & Hall, UK
2.Chapman, R.F. (1998). *The Insects: Structure and Function.* IV Edition, Cambridge University Press, UK
3. Pedigo L.P. (2002). *Entomology and Pest Management.* Prentice Hall Publication
4. Mathews, G. (2011). *Integrated Vector Management: Controlling Vectors of Malaria and Other Insect Vector Borne Diseases*. Wiley-Blackwell

DISCIPLINE SPECIFIC ELECTIVE COURSE

VI SEMESTER ZOOLOGY

AQUATIC BIOLOGY

THEORY **(Credits 4)**

UNIT I 12 hrs

Aquatic Biomes

Ecosystems: Concept, types and structure of ecosystem

Hydrosphere : (Water) Physical and chemical properties. **Brief introduction of the aquatic biomes:** Freshwater ecosystem (lakes, wetlands, streams and rivers), estuaries, intertidal zones, oceanic pelagic zone, marine benthic zone and coral reefs

UNIT II 12 hrs

Freshwater Biology

Physico–chemical Characteristics: Light, Temperature, Thermal stratification, Dissolved Solids, Carbonate, Bicarbonates, Phosphates and Nitrates, Turbidity; dissolved gases (Oxygen, Carbon dioxide). **Pond:** The pond as an ecosystem – Origin and classification, flora and fauna of pond ecosystem. Freshwater adaptations. **Lakes**: Origin and classification, Lake as an Ecosystem.

UNIT III 12hrs

Marine Biology

Physico–chemical Characteristics: Light, Temperature, pressure, stratification, Salinity and density of Sea water,biotic community of Continental shelf open sea , Adaptations of deep sea organisms, Coral reefs, Sea weeds.

UNIT IV 12 hrs

Management of Aquatic Resources

Water pollution: Definition, sources Types and classification of pollutants. Effects of Water Pollution, Oxygen sag curves and Eutrophication Drinking water: Collection, purification and distribution. Wastewater treatment: Primary, secondary and tertiary treatment

Causes of pollution: Agricultural, Industrial, Sewage, Thermal and Oil spills, Management and conservation (legislations), Sewage treatment, Water quality assessment- BOD and COD.

UNIT V: Aquaculture 12 hrs

Aquaculture in India: an overview – nutritional value and food security - Site selection and preparation of culture ponds **Fish culture:** carps, marine fishes and ornamental fishes.

Prawn culture: Freshwater prawns and marine shrimps. Fattening of crabs. Crayfish and Lobster

Pearl culture: Types of pearls, composition, Biology of pearl oyster, pearl formation, culture of pearls .

SUGGESTED READINGS

1. B. Das, (2012). Parasitology, Books & Allied Pvt. Ltd-II
2. S.Bhattacharya (2011). Environmental toxicology, Books & Allied Pvt. Ltd
3. S.Bhattacharya (2011). Environmental toxicology, Books & Allied Pvt. Ltd
4. T. K. Saha. (2012). Ecology and Environmental Biology. Books & Allied Pvt.

PRACTICAL VI

AQUATIC BIOLOGY

PRACTICAL **(Credits 2)**

1&2. Identify the important macrophytes, phytoplanktons and zooplanktons present in a lake ecosystem/ photographs.

3 Estimation of dissolved oxygen in different water samples.

4 Estimation of dissolved carbon dioxide in different water samples.

5 Estimation of chlorides in different water samples.

6 Estimation of hardness in different water samples.

7 Measurement of pH, using pH-meter, pH paper.

8 Study of pond ecosystem.

9 Study of aquarium ecosystem.

10 Morphometric measurement of locally available freshwater fish and marine water fish.

11 Identification of fish(any six).

12&13. Fish by products.

14 . Project Report on a visit to a Sewage treatment plant/Marine bioreserve/ Fisheries Institutes.

15. Repetition.

PRACTICAL VI

AQUATIC BIOLOGY

Scheme of Practical Examination

Duration 3 Hours Max Marks: 70 Marks

1.	Estimation of any 2 parameters – by lots	10Marks
2.	Estimation of any 2 parameters – by lots	10Marks
3.	Morphometric measurement of freshwater fish and marine water fish.	10Marks
4.	Identification of fish. (A&B)	08 Marks
5.	Identification of phyto and zooplanktons (C&D)	08 Marks
6.	Fish by products	04 Marks
7.	Report	10 Marks
8.	Record	10 Marks

SCHEME OF VALUATION FOR PRACTICAL -V

1. Procedure - 04, Experiment- 04, Result - 02

2. Procedure - 04, Experiment- 04, Result - 02,

3. Procedure - 04, Experiment- 04 , Result - 02,

4.Identification -01, Classification-01,Diagram –01,Comment- 01 5.

Identification -01, Classification-01,Diagram –01,Comment- 01

6. Identification -01, Classification-01,Diagram –01,Comment- 01

.

DISCIPLINE SPECIFIC ELECTIVE COURSE

VI SEMESTER ZOOLOGY

IMMUNOLOGY

THEORY **(CREDITS 4)**

Unit 1: **Overview of the Immune System** **12Hrs**

Introduction to basic concepts in immunology, components of immune system, principles of innate and adaptive immune system

Unit 2: Cells and Organs of the Immune System **12Hrs**

Haematopoeisis, Cells of immune system and organs (primary and secondary lymphoid

organs) of the immune system
Antigens: Basic properties of antigens, B and T cell epitopes, haptens and adjuvants
Unit 3: Antibodies 12Hrs
Structure, classes and function of antibodies, monoclonal antibodies, antigen antibody interactions as tools for research and diagnosis
Unit 4: Working of the immune system 12Hrs
Structure and functions of MHC, exogenous and endogenous pathways of antigen presentation and processing, Basic properties and functions of cytokines, Complement system: Components and pathways.
Unit 5: **Immune system in health and disease 12Hrs**
Gell and Coombs' classification and brief description of various types of hypersensitivities, Introduction to concepts of autoimmunity and immunodeficiency,
Unit 6: Vaccines 12Hrs
General introduction to vaccines, Various types of vaccines
CBCS Undergraduate Program in Zoology

PRACTICAL VI

IMMUNOLOGY

PRACTICAL (CREDITS 2)

1 . Demonstration of lymphoid organs
2. Histological study of spleen, thymus and lymph nodes through slides/ photographs
3. Preparation of stained blood film to study various types of blood cells.
4. Ouchterlony's double immuno-diffusion method.
5. ABO blood group determination.
6. Cell counting and viability test from splenocytes of farm bred animals/cell lines.
7. Demonstration of
a) ELISA
b) Immunoelectrophoresis

SUGGESTED READINGS
1. Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J (2006). *Immunology*, VI Edition. W.H. Freeman and Company.

2, David, M., Jonathan, B., David, R. B. and Ivan R. (2006). *Immunology,* VII Edition, Mosby, Elsevier Publication.

3. Abbas, K. Abul and Lechtman H. Andrew (2003.) *Cellular and Molecular Immunology.* V Edition. Saunders Publication.

SKILL ENHANCEMENT COURSE

MEDICAL DIAGNOSTICS

THEORY **(Credits 2)**

Unit I 10 hrs

Introduction to Medical Diagnostics and its Importance

Diagnostics Methods Used for Analysis of Blood

Blood composition, Preparation of blood smear and Differential Leucocyte Count (D.L.C) using Leishman's stain, Platelet count using haemocytometer, Erythrocyte Sedimentary Rate (E.S.R), Packed Cell Volume (P.C.V.)

Unit II 10 hrs

Non-infectious Diseases

Causes, types, symptoms, complications, diagnosis and prevention of Diabetes (Type I and Type II), Hypertension (Primary and secondary), Testing of blood glucose using Glucometer/Kit

Infectious Diseases

Causes, types, symptoms, diagnosis and prevention of Tuberculosis and Hepatitis

Unit III: 10 hrs

Diagnostic Methods Used for Urine Analysis

Urine Analysis: Physical characteristics; Abnormal constituents

Tumours

Types (Benign/Malignant), Detection and metastasis; Medical imaging: X-Ray of Bone fracture, PET, MRI and CT Scan (using photographs).

SUGGESTED READINGS

1. Asis. Das. (2012). Medical Physiology, Books & Allied Pvt. Ltd
2. Cheesbrough M., A Laboratory Manual for Rural Tropical Hospitals, A Basis forTraining Courses.
3. Godkar P.B. and Godkar D.P. Textbook of Medical Laboratory Technology, II Edition, Bhalani Publishing House.
4. Guyton A.C. and Hall J.E. Textbook of Medical Physiology, Saunders
5. Park, K. (2007), and Social Medicine, B.B. Publishers.
6. Prakash, G. (2012), Lab Manual on Blood Analysis and Medical Diagnostics, S.Chand and Co.
7. Robbins and Cortan, Pathologic Basis of Disease, VIII Edition, Saunders.

JSS COLLEGE OF ARTS, COMMERCE & SCIENCE

(An Autonomous College of University of Mysore)

Re-accredited by NAAC with 'A' grade

OOTY ROAD, MYSORE-570 025, KARNATAKA

ESTD-1964

SYLLABUS

B. Voc. (Food Processing & Engineering)

2018 - 2019

DEPARTMENT OF FOOD PROCESSING & ENGINEERING

Scheme of Instruction For B. Voc. (Food Processing & Engineering)								
General Education Component								
(L-Lecture; T-Tutorial; P-Practical/Practice) (1 Credit = 15 Hrs)								
Semesters	**Paper No.**	**Title**	**L:T:P**	**Theory Hours**	**Tutorial Hours**	**Practical Hours**	**Total Hours**	**Total Credits**
Sem I	FPA 020	Communication Language Kannada	3:0:0	45	0	0	45	3
	FPA 510	Biochemistry-I	2:0:1	30	0	15	45	3
	FPA 520	Microbiology-I	2:0:1	30	0	15	45	3
	FPA 540	Computer Fundamentals & DOS	2:0:1	30	0	15	45	3
								12
Sem II	FPB540	Communication Language English	3:0:0	45	0	0	45	3
	FPB 510	Biochemistry-II	2:0:1	30	0	15	45	3
	FPB 520	Microbiology-II	2:0:1	30	0	15	45	3
	FPB 550	Computer C Programming	2:0:1	30	0	15	45	3
								12
Sem III	FPC 550	Indian Constitution	3:0:0	45	0	0	45	3
	FPD 580	Bio statistics	2:0:1	30	0	15	45	3
	FPC 510	Biochemistry-III	2:0:1	30	0	15	45	3
	FPC 520	Microbiology-III	2:0:1	30	0	15	45	3
								12
Sem IV	FPC 570	ICT	2:0:1	30	0	15	45	3
	FPD 510	Biochemistry-IV	2:0:1	30	0	15	45	3
	FPD 520	Microbiology-IV	2:0:1	30	0	15	45	3
	FPD 560	Environmental Studies	3:0:0	45	0	0	45	3
								12
Sem V	FPE 510	Biochemistry-V	4:0:2	60	0	30	90	6
	FPE 520	Microbiology-V	4:0:2	60	0	30	90	6
								12
Sem VI	FPF 510	Biochemistry-V	4:0:2	60	0	30	90	6
	FPF 520	Microbiology-V	4:0:2	60	0	30	90	6
								12

DEPARTMENT OF BIOCHEMISTRY
SCHEME OF INSTRUCTION

Scheme of Instruction For B.Voc- Food Processing and Engineering 2018-19									
General Education Component									
NSQF/ NVE QF Level	**Vocational Qualification**	**Semester**	**Title**	**L:T:P**	**Theory Hours**	**Tutorial Hours**	**Practical Hours**	**Total Hours**	**Credits**
Level- IV	**Diploma**	Semester- I	Biomolecule	2:0:1	30	0	15	45	3
Level- V		Semester-II	Enzymology and Bioenergetics	2:0:1	30	0	15	45	3
Level- VI	**Advanced Diploma**	Semester-III	Metabolism	2:0:1	30	0	15	45	3
		Semester-IV	Biochemical Techniques	2:0:1	30	0	15	45	3
Level- VII	**Degree**	Semester-V	Food and Nutrition	4:0:2	60	0	30	90	6
		Semester-VI	Applied Biochemistry	4:0:2	60	0	30	90	6

Proforma of assessment For B.Voc- Food Processing and Engineering 2018-19
General Education Component-Biochemistry

NSQF/ NVE QF Level	Vocational Qualification	Semester	Title	Theory				Practical				Credits
				Exam		C-1	C-2	Exam		C-1	C-2	
				Code	Marks	Marks	Marks	Code	Marks	Marks	Marks	
Level- IV	**Diploma**	Semester- I	Biomolecule	FPA510	70	10	10	FPA530	70	05	05	3
Level- V		Semester-II	Enzymology and Bioenergetics	FPB510	70	10	10	FPB530	70	05	05	3
Level- VI	**Advanced Diploma**	Semester-III	Metabolism	FPC510	70	10	10	FPC530	70	05	05	3
		Semester-IV	Biochemical Techniques	FPD510	70	10	10	FPD530	70	05	05	3
Level- VII	**Degree**	Semester-V	Food & Nutrition	FPE510	70	10	10	FPE530	70	05	05	6
		Semester-VI	Applied Biochemistry	FPF510	70	10	10	FPF530	70	05	05	6

SCHEME OF VALUATION FOR PRACTICAL EXAMINATION

- ✓ A candidate appearing for the first time should submit a duly signed and certified practical record
- ✓ Each candidate has to perform one experiment in the specified duration of three hours for ***FORTY FIVE*** **marks**
- ✓ Practical record has to be valued for ***TEN m*****arks** by examiners at the time of examination
- ✓ Viva-voce for ***FIFTEEN marks*** in practical is awarded by continuous assessment in the lab

Sl no	Component	Marks
1	Write up of the experiment	15
2	Conducting experiment	25
3	Result	05
4	Viva-voce	15
5	Practical record	10
	TOTAL	**70**

FPA510

SEMESTER I

Paper –I **(30 hours -2 Credits)**

BIOMOLECULES

Course Outcome:

After completion of the course a student is able to

CO1: Explian the structure and properties of carbohydrates, lipids, proteins, and nucleic acids in living organisms

CO2: Describe the structure and functions of RNA and DNA

CO3: Understand the role of vitamins in our body

CO4: Understand the behaviour of proteins in solutions

SECTION-I : Amino Acids & Proteins: **09 hrs**

1. Introduction to Bio-chemistry.
2. Definition, classification and biological functions of Amino acids and proteins.
3. **Amino Acids:** Common structural features. Stereoisomerism and RS system of designating optical isomers. Classification based on the nature of "R" groups. Amino acids present in proteins and non-protein amino acids. Specialized role of amino acids.Physical and Chemical properties of amino acids.Titration of amino acids.
4. **Proteins:** Levels of protein structure. Forces stabilising structure and shape of proteins. Native proteins and their conformations. Behavior of proteins in solutions. Salting in & salting out of proteins. Denaturation of proteins.

SECTION-II: Carbohydrates: **08 hrs**

1. Definition, classification and biological functions of carbohydrates.
2. Monosaccharides-Fischer and Haworth structures of monosacharides,. Derivatives of monosaccharides (Sugar acids, deoxysugars, amino sugars and other derivatives of biological importance). Oligosaccharides (structure of maltose, lactose, sucrose, cellobiose, and trehalose).
3. Homo-and hetero-polysaccharides (structures of starch, inulin, glycogen, cellulose, chitin). Polysaccharides of bacterial cell well.

SECTION-III: Lipids **08 hrs**

1. Definition and classification of lipids, fatty acids (saturated and unsaturated).Essential fatty acids. m. p., b. p. and their relation to molecular size. Fats as source of energy.Waxes.
2. Structures and functions of lipids :Triacylglycerols, phospholipids : lecithins (PhosphotidylCholines),

cephalins (Phosphotidylethanolamines), Phosphatidylserines, phosphatidyl inositol, sphingomyelins,
plasmalogens), cerebrosides, gangliosides.

3. Lipoproteins—Composition, classification and biological functions.Liposomes.
4. Prostaglandins, Leukotrienes, Thromboxanes and their importance.
5. Sources and biochemical functions of water & fat soluble vitamins.

SECTION-IV : Nucleic Acid **05 hrs**

1. Nucleic Acids: Structure and properties of purine and pyrimidine bases. Nucleosides and nucleotides. Biologically important nucleotides. Double helical model of DNA. Denaturation of DNA. Physical and chemical properties of nucleic acids.

FPA530 **PRACTICALS** **(15 Hrs 1 Credits)**

1. Qualitative tests for : (a) Carbohydrates. (b) Amino acids and proteins (c) Cholesterol and lipids **3 Hrs X 2**
2. Estimation of amino acid by formal titration **3 Hrs**
3. Estimation of ascorbic acid by dye method. **3 Hrs**
4. Estimation of reducing sugars by DNS method **3 Hrs**

FPB510 **Semester II**

Paper II **(30 hours – 2 credits)**

ENZYMOLOGY AND BIOENERGETICS

Course Outcome:

After completion of the course a student is able to;

CO1: Describe the role and functions of enzymes.

CO2: Understand the role of cofactor and coenzymes in enzyme catalysed reactions.

CO3: Describe the applications of enzymes in diagnostics.

CO4: Discuss the commercial importance of enzymes.

SECTION-I : Enzymology
08 hrs

Introduction to enzymes - General characteristics of enzymes. Prostheticgroup. Holoenzymes, apoenzyme and cofactors. Coenzymes and their biochemical functions, assay of enzyme activity, units of enzyme activity. Active sites(s) of enzymes.IUB system of nomenclature and classification of enzymes. Enzymes as catalysts. Theories of enzymes catalysis: Acidbase catalysis, covalent catalysis.

SECTION-II: Enzyme Purification : **08 hrs**

Need for purification. Preliminary fractionation procedures and precipitation techniques, Chromatography methods : Gel filteration, adsorption–, ion exchange– and affinity chromatography. Types of support materials.Selection of appropriate conditions and elution procedures.Criteria of enzyme purity.

SECTION-III : Enzyme Kinetics **09 hrs**

Factors affecting velocity of enzyme catalysed reactions: Enzyme concentration, pH and temperature. Michaelis –Menten equation. Determination of Km and its significance.

Enzyme inhibition.Various types of enzyme inhibitions..Enzyme inhibitors and their importance.Allosteric enzymes and enzyme regulation.Isoenzymes and their clinical significance.

SECTION-IV: Bioenergetics **05 hrs**

Biological systems and concept of free energy, Endergonic processes and role of ATP & other high energy compounds. Biological oxidations. Redox potential. Commercial importence of enzymes

FPB530 **PRACTICALS (15 Hrs – 1 Credit)**

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1. Assay of salivary amylase enzyme activity**.** **3 Hrs**
2. Effect of pH on enzyme activity**.** **3 Hrs**
3. Effect of temperature on enzyme activity **3 Hrs**
4. Effect of substrate concentration on enzyme activity and determination of Km and Vmax **3 Hrs**
5. Effect of activators (NaCl) on salivary enzyme activity **3 Hrs**

FPC510 **Semester III**

Paper – III **(30 hours- 2 Credits)**

METABOLISM

Course Outcome:

After completion of the course a student is able to;

CO1: Gain the knowledge on cellular metabolism and their regulations

CO2: Able to describe the linked pathways of metabolism

CO3: Demonstrate an understanding of the metabolic pathways - the energy-yielding and energy-requiring reactions in life.

CO4: Understand the role of enzymes in metabolic reactions.

SECTION-I

Carbohydrate Metabolism **08 hrs**

Digestion, Absorption and transport of Carbohydrates, Metabolic Pathways, Glycolysis, Pentose Phosphate Pathway, Glucuronate and glyoxylate pathway, TCA cycle, Glycogenolysis& Glycogenesis, Gluconeogenesis. Diseases associated with carbohydrate metabolism.

SECTION-II

Lipid Metabolism **08 hrs**

Digestion, absorption & Transport of Lipids, β-Oxidation of fatty acids. α and ω oxidation of fatty acids Degradation of triglycerides and phospholipids.Formation and utilization of ketone bodies.Biosynthesis of saturated fatty acids ,Biosynthesis of Cholesterol. Diseases associated with Lipid metabolism.

SECTION-III **08 hrs**

Protein Metabolism

Digestion, absorption & transport of Proteins, General Reactions of Amino Acids : Deamination, transamination and decarboxylation. Urea cycle and its significance. Ketogenic and glucogenic amino acids. Biosynthesis of amino acids (Phenyl alanine and Glutamic acid) and their degradation. Diseases associated with Proteins metabolism.

SECTION-IV **06 hrs**

Nucleic acid Metabolism

Degradation of purines and pyrimidines. Biosynthesis of purines, pyrimidines and nucleotides. Catabolism of Heme & Formation of Bile pigments. Diseases associated with Nucleic acid metabolism.

FPC530 **PRACTICALS** **(15 Hrs = 1 Credits)**

1. Estimation of protein by Biuret method. **3 Hrs**
2. Estimation of Ca+ in serum. **3 Hrs**
3. Estimation of iron in drumstics **3 Hrs**
4. Estimation of creatinine in serum. **3 Hrs**

5. Estimation of uric acid in urine **3 Hrs**

FPD510 **Semester IV**

Paper IV **(30 hours -2 Credits)**

BIOCHEMICAL TECHNIQUES

Course Outcome:

After completion of the course a student is able to;

CO1: Use selected analytical techniques for the sepration of biomolecules.

CO2: Differentiate certain functionalities of biomolecules by using spectroscopic techniques.

CO3: Understand the intersection of life and information sciences, using different sequencing and mapping like SDS-PAGE, TLC, GLC and Chromatography.

CO4: Explain the dangers and safety precautions associated with x-rays and identify the various isotopes used in radiography.

SECTION-I **08 hrs**

Spectroscopic Techniques :

Beer-Lambert's Law. Light absorption and its transmittance. Determination and application of extinction coefficient. Principle and Applications of following spectroscopic techniques - U.V.-Visible, infra-red, Fluorescent emission and NMR spectroscopy.

SECTION-II **08 hrs**

Electrophoretic Techniques :

Principles and applications of the following electrophoresis techniques. Paper electrophoresis, PAGE, SDS- PAGE.

Centrifugation Techniques :

Principle of differential and density gradient centrifugation. Ultra centrifuge – construction and applications

SECTION-III **08 hrs**

Chromatographic Techniques:

Principles of Adsorption and Partition chromatography. Techniques of ascending, descending, circular paper chromatography.

Thin Layer Chromatography-Technique and advantages over paper chromatography

Column chromatography – Principle and applications of Gel Filtration chromatography, ion – exchange chromatography.

SECTION-IV **06 hrs**

Radio Isotopic Techniques :

Properties of radioactive emissions.Units of radioactivity. Isotopes and their applications in biological studies - ^{3}H, ^{14}C, ^{131}I, ^{60}CO, and ^{32}P. Techniques used to measure radioactivity- GM counter. Biological hazards of radiation and safety measures in handling radioisotopes.

FPD530 PRACTICAL (15 Hrs = 1 Credits)

1. Identification of amino acids by circular paper chromatography. **3 Hrs**
2. Identification of amino acids by asending Paper chromatography **3 Hrs**
3. Separation of phospholipids by thin layer chromatography. **3 Hrs**
4. Separation of leaf pigments by column chromatography. **3 Hrs**
5. Separation of proteins by PAGE. **3 Hrs**

FPE510 **Semester V**

PaperV **(60 hours-4 Credits)**

FOOD AND NUTRITION

Course Outcome:

After completion of the course a student is able to;

CO1: Explain the theoretical and practical uses on micro and macronutrients.

CO2: Describe the role of electrolytes in nutritional biochemistry and their functions in metabolism.

CO3: Explain the role of nutrients in the optimal functioning of key biochemical pathways in the body.

CO4: Discuss the biological roles and deficiency disorders of proteins.

SECTION-I

15 Hrs

1. Introduction:

Concept of Nutrition, Calorific value of foods and its determination (Bomb calorimeter), different components of energy expenditure, measurement of energy expenditure by direct and indirect calorometric method (principles only) Energy expenditure at rest and work, respiratory quotient, Basal Metabolic Rate (BMR), determination of BMR by indirect calorimetric method, factors affecting BMR. Specific dynamic action of foods.

Proximate analysis of food samples:

Moisture, fiber, ash, proteins, carbohydrates, fats and their importance

Carbohydrates:

Dietary sources, dietary fibres and protein sparing action, glycemic index and its importance

Fats

Dietary sources, Visible and invisible fats, trans fats and its effects in fried foods

Water Metabolism

Distribution in the body, factors maintaining water balance and factors influencing water balance.

SECTION-II **15 Hrs**

1. Proteins:

Dietary sources, nutritional classification, Nutritional value of proteins – PER, Digestive coefficient, NPU and Biological value of proteins (BV). Essential amino acids. Nitrogen balance, mutual supplementation of proteins, Malnutrition – Kwashiorkor and marasmus (causes, clinical signs with symptoms & treatment

Vitamins

Classification, example with structure, dietary sources, daily requirement, biological roles and deficiency disorders with symptoms– Thiamine, Riboflavin, Niacin, pantothenic acid, Pyridoxine, Biotin, Folic acid,.

SECTION – III **15 Hrs**

Structures, dietary sources, daily requirement, biological roles and deficiency disorders with symptoms- Vitamin B12,C,A,D,E & K. Hypervitaminosis.

Minerals:

Dietary sources, physiological functions, deficiency disorders, absorption, balance and excretion of Macro nutrients- Ca, P, Na, K, Cl and Micronutrients – Fe, Zn, Cu, I &Mg

SECTION IV **15Hrs**

Digestion:

Gastrointestinal tract secretions - Composition and functions of Saliva, gastric, bile, pancreatic and intestinal Juices. Appetite, gastrointestinal tract hormones.

Digestion, absorption and transport of carbohydrates, proteins and fats

Antinutritional factors: Sources and harmful effects of anti vitamins (e.g.: avidin, dicumarol), Protease inhibitors, oxalates and fitates. Natural toxicants, (e.g.: Lathyrus sativa).Food adultrants- structure and harmfull effects of - Butter yellow, lead chromate and malachite green.

FPE530 **PRACTICAL** **(30 Hrs = 2 Credits)**

1. Estimation of haemoglobin in blood. **3 Hrs**
2. Identification of Sugars in fruit juice using paper chromatography. **3 Hrs**
3. Determination of nature of inhibition of alkaline phosphatase by cysteine. **3 Hrs**
4. Determination of proteins by dye binding assay. **3 Hrs**
5. Proximate analysis of food samples- Moisture, fibre, protein fat and carbohydrate (by difference) (3 experiments) **3 HrsX3**
6. Detection of adulterants in food. **3 Hrs**
7. Estimation of Calcium in ragi. **3 Hrs**
8. Estimation of Vitamin – C in lemon or gooseberries by DPPH method. **3 Hrs**

FPF510 **Semester VI**

Paper– VI **(60 hours -4 Credits)**

APPLIED BIOCHEMISTRY

Course Outcome:

After completion of the course a student is able to;

CO1: Explain concepts such as gene structure, function, and its regulation.

CO2: Discuss the molecular events and enzymes involved in DNA replication.

CO3: Understand the functions of immune system including organs, cells and receptors.

CO4: Discuss the elementary aspects of the molecular biology of cancer

SECTION-I **10 Hrs**

DNA Organization: Structure of chromatin – Histones and Nucleosomes. Active and inactive chromatin. Compaction of Chromatin. Chromosomes, Structure of Genome in eukaryotes. Rearrangements in Genetic Material. Integration of Chromosomes with viruses. Transposition, Experimental proofs for DNA as genetic material.

SECTION-II **20 Hrs**

DNA Replication : Semiconservative replication-proof. Molecular events and enzymes involved in DNA replication. DNA repair mechanisms. Mutations. RNA Synthesis : Initiation, elongation and termination during RNA synthesis. Transcription signals. Processing of RNA. Introns and Exons. Nucleases.

Genetic Code and Protein Biosynthesis : Characteristics of Genetic code, Deciphering of Genetic Code. Initiation, elongation and termination of protein chains. Post translational modifications in proteins. Inhibitors of protein biosynthesis.

SECTION-III **15 Hrs**

Definition of immune system and antigens. Cells involved in immune response. T-cell and B-cells, Immunoglobulins, chemical structure of the Antibody molecule.Haptens and carrier molecules, cell mediated immune response. Complement system, activation and its role in defense.

Brief discussion of various immunological techniques; Precipitation reactions in gels Haemagglutination, Immuno-fluorescence, radio-immunoassay (RIA), enzyme likedimmunoadsorbent assay (ELISA) and immunoblotting.

SECTION-IV **15 Hrs**

Membranes : Structure and functions of biological membranes, various models of membrane structure. Transport of solutes across membranes, Sodium pump.

Elementary aspects of the Molecular Biology of cancer and introduction to stem cells.Molecular basis of the Origin and Evolution of Life.

FPF530 **PRACTICALS** **(30 Hrs = 2 Credits)**

1. Estimation of DNA by diphenylamine method. **3 Hrs**
2. Effect of temperature on the Viscosity of DNA using Oswald's viscometer. **3 Hrs**
3. Assays of SGPT and SGOT in serum. **3 Hrs X**
4. Extraction of RNA from yeast and its estimation by Orcinol method. **3 HrsX2**
5. Determination of total protein and A/G ratio in serum. **3 Hrs**
6. Estimation of serum phospholipids. **3 Hrs**
7. Immobilization of enzymes/ cells by entrapment in alginate gel. **3 Hrs**
8. Demonstration of ELISA. **3 Hrs**

Pattern of Question Paper for Boc Voc
Semester I to VI
Paper I to VI

Time : 2 Hrs 30 Mins Max Marks 70

1. Answer all the questions in one sentence or a word 10 X 1 = 10

a. ----------
b. ----------
c. ----------
d. ----------
e. ----------
a. ----------
b. ----------
c. ----------
d. ----------
e. ----------

5. Answer any four of the following questions 4 X 5 = 20

a. ----------
b. ----------
c. ----------
d. ----------
e. ----------

6. Answer any four questions of the following 4 X 10 = 40

a. ----------
b. ----------
c. ----------
d. ----------
e. ----------

(Note- 10 Marks may be divided in to 6+4 or 5+5)

I SEMESTER PRACTICAL EXAMINATION

BIOMOLECULES

PRACTICAL I

SCHEME OF EXAMINATION

DURATION: 3 Hours

Maximum Marks: 70

Practical proper: 60

Record marks: 10

NOTE :- Candidates are required to submit the records duly signed by the teacher-in charge and certified by the Head of the Department

PART **15** Marks

The candidate has to write principle and procedure with tabular column for one experiment in the first 15 min. Then the examiner has to put his/her signature and value the paper at the end of the examination

1. Estimation of amino acid by formal titration
2. Estimation of ascorbic acid by dye method.
3. Estimation of reducing sugars by DNS method

PART B

Qualitative Analysis of Biomolecules 30 Marks

Any one of the following substances may be given for identification

1 Carbohydrate – Glucose, Fructose, Galactose, Lactose, Maltose, Sucrose and Starch.

2 Amino acids – Arginine, Tryptophan, Tyrosine, Cystein, Histidine, phenyl alanine

3 Proteins- Albumin and casein.

PART C 15 Marks

Viva

SCHEME OF VALUATION

(ASSESMENT OF EXPARIMENTAL RESULTS)

CLASS RECORDS :

i) For conducting and recording 5 experiments = 07 marks.

4 experiments = 06 marks

Less than 4 experiments = 04 marks

ii) For accuracy and neatness = 03 marks.

PART A

Principle- 7 Marks

Procedure- 8 Marks

PART B

Qualitative Analysis Of Biomolecules

1 Identification of the class of biomolecule 4 Marks

If carbohydrate is given

i) Reducing test(any two test) 7 Marks

ii) Classification test 6 Marks

iii) Distinguishing test (aldose or ketose) 6 Marks

iv) Preparation of osazone and identification 7 Marks

If aminoacid or protein is given, following tests may be conducted

i) Precipitation test

ii) Xanthoproteic test

iii) Millons test

iv) Sakaguchi test

v) Lead acetate/Sodium nitroprusside test 5 x 6 = 30 Marks

PART C

Viva- Five questions 5 x 3 = 15 Marks

II SEMESTER PRACTICAL EXAMINATION

ENZYMOLOGY AND BIOENERGETICS

PRACTICAL II

SCHEME OF EXAMINATION

SCHEME OF EXAMINATION

DURATION: 3 Hours

Maximum Marks: 70

Practical proper: 60

Record marks: 10

NOTE:- Candidates are required to submit the records duly signed by the teacher-in charge and certified by the Head of the Department

PART A 15 Marks

The candidate has to write procedure with tabular column for one experiment in the first 15 min.

Then the examiner has to put his/her signature and value the paper at the end of the examination

1. Assay of salivary amylase enzyme activity**.**
2. Effect of pH on enzyme activity**.**
3. Effect of temperature on enzyme activity
4. Effect of substrate concentration on enzyme activity and determination of Km and Vmax
5. Effect of activators (NaCl) on salivary enzyme activity

PART B 30 Marks

Any one of the following experiment may be set

1. Determination of specific activity of Salivary amylase by DNS.
2. Determination of pH optimum of Salivary amylase.
3. Determination of Km and Vmax of Salivary amylase.
4. Determination of initial velocity (time Kinetics) of Salivary amylase.

Note-

1. Specifiv activity:

i) Standard solution of reducing sugar must be supplied by the examiner.

ii) Concentration of protein in enzyme solution must be given to the students.

2. Optimum pH: buffer of 5 different values from 5 to 9 may be given (buffer solutions is to be supplied named as A,B,C,D,E and asked to found out the buffer in which activity is maximum)
3. Optimum time: 10' , 20' , 30' , 40' and 50'range may be considered for the time kinetics.
4. Determination of Km and Vmax: substrates of different concentration range such as 2, 5, 10, 15, 20 and 30 uMole maybe given(Standard graph of the substrate must be given).

PART C 15 Marks

Viva

SCHEME OF VALUATION

(ASSESMENT OF EXPARIMENTAL RESULTS)

CLASS RECORDS :

i) For conducting and recording 5 experiments = 07 marks.

4 experiments = 06 marks

Less than 4 experiments = 04 marks

ii) For accuracy and neatness = 03 marks.

PART B

Distribution of marks for enzyme assay

1. Tabular column	5 Marks
2. For conduction of experiment	12 Marks
3. Graph	5 Marks
4. Calculation	4 Marks
5. Result	4 Marks

PART C

Viva- Five questions 5 x 3 = 15 Marks

III SEMESTER PRACTICAL EXAMINATION

METABOLISM

PRACTICAL III

SCHEME OF EXAMINATION

SCHEME OF EXAMINATION

DURATION: 3 Hours

Maximum Marks: 70

Practical proper: 60

Record marks: 10

NOTE:- Candidates are required to submit the records duly signed by the teacher-in charge and certified by the Head of the Department

PART A 15 Marks

The candidate has to write procedure with tabular column for one experiment in the first 15 min. Then the examiner has to put his/her signature and value the paper at the end of the examination

1. Estimation of protein by Biuret method.
2. Estimation of Ca+ in serum.
3. Estimation of iron in drumstics
4. Estimation of creatinine in serum
5. Estimation of uric acid in urine

PART B 30 Marks

Any one of the following experiment may be set

1. Estimation of protein by Biuret method.
2. Estimation of Ca+ in serum.
3. Estimation of iron in drumstics
4. Estimation of creatinine in serum
5. Estimation of uric acid in urine

PART C 15 Marks

Viva

SCHEME OF VALUATION

(ASSESMENT OF EXPARIMENTAL RESULTS)

CLASS RECORDS :

i) For conducting and recording 5 experiments = 07 marks.

4 experiments = 06 marks

Less than 4 experiments = 04 marks

ii) For accuracy and neatness = 03 marks.

PART A

Principle- 7 Marks

Procedure- 8 Marks

PART B

Assessment of experimental results for colorimetric estimation

Preparation standard and working solution - 5 Marks

Distribution of marks for assay

1. Tabular column	5 Marks
2. For conduction of experiment	5 Marks
3. Graph	5 Marks
4. Result	
Up to 10% error	10 Marks
Up to 15% error	8 Marks
Up to 20% error	6 Marks
Any other value	4 Marks

Assessment of experimental results for Calcium estimation

Preparation of standard solution and calculation of the normality - 6 Marks

Discripancy	Standardization	Estimation
0.1 ml	10 Marks	10 Marks
0.2 ml	8 Marks	8 Marks
0.3 ml	6 Marks	6 Marks
Any other value	4 Marks	4 Marks
Calculation	2 Marks	2 Marks

PART C

Five questions 5x 3 = 15 Marks

IV SEMESTER PRACTICAL EXAMINATION
BIOCHEMICAL TECHNIQUES

PRACTICAL IV

SCHEME OF EXAMINATION

SCHEME OF EXAMINATION

DURATION: 3 Hours

Maximum Marks: 70

Practical proper: 60

Record marks: 10

NOTE:- Candidates are required to submit the records duly signed by the teacher-in charge and certified by the Head of the Department

PART A 15 Marks

The candidate has to write procedure with tabular column for one experiment in the first 15 min. Then the examiner has to put his/her signature and value the paper at the end of the examination

1. Identification of amino acids by circular paper chromatography.
2. Identification of amino acids by asending Paper chromatography
3. Separation of phospholipids by thin layer chromatography.
4. Separation of leaf pigments by column chromatography
5. Separation of proteins by PAGE

PART B 30

Marks

Any one of the following experiment may be set

1. Identification of amino acids by circular paper chromatography.
2. Identification of amino acids by asending Paper chromatography
3. Separation of phospholipids by thin layer chromatography.
4. Separation of leaf pigments by column chromatography

PART C 15

Marks

Viva

SCHEME OF VALUATION

(ASSESMENT OF EXPARIMENTAL RESULTS)

CLASS RECORDS :

i) For conducting and recording 5 experiments = 07 marks.
4 experiments = 06 marks
Less than 4 experiments = 04 marks

ii) For accuracy and neatness = 03 marks.

PART A

Principle- 7 Marks

Procedure- 8 Marks

PART B

1. Principle and Procedure writing……12 marks

2. For development of Chromatogram…… 12 marks

3. For correct identification……6marks

PART C

Viva- Five questions 5x 3 = 15 Marks

V SEMESTER PRACTICAL EXAMINATION

FOOD AND NUTRITION

PRACTICAL V

SCHEME OF EXAMINATION

SCHEME OF EXAMINATION

DURATION: 3 Hours

Maximum Marks: 70

Practical proper: 60

Record marks: 10

NOTE:- Candidates are required to submit the records duly signed by the teacher-in charge and certified by the Head of the Department

PART A 15 Marks

The candidate has to write procedure with tabular column for one experiment in the first 15 min. Then the examiner has to put his/her signature and value the paper at the end of the examination

1. Identification of Sugars in fruit juice using paper chromatography.
2. Proximate analysis of food samples- Moisture, fibre, protein fat and carbohydrate (by difference) (3 experiments)
3. Detection of adulterants in food.

PART B 30 Marks

Any one of the following experiment may be set

1. Estimation of haemoglobin in blood.
2. Determination of nature of inhibition of alkaline phosphatase by cysteine.
3. Determination of proteins by dye binding assay.
4. Estimation of Calcium in ragi.
5. Estimation of Vitamin – C in lemon or gooseberries by DPPH method

.

PART C 15 Marks

Viva

SCHEME OF VALUATION

(ASSESMENT OF EXPARIMENTAL RESULTS)

CLASS RECORDS :

i) For conducting and recording 5 experiments = 07 marks.
4 experiments = 06 marks
Less than 4 experiments = 04 marks

ii) For accuracy and neatness = 03 marks.

PART A

Principle- 7 Marks

Procedure- 8 Marks

PART B

Assessment of experimental results for colorimetric estimation

Preparation standard and working solution - 5 Marks

Distribution of marks for assay

1. Tabular column	5 Marks
2. For conduction of experiment	5 Marks
3. Graph	5 Marks
4. Result	
Up to 10% error	10 Marks
Up to 15% error	8 Marks
Up to 20% error	6 Marks
Any other value	4 Marks

Assessment of experimental results for Calcium and vitamin C estimation

Preparation of standard solution and calculation of the normality - 6 Marks

Discripancy	Standardization	Estimation
0.1 ml	10 Marks	10 Marks
0.2 ml	8 Marks	8 Marks
0.3 ml	6 Marks	6 Marks
Any other value	4 Marks	4 Marks
Calculation	2 Marks	2 Marks

PART C

Viva- Five questions 5 x 3 = 15 Marks

VI SEMESTER PRACTICAL EXAMINATION

APPLIED BIOCHEMISTRY
PRACTICAL VI

SCHEME OF EXAMINATION

SCHEME OF EXAMINATION

DURATION: 3 Hours

Maximum Marks: 70

Practical proper: 60

Record marks: 10

NOTE:- Candidates are required to submit the records duly signed by the teacher-in charge and certified by the Head of the Department

PART A 15 Marks

The candidate has to write procedure with tabular column for one experiment in the first 15 min. Then the examiner has to put his/her signature and value the paper at the end of the examination

1. Effect of temperature on the Viscosity of DNA using Oswald's viscometer.
2. Extraction of RNA from yeast.
3. Immobilization of enzymes/ cells by entrapment in alginate gel
4. Demonstration of ELISA

PART B 30

Marks

Any one of the following experiment may be set

1. Estimation of DNA by diphenylamine method.
2. Assays of SGPT and SGOT in serum.
3. Estimation RNA by Orcinol method.
4. Determination of total protein and A/G ratio in serum.
5. Estimation of serum phospholipids.
6.

PART C 15

Marks

Viva

SCHEME OF VALUATION

(ASSESMENT OF EXPARIMENTAL RESULTS)

CLASS RECORDS :

i) For conducting and recording 5 experiments = 07 marks.
4 experiments = 06 marks
Less than 4 experiments = 04 marks
ii) For accuracy and neatness = 03 marks.

PART A

Principle- 7 Marks

Procedure- 8 Marks

PART B

Assessment of experimental results for colorimetric estimation

Preparation standard and working solution - 5 Marks

Distribution of marks for assay

1. Tabular column 5 Marks
2. For conduction of experiment 5 Marks
3. Graph 5 Marks
4. Result

Up to 10% error 10 Marks
Up to 15% error 8 Marks
Up to 20% error 6 Marks
Any other value 4 Marks

PART C

Viva- Five questions 5 x 3 = 15 Marks

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DEPARTMENT OF MICROBIOLOGY

Revised Scheme of Instruction For B.Voc- Food Processing and Engineering 2016-17									
General Education Component									
NSQF/ NVE QF Level	**Vocational Qualification**	**Semester**	**Title**	**L:T:P**	**Theory Hours**	**Tutorial Hours**	**Practical Hours**	**Total Hours**	**Credits**
Level- IV	**Diploma**	Semester-I	Fundamentals of Microbiology	2:0:1	30	0	15	45	3
Level- V		Semester-II	Microbial Physiology And Metabolism	2:0:1	30	0	15	45	3
Level- VI	**Advanced Diploma**	Semester-III	Food Microbiology	2:0:1	30	0	15	45	3
		Semester-IV	Immunology	2:0:1	30	0	15	45	3
Level- VII	**Degree**	Semester-V	Pathogenic Microbiology	4:0:2	60	0	30	90	6
		Semester-VI	Medical Microbiology	4:0:2	60	0	30	90	6

Paper code: FPA520 **MICROBIOLOGY** **30hours-2 Credits**

I B.Voc., I Semester

TITLE: FUNDAMENTALS OF MICROBIOLOGY

Course outcome:

After successful completion of this course students are able to:

CO1: Gain basic knowledge about Microbiology starting from history to Microorganisms.

CO2: Various Culture media and their applications and also understand various physical and chemical means of sterilization.

CO3: Know about microbial techniques for isolation of pure cultures of bacteria.

CO4: To identify the bacteria based on staining and cultural characteristics.

CO5: Able to perform routine culture handling tasks safely and effectively.

CO6: The maintenance and preservation of cultures.

UNIT-I **10Hrs**

1. History: Contributions of - Antony van Leeuwenhoek,Edward Jenner, Louis Pasteur, Robert Koch, Dmitry Iwanowski, Alexander Fleming (in brief).
   Development and scope of Microbiology. Branches of Microbiology.
2. Microscopy: Types of Microscope, Construction and working principle of bright field microscope. Dark field, fluorescence and phase contrast microscopy(application). Electron microscopy- Types, applications and their limitations.
3. Staining technique: Types of stains, Principle of Simple, negative and differential staining techniques (gram's staining).

UNIT-II **06hrs**

Sterilization technique: Definition – Sterilization, disinfection, antiseptic, antibiosis, Fungicide, Bactericide.

A. Physical methods:

a) Heat – i) Dry heat – Hot air

ii) Moist heat method – Autoclave and Pressure cooker

b) Filtration–Types of filters: Membrane filter, Hepa filter (e.g., Laminar air flow)

c) Radiation methods – UV rays, Gamma rays and Cathode rays

B. Chemical method: Use and mode of action of- Alcohols, Aldehydes, Halogens and Phenols.

UNIT-III **06hrs**

Media – Types, Pure culture and Cultural characteristics: Serial dilution, pure culture by isolation – Pour plate, Spread plate, Streak plate and Micromanipulator techniques . Colony characteristics – plate cultures/solid media and broth cultures/liquid media. Maintenance and Preservation of pure cultures – Sub culturing, overlaying with mineral oil, Refigeration

(4^0C) Lyophilization and cryopreservation.

UNIT-IV **08hrs**

1. Comparative account of Prokaryotic and eukaryotic cell**.** Systems of classification: Haeckel's three-kingdom,Whittaker's five-kingdom and Cavalier-Smith's eight kingdom classification.
2. General characteristics of bacteria, fungi, actinomycete, virus, protozoa and algae. Organization of cell wall, cell membrane, flagella capsules and formation of spores in bacteria.
3. Bacteriophages : Morphology and multiplication(T-4 phage)

PRACTICALS **15 Hrs -1 Credit**

1. Staining and mounting of algae and fungi **3Hrs x1**
2. Simple,Negative and Gram's staining **3Hrs x1**
3. Preparation of culture media- Nutrient agar, PDA and NB **3Hrs x1**
4. Methods of obtaining pure cultures of microorganism-Spread plate, pour plate and streak plate and subculturing **3Hrs x1**
5. Isolation of microorganisms from soil by serial dilution technique (Bacteria and Fungi) **3Hrs x1**

Paper code: FPB520 **MICROBIOLOGY** **30hours-2 Credits**

I B.Voc.,II Semester

TITLE: MICROBIAL GROWTH AND METABOLISM

Enable the students to have sound knowledge about:

CO1. Inculcate the knowledge regarding microbial growth, functions, physiology and metabolism.

CO2. Understand the microbial transport systems and microbial metabolism

CO3. Know the microbial growth in response to environmental factors.

CO4. Get equipped with various methods of bacterial growth measurement.

CO5. Knowledge of properties, structure, function of enzymes, enzyme kinetics and their regulation.

UNIT: I **08Hrs**

1. Major nutritional type of Microorganisms.
2. Nutritional requirements of Microorganisms. Elementary nutrients: Carbon, Nitrogen, Sulphur, Oxygen and Energy sources, Vitamins and Growth factors.
3. Uptake of nutrients: Diffusion- Simple and Facilitated, Active transport (use of Proton motive force, ATP : ABC transporter), Group translocation, Iron uptake.

UNIT: II **07Hrs**

1. Definition, Growth rate and generation time. The growth curve in batch culture - Phases of growth and their significance.
2. Physical and chemical factors affecting growth-Temperature, pH, Oxygen and saline (water activity) Requirements. Measurement of growth by cell number (Haemocytometer) and cell mass (Turbidometer).

UNIT:III **05Hrs**

Microbial Enzymes: Definition, Nomenclature, Classification, Properties, Mode and Mechanism of enzyme action, Factors effecting enzyme action. Cofactors and Coenzymes.

UNIT:IV **10Hrs**

Aerobic respiration: Definition, Sugar degradation pathways - EMP, HMP and ED pathways. Ultra structure of Mitochondrion, Formation of acetyl CoA from pyruvate, TCA cycle, Electron transport system and Oxidative phosphorylation

Anaerobic respiration: Introduction, Anerobic respiration with special reference to dissimilatory Nitrate reduction. (Denitrification; nitrate /nitrite and nitrate/ammonia respiration; fermentative nitrate reduction) Fermentation - Alcohol fermentation and Pasteur effect; Lactate fermentation (homofermentative and heterofermentative pathways).

PRACTICALS

15 hours– 01 Credit

1. Effect of temperature and pH on growth of bacteria. **3Hrs x1**
2. Acid and gas production from carbohydrates- Demonstration of fermentation of lactose **3Hrs x1**
3. Turbidimetric/spectrophotometric monitoring of growth using liquid cultures **3Hrs x1**
4. Cell counting by Haemocytometer **3Hrs x1**
5. Starch hydrolysis **3Hrs x1**

Paper code: FPC520 MICROBIOLOGY 30hours-2 Credits

II B.Voc.,III Semester

TITLE: FOOD MICROBIOLOGY

Enable the students to get sufficient knowledge about:

CO1.Food related microorganisms, their contamination, spoilage and preservation

CO2. The significance and activities of microorganisms in food

CO3. Understand the food borne intoxication and infections.

CO4. Learn about food safety and quality control.

CO5. The principles involving various methods of food preservation.

UNIT:I 10Hrs

1. Introduction to Food Microbiology: Definition, Concept and Scope. Food as a substrate for microorganisms. **.**
2. Contamination, preservation and spoilage in various foods viz. – fruits and vegetables, canned foods, cereals and cereal product(cereal grains, flour, bread, pasta, macroni), sugars & sugars products (Honey, Candy), Meat (Fresh meat, fish), Milk and Milk products (cheese, butter).

UNIT:II 05Hrs

1. Methods of food preservation: Physical method – high temperature, low temperature, canning. Drying – solar drying, drum drying, spray drying. Radiation.
   Chemical methods – chemical preservatives – salient features of the chemical preservatives (propionates, benzoate, sorbates, nitrates and nitrites, sulphur dioxide and sulphates, sugar and salt)

UNIT:III 05Hrs

1. Food borne intoxication and infection:
   Bacterial intoxication- Botulism,
   Bacterial infection- Salmonellosis.
   Mycotoxin – Origin, types and importance of toxins with reference to Aflatoxins.

2.. Food safety and quality control. –A brief account on FPO, HACCP, Food laws and Food standards (in brief)

UNIT:IV 10Hrs

1. Microorganisms of industrial importance. Biology of industrial microorganisms: Isolation, Screening, Improvement and Preservation.
2. Raw materials-Molasses, corn steep liquor, sulphite waste liquor and whey. Buffers, Precursors, Inhibitors and Antifoam agents.

3. Fermenters and fermentation process: Design, types and basic function of fermenters, Fermentation process – Surface, Submerged and Solid state fermentation. Types- Batch and Continuous fermentation.

4.Yeasts (Baker's) and its uses, Production of : Wine , Alcohol and lactic acid.

PRACTICALS **3hrsX5 practicals**

1. Isolation and identification of fungi from spoiled fruits and vegetables **3hrsx1**
2. Isolation and enumeration of bacteria from spoiled fruits and vegetables **3hrsx1**
3. Production of citric acid using *Aspergillus niger*. **3hrsx1**
4. Estimation of lactic acid in milk **3hrsx1**
5. Preparation of alcohol using jaggery or molasses. **3hrsx1**

Paper code: FPD520 **MICROBIOLOGY** **30hours-2 Credits**

II B.Voc.,IV Semester

TITLE: IMMUNOLOGY

The course provides a solid foundation to understand:

CO1. Demonstrate and understanding the key concepts in immunology.

CO2. Understand the overall organization of the immune system.

CO3. To make them understand the salient features of antigen antibody reaction & its uses in diagnostics and various other studies.

CO4 .Learn about immunization , preparation and its importance.

UNIT-I **10 hrs**

Introduction and history of Immunology,

Innate immunity- Physical Barriers, Biochemical, Cellular, Genetic factors, Body temperature, inflammation and fever

Acquired Immunity- Active & Passive Immunity,

Immune organs and cells: Primary lymphoid organs (Thymus, Bone marrow) & Secondary Lymphoid organs (Lymphnodes, Spleen and tonsils). Mucosa Associated Lymphoid tissue (MALT).

Immune cells- Role of immune cells. Stem cells. Lymphocytes- B lymphocytes-lymphocytes and Null cells. Types of T-cells. Macrophages: Types and function of macrophages.

Immune Response: Humoral Immune Response, Cell Mediated Immune response and Mechanism of AMI and CMI

UNIT-II **05 hrs**

Antigens: Nature and types.

Antibodies: Basic structure of immunoglobulin-IgG, Biological properties of immunoglobulins, Monoclonal antibodies. Function and type of antibodies.

UNIT-III **08 hrs**

Antigen- Antibody reactions: Salient features of Antigen-Antibody reaction. Precipitation reaction**:** Immunodiffusion test, Wasserman's test, RPR Test. Agglutination reaction: Blood grouping, Widal test. Complement fixation tests, Opsonization, Immunotechniques: ELISA

UNIT-IV **07 hrs**

Immunoprophylaxis: Types of vaccines- Live and Attenuated (Bacterial and Viral) and Toxoid with an example each. National Immunization program (Tabular form).

PRACTICALS **3hrsX5=15 practicals**

1. Demonstration of Immune organs (through photographs).
2. Demonstration of Immune cells in the smears prepared from Immune organs. (through photographs)
3. Agglutination- Blood Grouping test
4. Precipitation: Immunodiffusion test –ODD

5. Precipitation: Immunodiffusion test –RID

Paper code: FPE520 MICROBIOLOGY 60 hours -4 Credits

III B.Voc., V Semester

TITLE: PATHOGENIC MICROBIOLOGY

The course provides a solid foundation to understand:

CO1. The human immune response towards microbes in medical microbiology

CO2. Knowledge is gained about the relationship between microorganism and human disease, pathogenicity, Laboratory diagnosis, treatment and prophylaxis.

UNIT-I 20 Hrs

Introduction to important diseases caused by Streptococcus, Pneumococcus, Neisseria, Corynebacterium, Bacillus, Clostridium, Enterobacteriaceae (Proteus, Shigella, Salmonella), Vibrio, Yersinia, Hemophilus, Mycobacterium, The operative pathogenic mechanisms, laboratory diagnosis, prevention and control of these diseases.

UNIT-II 15 Hrs

Morphology, pathogenesis, life cycle, laboratory diagnosis, prevention and control of viral diseases viz. Rabies, Polio, Small pox, Herpes, Measles, Influenza and AIDS.

UNIT-III 15 Hrs

Introduction to Human mycotic infections vizCryptococcosis, Dermatophytosis, Blastomycosis, Opportunisitc Mycosis; Candidiasis and Aspergillosis.

UNIT-IV 10 Hrs

Life cycle, pathogenic, mechanisms and control of parasitic infections viz. amoebiasis, Kala-azar, toxoplasmosis, ascariasis, filarasis, hook worm infections.

PRACTICALS 3 hrsX10 practicals

1- 4. Identification of both gram positive and gram negative microorganisms on the basis of :

(i) Morphology.

(ii) Bio-chemical characteristics.

(iii) Serological reactions.

5.Stainings – Alberts, ZNCF.

6-7. Demonstration of pathogens (Viruses, fungi, parasites) through photographs/ permanent mounted slides.

8-9. Demonstration of cysts/ovas of protozoa/Helminths through photographs.

10. Isolation of dermatophytes from human skin.

Paper code: FPF520 **MICROBIOLOGY** **60 hours -4 Credits**

III B.Voc., VI Semester

TITLE: MEDICAL MICROBIOLOGY

Course outcome

On successful completion of this course the student will gain knowledge about:

CO1. Health clinics such as examination, collection of clinical samples and diagnosis.

CO2. Beneficial and harmful effect of normal flora

CO3. Host pathogen interaction

CO4. Determining level of antimicrobial activity and Mechanism of action of antimicrobial agents

UNIT-I **15 Hrs**

Brief introduction to terminology of Infectious diseases, Frequency of disease- morbidity and mortality rate. Characteristics of infectious disease.

Infections – Classification, sources, mode of transmission and types of infections.

Disease cycle –Sources, reservoirs, carriers and transmission of pathogen. Emerging (HIV/AIDS, Avian influenza) and reemerging (Tuberculosis, Malaria) Infectious diseases, Global travel & Health considerations.

UNIT-II **15 Hrs**

Normal flora of human body –Resident flora and transient flora. Beneficial and harmful effect of Normal Flora. Distribution and occurrence of Normal Flora of Skin, Eye, Respiratory Tract, Mouth, Intestinal Tract & Genitourinary Tract. Germfree and Gnotobiotic Life.

UNIT-III **10 Hrs**

Host pathogen interaction –Factors predisposing to microbial pathogenicity- Virulence, Exaltation and attenuation. Determinants of virulence-transmissibility, adhesion, invasiveness, toxigenicity-exotoxins and endotoxins. Avoidance of host defence mechanism.

UNIT-IV **20 Hrs**

Development of chemotherapy, General characteristics of antimicrobial drugs, Determining level of antimicrobial activity, Mechanism of action of antimicrobial agents, factors influencing the effectiveness of antimicrobial drugs, Antibacterial drugs viz Sulfonamides,Streptomycin, Quinolones, Penicillins, Cephalosporins, Tetracyclines, Erythromycin, Chloramphenicol, Drug Resistance, Antifungal and Antiviral drugs.

PRACTICALS : 10X3Hrs **30 Hrs -2 Credits**

1. Sterilization – Introduction to autoclave, hot air oven, filter sterilization.
2. Microbial flora off mouth-teeth crevices
3. Estimation of urine bacteria by calibrated loop method-Direct streak method.
4. Normal flora of human skin
5. Antibiotic sensitivity test
6. Streptomycin resistant mutant strain isolation by gradient plate technique

7. Identification of enteric pathogens using triple sugar iron agar medium
8.Determination of susceptibility to dental caries by synder test
9.Evaluation of antiseptics by filter paper disk method
10.Study of antimicrobial drugs as per theory syllabus.

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PATTERN OF QUESTION PAPER FOR B.VOC
SUBJECT: MICROBIOLOGY
(THEORY:I SEMESTER TO VI SEMESTER)

Time: 3hours Max marks: 70

I. Define/Explain any ten in one/two sentences: 3X10=30
(Twelve questions to be given and ten to be answered)
1
2
3
4
5
6
7
8
9
10
11
12

II Answer any FOUR of the following: 4X4=16
(Six questions to be given and four to be answered)-short answer type

13
14
15
16
17
18

III (Three essay type questions- with all internal choices) 8X3=24
19
20
21

Test+ Assessment (C-1+C-2) = 30 (15+15)

SCHEME OF PRACTICAL EXAMINATION

I B.Voc., I SEMESTER: PRACTICAL- I

Time: 3hours **Max marks: 70**

I. Write critical notes on **A, B** and **C** 5X3=15

(Stains, Media, Pure culture plates) as per syllabus

II. Stain the given material D by…….method. Write the principle, procedure and leave the preparation for evaluation.

(Simple staining/Gram-staining/Wet mounting of Algae and fungi/Negative staining)

(Preparation-10marks; Principle and Procedure-10 marks) 20

III Demonstrate/ Perform the experiment E giving the principle and procedure. Record the result. 25

(Demonstration- 10 marks; principle-5mark; procedure-5marks; result-05)

(Serial dilution/ Pour plate/Spread plate/Streak plate/subculturing)

IV. Record. 10

……

……

SCHEME OF PRACTICAL EXAMINATION

I B.Voc.,II SEMESTER: PRACTICAL- II

Microbial physiology and Metabolism

Time: 3hours **Max marks: 70**

I. Write critical notes on **A, B** and **C** 5X3=15

(Haemocytometer, Effect of temperature and pH, Acid and gas production from carbohydrates, Turbidimetry/spectrophotometry, Starch hydrolysis.)

II. Demonstrate/ Perform the experiment **A** giving the principle and procedure. Record the result. 20

(Cell counting by Haemocytometer)

(Preparation-10marks; Principle and Procedure-10 marks)

III Demonstrate/ Perform the experiment **A** giving the principle and procedure. Record the result. 25

(Demonstration- 10 marks; principle-5mark; procedure-5marks; result-05)

(Acid and gas production from carbohydrates, Starch hydrolysis ,Effect of temperature and pH)

IV. Record. 10

SCHEME OF PRACTICAL EXAMINATION
II B.Voc.,III Semester
FOOD MICROBIOLOGY

Time: 3hours. **Max.marks:70**

I. Demonstrate / Perform the experiment **A**, giving principle and procedure.Record and interpret the result.

(Demonstration -10marks; principle-5marks;procedure-3marks;results and interpretation-2marks).

(Isolation of microorganisms from spoiled vegetables/spoiled fruits). 25

II. Conduct the test for **B**. Write the principle and procedure. Record and interpret the results.

(Demonstration -10 marks; principle-5marks; procedure-3marks; results and interpretation-2marks). (Estimation of lactic acid in milk,Estimation of citric acid) 20

III. Write critical notes on **C, D** and **E**. (Identification -1mark; critical comments-1marks).

(Citric acid production, Estimation of lactic acid in milk,alcohol from jaggarey) 5X3=15

IV Record 10

……..

SCHEME OF PRACTICAL EXAMINATION
II B.Voc.,IV Semester
IMMUNOLOGY

Time:3hours **Max.marks:70**

I. Demonstrate / Perform the experiment **A**, giving principle and procedure. Record and interpret the result.

(Demonstration -10marks; principle-5marks;procedure-5marks;results and interpretation-5marks).

(Determination of blood group and Rh factor /Demonstration of RID ,ODD). 25

II. Demonstrate the experiment **B.** write the principle and procedure. Record and interpret the results.

(Demonstration -10marks; principle-5marks;procedure-3marks;results and interpretation-2marks).

(Blood grouping, ODD, RID) 20

III. Write critical notes on **C, D**, and **E**. (Identification -1mark; critical comments-1marks)

(Immune organs and immune cells) as per syllabus 5x3=15

IV Record 10

SCHEME OF PRACTICAL EXAMINATION
III B.Voc.,V Semester
PATHOGENIC MICROBIOLOGY

Time:3hours **Max.marks:70**

I. Demonstrate / Perform the experiment **A**, giving principle and procedure.Record and interpret the result.
(Demonstration -10marks; principle-5marks; procedure-5marks;results and interpretation-5marks).
(Serological test, Biochemical test). 25

II. Stain the given material D by…….method. Write the principle, procedure and leave the preparation for evaluation.
(Morphology- Simple staining/Gram-staining/Negative staining)
(Preparation-10marks; Principle and Procedure-10 marks) 20

III. Write critical notes on **C, D**, and **E**. (Identification -1mark; critical comments-1marks)
(pathogens ,cysts,ovas of protozoa/helminths) as per syllabus 5x3=15

IV. Record 10

……

SCHEME OF PRACTICAL EXAMINATION
III B.Voc.,VI Semester
PATHOGENIC MICROBIOLOGY

Time:3hours **Max.marks:70**

I. Demonstrate / Perform the experiment **A**, giving principle and procedure.Record and interpret the result.
(Demonstration -10marks; principle-5marks;procedure-5marks;results and interpretation-5marks).
(Normal flora of skin, Antibiotic sensitivity test, Microbial flora off mouth-teeth crevices, Estimation of urine bacteria by calibrated loop method-Direct streak method, Evaluation of antiseptics by filter paper disk method, Determination of susceptibility to dental caries by synder test, TSIA test). 25

.

II. Demonstrate the experiment **B.** write the principle and procedure. Record and interpret the results.
(Demonstration -10marks; principle-5marks;procedure-3marks;results and interpretation-2marks).
(Streptomycin resistant mutant strain isolation by gradient plate technique, Antibiotic sensitivity test,estimation of urine bacteria by calibrated loop method, Normal flora of skin, Antibiotic sensitivity test, Microbial flora off mouth-teeth crevices,TSIA test). 20

III. Write critical notes on **C, D**, and **E**. (Identification -1mark; critical comments-1marks)
(Results of Streptomycin resistant mutant strain isolation by gradient plate technique,Antibiotic sensitivity test,estimation of urine bacteria by calibrated loop method ,Normal flora of skin,mouth-teeth autoclave, hot air oven, filter sterilization, Antibiotics as per syllabus,TSIA test,Instruments) 5x3=15

IV .Report 10

Approved list of Paper setters

Sl No.	Name	College address
1.	Dr..M .Seema	Chairperson, Dept. of Microbiology JSS College, Ooty road, Mysore
2.	Dr..K.Sumana	Assistant prof. Dept. of Microbiology JSS College, Ooty road, Mysore
3	Dr.S.Mahadevamurthy	Associate Prof & HOD Dept. of Microbiology Yuvaraja's college Mysore.
4	Dr.Syeda Kauser Fathima	Associate Prof. of Microbiology Maharani's Science College for women JLB road Mysore.
5	Dr. H.S. Jayanth.	Asso.Prof.of Microbiology Dept. of Microbiology Yuvaraja's college Mysore.
6	Dr.Nagarathnamma	Asso. Prof. of Microbiology Government women college Mandya
7	Dr. Mashooda Begum	Asso.Prof.of Microbiology Maharani's Science College for women JLB road, Mysore.
8	Sri. M. Girish	Assistant prof. Dept. of Microbiology JSS College for Women Saraswathipuram,Mysore
9	Dr. P.K.Maheshwar	Assistant Prof. Dept. of Microbiology Dept. of Microbiology Yuvaraja's college,Mysore.
10	Smt. M.S.Shobha	Assistant Prof, Dept. of Microbiology Maharani's Science College Mysore
11	Sri. Shankaregowda	Asso.Prof.of Microbiology Government Science College Mandya
12	Sri. R.A. Manjunath	Assistant Prof. Dept. of Microbiology Saradavilas College,Mysore
13	Dr.M.P. Ragavendra	Assistant Prof. Dept. of Microbiology Maharani's Science College,Mysore
14	Dr.K.Girish	Assistant Prof.

		Dept. of Microbiology Maharani's Science College, Mysore
15	Sri. G.S. Siddegowda	Assistant Prof. Dept. of Microbiology Maharani's Science College Mysore
16	Smt. M.S. Poornima	Assistant Prof. Dept. of Microbiology Yuvaraja's College,Mysore
17	Dr.N.S.Devaki	Assistant Prof. Dept. of Molecular Biology Yuvaraja's College , Mysore
18	Syeda Farahna Parveen	Assistant Prof. Dept. of Microbiology St.Philomina's College, Mysore

19	Smt. Vanitha	Assistant Prof. Dept. of Microbiology Maharani's Science College,Mysore
20	Smt. Revanamba	Assistant Prof. Dept. of Microbiology Maharani's Science College,Mysore
21	Uzma Bathool	Assistant Prof. Dept. of Microbiology St.Philomina's College, Mysore
22	Mahadeva prasad	Assistant Prof. Dept. of Microbiology JSS College for Women Saraswathipuram,Mysore

DEPARTMENT OF COMPUTER SCIENCE

SEMESTER I

FPA 540 COMPUTER SCIENCE

PAPER - I

COMPUTER FUNDAMENTALS & DOS

(2 hrs theory / week) 30 hours - 2 Credits

CO1.Master the basic knowledge of applications of MS office package
CO2.Get the skill of office productivity tool
CO3.Learn the usage of internet
CO4.Skill to develop program using C language

SECTION- I **15 Hours**

INTRODUCTION

Computer, Characteristic of Computer, History of Computer, Generation of Computers, Components of Computer and Applications of Computers.

Key Factors of Computers: Hardware, Software - types of Software (Application and system), forms of software (firmware, shareware, freeware), Translator - Assembler, Compiler and Interpreters. Computer Application – Business, Scientific, Entertainment and educational.

CLASSIFICATION OF COMPUTERS

Mode of operations – Analog, Digital and hybrid Computers.

Size and capabilities – Micro, Mini, Main frame and Super computer.

MEMORY UNITS

Primary memory - RAM, ROM, PROM, EPROM, EEPROM, Flash memory, cache memory.

Secondary memory – Magnetic disk (Hard disk, Floppy disk, Zip disk, Jaz disk, Super disk), Optical disk (CD, CD – R, CD – RW, DVD).

COMPUTER PERIPHERALS DEVICES AND INTERFACES

Input devices – Working principle of Keyboard and mouse, Functional capabilities of Scanner, Digital Camera, OMR, OCR, touch pad, touch screen. Output Devices – Monitor, Printer, Plotter and projector.

PROGRAMMING LANGUAGES

Machine, Assembly language and High Level Language.

INFORMATION SYSTEM

Data and Information, types of information, what is an information System, Types of Information Systems — System development life cycle.

SECTION- II **15 Hours**

OPERATING SYSTEM AND THE USER INTERFACE

Operating System– Functions, services, Types-Batch, Single, Multiprogramming, and Multiprocessing.

Operating System – the user interface –running programs –managing hardware –enchaining the operating system with utility software- typical operating systems in use

COMPUTERS AND COMMUNICATION

Single user, multi-user, workstation, and client server systems. Computer networks, Types of Network LAN, WAN, Internet, Internet applications, WWW, Email, FTP, web browsers (Internet explorer, Google Chrome, Mozilla).

DISK OPERATING SYSTEM (DOS)

Introduction, History & version of DOS. DOS basics – physical structures of disk, drive, Name, FAT, File & Directory structure and Naming Rules, Booting Process, DOS System files, role of config.sys file.

DOS COMMANDS

Internal – DIR, MD, CD, RD, COPY, DEL REN, VOL, DATE, TIME, CLS, PATH, TYPE etc.

External – CHKDSK, XCOPY, PRINT, DISK COPY, DISKCOMP, DOSKEY, TREE, MOVE, LABEL, APPEND, FORMAT, SORT, FDISK, BACKUP, EDIT, MODE, ATTRIB, HELP, SYS, WILD CARD Characters etc.

Executable V/S Non executable Files in DOS.

TEXT BOOKS:

- Peter Norton's 'Introduction to Computers', Second Edition, TMH
- Computer Fundamentals – P K Sinha, BPB

REFERENCE BOOKS :

- Introduction to Computers – N Subramanian, TMH
- Understanding Computers – R Rajagopalan. TMH
- Computers Today – Donald Sanders, MGH

Practical

(1Hour per week X 15 Weeks = 15 Hours)

Experiments are based on topics mention in the Paper designed by concerned Faculty

SEMESTER II
COMPUTER SCIENCE
PAPER – II

FPB 550 **PROGRAMMING IN C**

(2 hrs theory / week) **30 hours - 2 Credits**

CO1.Master the basic knowledge of applications of MS office package

CO2.Get the skill of office productivity tool

CO3.Learn the usage of internet

CO4.Skill to develop program using C language

SECTION-I **15 Hours**

PROBLEM SOLVING TECHNIQUES

Problem Definition, Problem Analysis, Design of problem solutions and use of design tools, Algorithm, Flowcharts, Coding, Testing, Debugging, Program documentation.

INTRODUCTION TO C LANGUAGE

History Features and Applications of 'C ', Structure of C Program.

PROGRAMMING PRELIMINARIES

Character set, definitions and declarations of identifiers, Variables, Escape Sequence Characters.
Constants, Keywords, Data types with examples.

OPERATORS AND EXPRESSIONS

Various operators and expressions, Operator precedence with example programs.

INPUT-OUTPUT STATEMENTS

Various types of standard input output statements, standard mathematical functions, with example programs.

SECTION - II **15 Hours**

CONTROL STRUCTURES

Decision makes and branching statements, Decisions making and looping statements, break statement, continue statement and goto statement with example programs.

ARRAYS

Definitions and need of arrays, 1-d and 2-d arrays with example programs, introduction to multidimensional arrays.

STRING HANDLING

Declarations, Initialization, reading and writing of strings, operations and string functions with example programs, array of pointers to strings.

FUNCTIONS

Definitions and need of functions. Library functions, user defined functions in detail, function declaration and prototypes call by value, call by reference and functions and arrays, recursion, storage classes with example program.

STRUCTURE

Definition of structure, Array in Structures, Structure with Array, Difference between array and structure

TEXT BOOKS:

- Programming with ANSI C by: E. Balagurusamy

REFERENCE BOOKS :

- Let us C - Yashwanth kanetkar
- Computer concepts and C programming by - P. B. Kotur
- The Complete Reference C by Herbert Schildt

Practical

(1Hour per week X 15 Weeks = 15 Hours)

Experiments are based on topics mention in the Paper designed by concerned Faculty

Scheme of Examination

Sl. No	Semester	Paper	Marks for theory	Marks for internal assessment		Total
1	I	COMPUTER FUNDAMENTALS & DOS	70	C1 = 15 C2 = 15	30	100
2	II	PROGRAMMING IN C	70	C1 = 15 C2 = 15	30	100

Distribution of Internal assessment

1) **CLASS TEST (C1) -15 MARKS.**
2) **CLASS TEST (C2) -15 MARKS.**

} **= 30 marks**

Scheme of Practical Examination

Sl. No	Semester	Paper	Marks for Practical	Marks for Record	Marks for Viva	Total
1	I	COMPUTER FUNDAMENTALS & DOS	60	05	05	70
2	II	PROGRAMMING IN C	60	05	05	70

Pattern of Question Paper for B.Voc

Semester I
COMPUTER SCIENCE

Time : 2 Hrs 30 Mins Max Marks 70

1. Answer all the questions in one sentence or a word 5 X 1 = 5
   a. ----------
   b. ----------
   c. ----------
   d. ----------
   e. ----------

2. Tick the correct answer 5 X 1 = 5
   f. ----------
   g. ----------
   h. ----------
   i. ----------
   j. ----------

3. State whether the following statements are true or false 5 X 1 = 5
   a. ----------
   b. ----------
   c. ----------
   d. ----------
   e. ----------

4. Fill in the blanks with suitable answers 5 X 1 = 5
   a. ----------
   b. ----------
   c. ----------
   d. ----------
   e. ----------

5. Answer any ten of the following questions 10 X 3 = 30
   a. ----------
   b. ----------
   c. ----------
   d. ----------
   e. ----------
   f. ----------
   g. ----------
   h. ----------
   i. ----------
   j. ----------
   k. ----------

l. ----------

6. Answer any four questions of the following 4 X 5 = 20

a. ----------
b. ----------
c. ----------
d. ----------
e. ----------

Pattern of Question Paper for B.Voc
Semester II
COMPUTER SCIENCE

Time : 2 Hrs 30 Mins Max Marks 701. Answer all the questions in one sentence or a word 10 X 1 = 10

f. ----------
g. ----------
h. ----------
i. ----------
j. ----------
k. ----------
l. ----------
m. ----------
n. ----------
o. ----------

5. Answer any four of the following questions 4 X 5 = 20

f. ----------
g. ----------
h. ----------
i. ----------
j. ----------

6. Answer any four questions of the following 4 X 10 = 40

f. ----------
g. ----------
h. ----------
i. ----------
j. ----------
k. (Note- 10 Marks may be divided in to 6+4 or 5+5

FPA 020

FPA 020

I Semester

B.Voc Programme

Language kannada

Credits.3(45 hours)

¸Á»vÀå WÀlPÀ

12 UÀAmÉUÀ¼ÀÄ

1. PÁªÀå

1. AiÀiÁªÀ PÁ®zÀ ±Á¸ÀÛçªÉÃ£ÀÄ ºÉÃ½zÀgÉÃ£ÀÄ? - PÀÄªÉA¥ÀÄ
2. ¥ÀÄlÖ «zsÀªÉ - ¨ÉÃAzÉæ
3. gÀAUÉÆÃ° - ¥ÀÄw£À
4. ªÀÄÄA¨ÉÊ eÁvÀPÀ – fJ¸ïJ¸ï
5. CqÀÄUÉ ªÀÄ£ÉAiÀÄ ºÀÄqÀÄV - ªÉÊzÉÃ»
6. £À£Àß d£ÀUÀ¼ÀÄ -¹zÀÞ°AUÀAiÀÄå

2. UÀzÀå 12 UÀAmÉUÀ¼ÀÄ

1. ¤gÀAvÀgÀ ¤ÃjUÁV ¤AvÀ¯ÉèÃ Nl -£ÁUÉÃ±ï ºÉUÀqÉ
2. ªÀiÁ»w vÀAvÀæeÁÕ£À : MAzÀÄ ¸ÀÆÜ® £ÉÆÃl – f.J£ï. £ÀgÀ¹AºÀªÀÄÄÆwð
3. ªÀÄÆqsÀ£ÀA©PÉUÀ¼À ©Ãr£À°è - ¨sÀÄªÀ£ÉÃ±Àéj ºÉUÀqÉ
4. ¨ÉÃqÀzÀ CwyUÀ¼ÀÄ - J J£ï ªÀÄÄÆwðgÁAiÀÄgÀÄ

¨sÁµÁ WÀlPÀ

3. DqÀ½vÀ ªÀÄvÀÄÛ ªÁtÂdÅå PÀ£ÀßqÀ 21 UÀAmÉUÀ¼ÀÄ

1. DqÀ½vÀ ¨sÁµÉAiÀiÁV PÀ£ÀßqÀ ¸ÀégÀÆ¥À ªÀÄvÀÄÛ ®PÀët
2. ¸ÀPÁðj ¥ÀvÀæ ¸ÀégÀÆ¥À – C¢üPÀÈvÀ eÁÕ¥À£À ªÀÄvÀÄÛ ¸ÀÄvÉÆÛÃ¯É
3. ««zsÀ jÃwAiÀÄ CfðUÀ¼ÀÄ - gÀeÉ, ªÉÃvÀ£À, §rÛ, ¥ÀzÉÆÃ£Àßw EvÀgÉ
4. ªÁtÂdå PÀ£ÀßqÀzÀ ¸ÀégÀÆ¥À ªÀÄvÀÄÛ ®PÀët
5. ªÁtÂdå ¥ÀvÀæzÀ ««zsÀ CAUÀUÀ¼ÀÄ
   ªÁtÂdå ¥ÀvÀæUÀ¼ÀÄ- «ZÁgÀuÁ ¥ÀvÀæ, DzÉÃ±À ¥ÀvÀæ, GzÀj¥ÀvÀæ, ªÀ¸ÀÆ° ¥ÀvÀæ, ¥ÀjZÀAiÀÄ ¥ÀvÀæ, ¥ÀgÁªÀÄ±Àð£À ¥ÀvÀæ, ªÀåªÀºÁgÉÆÃfÓªÀ£À ¥ÀvÀæ, ¥Àj¥ÀvÀæ

6. UÀtPÀzÀ°è PÀ£ÀßqÀ – PÀ£ÀßqÀzÀ CAvÀeÁð® vÁtUÀ¼ÀÄ- £ÀÄr, §gÀºÀ- ¥Áj¨sÁ¶PÀ ¥ÀzÀUÀ¼ÀÄ
7. ¨sÁµÁAvÀgÀ : ¸ÀégÀÆ¥À ªÀÄvÀÄÛ ®PÀët- PÀ£ÀßqÀ¢AzÀ EAVè¶UÉ- EAVè¶¤AzÀ PÀ£ÀßqÀPÉÌ

¥ÀgÁªÀÄ±Àð£À UÀæAxÀUÀ¼ÀÄ

1. ¸ÀªÀÄUÀæPÁªÀå - f J¸ï ²ªÀgÀÄzÀæ¥Àà
2. ©AzÀÄ ©A¢UÉ - ªÉÊzÉÃ»
3. ¥ÀQëPÁ² - PÀÄªÉA¥ÀÄ
4. ¸ÀªÀÄUÀæPÁªÀå - ¨ÉÃAzÉæ
5. ±ÀvÀÄæ«®èzÀ ¸ÀªÀÄgÀ - £ÁUÉÃ±ïºÉUÉØ
6. ªÁåªÀºÁjPÀ PÀ£ÀßqÀ - JZï J¸ï PÉ
7. DqÀ½vÀPÀ£ÀßqÀ - qÁ C±ÉÆÃPïPÀÄªÀiÁgï gÀAeÉÃgÀ

ªÀÄvÀÄÛ EvÀgÀgÀÄ

8. PÀbÉÃj PÉÊ¦r - PÀÄªÉA¥ÀÄ PÀ£ÀßqÀ CzsÀåAiÀÄ£À ¸ÀA¸ÉÜ
9. ¯ÉÃR£ÀPÀ¯É - J¸ï ¥ÀæºÁèzÀgÁªï
10. DqÀ½vÀ¨sÁµÉ PÉ®ªÀÅ «ªÀgÀUÀ¼ÀÄ - ¥ÀæzsÁ£À UÀÄgÀÄzÀvÀÛ

B.Voc Programme

Language kannada

I Semester

¥Àæ±Éß¥ÀwæPÉ ¸ÀégÀÆ¥À

3.00 UÀAmÉUÀ¼ÀÄ 70 CAPÀUÀ¼ÀÄ

«¨sÁUÀ-1

1. ¨sÁªÁxÀð §gÉ¬Äj : 1óó*5=5

C)

CxÀªÁ

D)

2. ¸ÀAzÀ¨sÀð ¸À»vÀ «ªÀj¹ 1óó*5=5

C)

CxÀªÁ

D)

3. PÉ¼ÀV£À ¥Àæ±ÉßUÉ GvÀÛj¹: 1*10=10

C)

CxÀªÁ

D)

«¨sÁUÀ-2

5. PÉ¼ÀV£À ¥Àæ±ÉßUÉ GvÀÛj¹: 1óó*10=10

C)

CxÀªÁ

D)

5. PÉ¼ÀV£À ¥Àæ±ÉßUÉ GvÀÛj¹: 1*10=10

C)

CxÀªÁ

D)

«¨sÁUÀ-3

6. LzÀPÉÌ n¥ÀàtÂ §gÉ¬Äj: 3*5=15

C)

CxÀªÁ

D)

7. PÉ¼ÀV£À ¥Àæ±ÉßUÉ GvÀÛj¹: 1*10=10

C)

CxÀªÁ

D)

9. PÀ£ÀßqÀPÉÌ ¨sÁµÁAvÀj¹: 1*5=5

10. EAVè¶UÉ ¨sÁµÁAvÀj¹: 1*5=5

FPB540

B.Voc- II Semester

Communicative English

No. of Credits : 3 No. of Instruction hrs : 3 / Week(45 hrs)

AIMS: 1) To familiarize students to basic English

2) To enable them to develop listening & speaking skills

OBJECTIVES: Students should be able to ___

1) Write English without grammatical errors
2) Speak English Language effectively and accurately
3) Listen and understand public announcements and news on TV & Radio

Module – 1 Grammar

		Marks	Hrs/ Week
1.	Subject and Verb Agreement	5	6
2.	Voice	5	5
3.	Articles	5	3
4.	Speech	5	6
5.	Question tag	5	5
6.	Framing of Questions	5	Q=05

Module – 2 Writing Skills

1.	Letter Writing Letter of Application/Letter of Grievances/Resume Preparation	10	4
2.	Comprehension	10	3
3.	Essay Writing	10	3

Module – 3 Speaking Skills

1.	Greeting		
2.	Requesting		
3.	Enquiring		
4.	Explaining	10	Q=05
5.	Reporting		
6.	Permission		
7.	Thanking		
		70	**45**

PAPER CODE **:FPB540**

B.Voc II SEMESTER

COMMUNICATIVE ENGLISH

MODEL QUESTION PAPER

TIME: 3 Hrs **MAX MARKS: 70**

Instructions to students: All sections are compulsory.

SECTION A

I Fill in the blanks with correct form of verbs: 5 X 1 = 05

a) Slow and Steady _____ the race.(to win)
b) Christians _____ to church on Sundays. (to go)
c) They have _____ the work. (to complete)
d) He _____ absent yesterday. (to be)
e) We _____ learning grammar now. (to be)

II Change the voice of the following sentences: 5 X 1 = 05

a) He is writing a poem.
b) We have won the match.
c) The poet took the second road.
d) A song will be sung by her.
e) Close the door.

III Fill in the blanks with suitable article: 5 X 1 = 05

a) My father is _____ MLA.
b) _____ earth moves round the sun.
c) The poet rejected ____ first road.
d) The Nyle is _____ long river.
e) Brutus was _____ honest man.

IV Change the speech of the following: 5 X 1 = 05

a) The King said to people," I am happy to be here".
b) Mother said to the child," Don't go near water".
c) Raju asked Rosie who she was.
d) Velan said to Venu," Why are you crying?"
e) The lady told the writer that he was very humorous.

V Add question tag to the following: 5 X 1 = 05

a) He is a good singer.
b) The poet observed the daffodils.
c) Behrman saves the life of Johnsy.
d) English is not a difficult language.
e) India has won the second test.

VI Frame questions so as to get the underlined words as answers: 5 X 1 = 05

a) Shakespeare wrote 'Macbeth'
b) Rama killed Ravana.
c) He goes to college by car.
d) The College starts at 10.30 am

e) Lear's daughters were selfish.

SECTION B P.T.O

VII Letter Writing: 10 X 1 = 10

a) Write a letter of application to the post of a Computer Programmer at SkillTec Ltd. Mysuru

OR

b) Prepare your resume.

VIII Read the following essay carefully and answer the questions set on it: 5 X 2 =10

I was wrong to think that city life is altogether unhealthy. Perhaps it was so at one time, now a days with proper roads, pavements and drainage systems, sickness is kept at bay. Cities are planned in such a way as to provide open space with parks and playgrounds for the benefit of the dwellers.

Even when sickness does strike, there are doctors and hospitals near at hand. This is not the case in the country where people frequently suffer and sometimes die for want of medical facilities.

1) What does the writer think of the city life?
2) What causes sickness?
3) Where do you find doctors and hospitals in plenty?
4) How does the passage distinguish between city and country life?
5) Give a suitable title to the passage.

IX Write an essay on one of the following: 10 X 1 = 10

a) Use and abuse of social media.
b) Role of students in nation building
c) Afforestation?

X Answer the following: 5 X 2 = 10

1. Write an imaginary conversation between a customer and Bank Manager regarding opening an account.
2. Write a dialogue between two friends who meet after a long time.

B.Voc II SEMESTER
COMMUNICATIVE ENGLISH
QUESTION PAPER SCHEME

TIME: 3 Hrs MAX MARKS: 70

Instructions to Students: All sections are compulsory.

SECTION A

I Fill in the blanks with correct form of verbs 5 X 1 = 05

a)
b)
c)
d)
e)

II Change the voice of the following sentences 5 X 1 = 05

a)
b)
c)
d)
e)

III Fill in the blanks with suitable article 5 X 1 = 05

a)
b)
c)
d)
e)

IV Change the speech of the following 5 X 1 = 05

a)
b)
c)
d)
e)

V Add question tag to the following 5 X 1 = 05

a)
b)
c)
d)
e)

VI Frame questions so as to get the underlined words as answers 5 X 1 = 05

a)
b)
c)
d)
e)

SECTION B

VII 10 X 1 = 10

1. Write a letter of application

OR

2. Prepare a Resume.

VIII Read the following essay carefully and answer the questions. 10 X 1 = 10

a)
b)
c)
d)
e)

IX Write an essay on one of the following: 10 X 1 = 10

a)
b)
c)

X Answer the following :(Dialogue writing) 5 X 2 = 10

1)
2)

FPC 550 INDIAN CONSTITUTION

COMMON PAPER TO ALL DEGREE CLASSES (FOR B.Voc 45 HOURS 3/WEEK)

70 MARKS

UNIT I **08 hrs**

a) Preamble of the Indian Constitution

b) Salient features of Indian Constitution

UNIT II **10 hrs**

a) Fundamental Rights

b) Fundamental Duties

c) Directive principles of State Policy

UNIT III **14 hrs**

a) President – Election Method, Powers and Functions

b) The Role of the Prime Minister

c) The Parliament – Structure, Power and Functions(Lok Sabha and Rajya Sabha)

d) Supreme Court – Organization and Jurisdiction

UNIT IV **13 hrs**

a) The Role of Governor in the Administration of State

b) Powers and Functions of the Chief Minister

c) Composition , Powers and Functions of both the Houses of State Legislature

d) High Court – Organization and Jurisdiction

TEXT BOOKS

- An introduction to the Constitution of India by M V Pylee
- Introduction to the Constitution of India by D D Basu
- Understanding the Constitution of India by Dr. H M Rajashekar
- Indian Constitution by Sommanna, Brahamananda, H B Mallikarjuna swamy,
- Indian Constitution by H T Ramakrishana, Rajiv

Sl. no.	Information Communication Technology	Hrs
1	The humanitarian supply chain – Definition, system of organizations, people, technology, activities, information and resources involved in moving a product or service from supplier to customer	5
2	Technology framework – Front-end services, Middleware services and Infrastructure services: Supporting the food assistance supply chain; Mapping technologies; Web portals	5
3	Mobile technologies - Combining hand-held and wireless communications technologies	5
4	Beneficiary identification - Challenges in food assistance to ensure that assistance goes to the right beneficiaries	5
5	ICT in emergencies – Requirement inputs of Food assistance interventions during emergencies	5
6	Linking the humanitarian supply chain - Ways in which WFP uses technology and technological techniques to fulfill its role as the provider of food assistance in development and emergencies	5

Sl. no.	Practical	Hrs
1.	Identification of software related to Food Processing and Engineering	3
2.	Practicing the use of software	6
3.	Requirement development for Food Processing Software	6

MODEL QUESTION PAPER

CODE NO: **FPC 570**

Semester - III

INFORMATION AND COMMUNICATION TECHNOLOGY

TIME: 3 hrs **Max marks: 70**

Instructions: Draw neat and labeled diagram wherever necessary.

PART-A

I. Write short notes for the following(any 5): (5x2=10)

1. ----------
2. ----------
3. ----------
4. ----------
5. ----------
6. ----------

PART-B

II. Answer any 4 of the following: (4x5=20)

1. ----------
2. ----------
3. ----------
4. ----------
5. ----------

PART –C

III. Answer any 4 of the following: (4x10=40)

IV.

1. ----------
2. ----------
3. ----------
4. ----------
5. ----------

INFORMATION AND COMMUNICATION TECHNOLOGY

PRACTICAL

SCHEME OF EXAMINATION

DURATION: 3 Hours

Maximum Marks: 70

Practical proper: 60

Record marks: 10

NOTE :- Candidates are required to submit the records duly signed by the teacher-in charge and certified by the Head of the Department

1. Identification of software related to Food Processing and Engineering.
2. Practicing the use of software.
3. Requirement development for Food Processing Software.

Environmental Studies (One-Semester Compulsory Core Module for B.Voc Programmes)

Unit 1: Environment and natural systems **4 hrs**

- Introduction to Environment and Environmental Studies
- Definition and Components of Environment, Relationship between the different components of Environment
- Man and Environment relationship
- Impact of technology on Environment, Environmental Degradation
- Multidisciplinary nature of the Environment studies
- Its scope and importance in the present day Education System

UNIT 2: Ecology and Ecosystems: **7 hrs**

- Introduction: Ecology- Objectives and Classification
- Concept of an ecosystem- structure and functions of ecosystem
- Components of ecosystem- Producers, Consumers, Decomposers
- Bio-Geo- Chemical Cycles- Hydrologic Cycle, Carbon cycle, Energy Flow in Ecosystem, Food Chains, Food webs ,Ecological Pyramids
- Major Ecosystems: Forest Ecosystem, Grassland Ecosystem, Desert Ecosystem, Aquatic Ecosystem, Estuarine Ecosystem**.**

Unit 3: Natural Resources **7 hrs**

Renewable and Nonrenewable resources, exploitation and conservation,

- Water resources: Surface and Ground water sources, Indian and Global scenario.
  Land as a resource, land use change and land degradation
- Forest resources: Definition and Classification of Forests
  Ecological and Economic importance and benefits of forest, Indian scenario,
  Deforestation: causes and effects, case studies remedial measures
- Food resources: Sources of food, Global and Indian food demand scenario,
  Limits of food production, Environmental effects of Agriculture
- Energy resources: Renewable and non renewable energy sources, use of alternate energy sources, growing energy needs, case studies
- Mineral resources: Definition and Classification of minerals, mining issues Case studies.
- Role of individual in conservation of natural resources.

Unit 4 : Biodiversity and its Conservation **6 hrs**

- Biodiversity : Definition, Levels of biological diversity : genetic, species and ecosystem diversity
- Biogeographic zones of India
- Hot spots of biodiversity
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational values
- Biodiversity patterns
- India as a mega-biodiversity nation

- Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions.
- Endangered and endemic species of India
- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT 5: Environmental pollution: 9 hrs

- Types of Environmental Pollution:
- Water Pollution: Introduction – Water Quality Standards, Sources of Water Pollution: Industrial Agricultural, Municipal; Classification of water pollutants, Effects of water pollutants, Eutrophication.
- b) Marine pollution: Causes, effects and control.
- c) Air Pollution: Composition of air, Structure of atmosphere, Ambient Air Quality Standards, Classification of air pollutants, Sources of common air pollutants like PM, SO2, NOX, Natural & Anthropogenic Sources, Effects of common air pollutants
- d) Soil Pollution: causes, effects and control.
- e) Noise Pollution: Introduction, Sound and Noise, Noise measurements, Causes and Effects
- f) Thermal Pollution: Causes, effects and control.
- g) Nuclear hazards and human health risks.
- Solid waste management: Control measures of urban and industrial waste.
- Role of individual in the prevention of pollution,Pollution case studies.

UNIT 6: Sustainable development and Environmental issues and Policies. 7 hrs

- Sustainable development: Meaning, changes in resource utilization, urbanization.
- Water conservation: watershed management and Rain water harvesting.
- Environmental issues: Climate change, global warming, acid rain, ozone layer depletion.
- Disaster management: floods, drought,earthquake, cyclones and landslides.
- Wasteland reclamation.
- Environment Protection Act: Air, Water, Wildlife (Prevention and Control of Pollution)
- Forest Conservation Act.
- Issues involved in enforcement of environmental legislation.
- Environment: rights and duties**.**

Unit 7 : Human Population and the Environment 5 hrs

- Population growth, Explosion, demographic variation among nations.
- Family welfare Program.
- Environment, human health and welfare; infectious and lifestyle diseases in contemporary world.
- Value Education: Environmental ethics.
- HIV/AIDS
- Women and Child welfare.
- Role of information technology in Environment and human health

Unit 8: Field visit 5 hrs

- Field work Visit to an area to document environmental assets :river/ forest/ grassland/ hill/ mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.
- Visit to the solid waste treatment plant and water treatment plant.
- Video: The one degree • (Equal to 5 lectures)

REFERENCE BOOKS:

1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha Second edition, 2013 Publisher: Universities Press (India) Private Ltd, Hyderabad.
2. Basics of Environmental Studies by Prof Dr N S Varandani, 2013 Publisher: LAP -Lambert Academic Publishing, Germany
3. Environmental Studies by Anindita Basak, 2009 Publisher: Drling Kindersley(India)Pvt. Ltd Pearson
4. Textbook of Environmental Studies by Deeksha Dave & S S Kateva , Cengage Publishers.
5. Environmental Sciences by Daniel B Botkin & Edward A Keller Publisher: John Wiley & Sons.
6. Environmental Studies by R. Rajagopalan, Oxford University Press
7. Environmental Studies by Benny Joseph, TMH publishers
8. Environmental Studies by Dr. Suresh K Dhameja, 2007 Published by : S K Kataria & Sons New Delhi
9. Basics of Environmental Studies by U K Khare, 2011 Published by Tata McGraw Hill.
10. Environmental Studies by N.Arumugam & V.Kumaresan, saras publication.

Scheme of Examination

Sl. No	Semester	Paper	Marks for theory	Marks for internal assessment	Total
1	Even sem	Environmental studies	70	30	100

ENVIRONMENTAL STUDIES (ONE-SEMESTER COMPULSORY CORE MODULE FOR B.VOC PROGRAMMES)

Scheme of examination

Question paper pattern

Sl.no	Types of questions	Marks	No. of questions	Total marks
1	Short notes	**2**	**5**	**10**
2	Medium type	**5**	**4**	**20**
3	Long answers	**10**	**4**	**40**
			Total	**70 marks**

Distribution of Internal assessment

3) **ASSIGNMENT/SEMINAR-15 MARKS.**
4) **CLASS TEST-15 MARKS.**

MODEL QUESTION PAPER

CODE NO: FPD 560 **COMMON TO EVEN SEMESTER**

ENVIRONMENTAL STUDIES

TIME: 3 hrs **Max marks: 70**

Instructions: Draw neat and labeled diagram wherever necessary.

PART-A

V. Write short notes for the following(any 5): **(5x2=10)**

7. ----------
8. ----------
9. ----------
10. ----------
11. ----------
12. ----------

PART-B

VI. Answer any 4 of the following: **(4x5=20)**

6. ----------
7. ----------
8. ----------
9. ----------
10. ----------

PART –C

VII. Answer any 4 of the following: **(4x10=40)**

6. ----------
7. ----------
8. ----------
9. ----------
10. ----------

FPD 580 **B.Voc Semester - IV**

Sl. no.	Biostatistics	Hrs
1.	Statistical concepts: Data structure, sampling methods, collection, classification and tabulation of data, graphical and diagrammatic representation, histogram, frequency polygon, frequency curve, bar graph, pie chart etc.	4
2.	Measure of Central Frequency: Mean, median, mode.	2
3.	Measure of dispersion of data: Range, semi-interquartile range, mean deviation, standard deviation, standard error, coefficient of variation, confidence limits.	5
4.	Types of distribution of data: Normal, Binomial, Poisson.	7
5.	Z-test, t-test, ANOVA, multiple comparisons, LSD and DMRT, Chi-square test.	4
6.	Regression estimate, correlation coefficient.	4
7.	Experimental designs, data transformation.	4

Sl. no.	Practical	Hrs
1.	Analytical Problems / calculations	15

MODEL QUESTION PAPER

Semester-IV

CODE NO: FPD 580

BIOSTATISTICS

TIME: 3 hrs **Max marks: 70**

Instructions: Draw neat and labeled diagram wherever necessary.

PART-A

VIII. Write short notes for the following(any 5): (5x2=10)

13. ----------
14. ----------
15. ----------
16. ----------
17. ----------
18. ----------

PART-B

IX. Answer any 4 of the following: (4x5=20)

11. ----------
12. ----------
13. ----------
14. ----------
15. ----------

PART –C

X. Answer any 4 of the following: (4x10=40)

XI.

11. ----------
12. ----------
13. ----------
14. ----------
15. ----------

IV SEMESTER PRACTICAL EXAMINATION

BIOSTATISTICS
PRACTICAL
SCHEME OF EXAMINATION

DURATION: 3 Hours
Maximum Marks: 70

Practical proper: 60

Record marks: 10

NOTE :- Candidates are required to submit the records duly signed by the teacher-in charge and certified by the Head of the Department

4. Analytical Problems / calculations.

JSS COLLEGE OF ARTS COMMERCE & SCIENCE

(Autonomous)

Ooty Road, Mysuru – 25

DEPARTMENT OF COMMERCE AND MANAGEMENT

B.Com Pragramme

(I Year)

Syllabus as per NEP

2021-22 Scheme

SYLLABUS FOR B.COM DEGREE AS PER NEP – 2020 REGULATIONS IMPLEMENTED FROM THE ACADEMIC YEAR 2021-22

I. OBJECTIVES:

1. To develop the skills required for the application of accounting concepts andtechniques learned in the classroom at the workplace.
2. To provide competent and technical skills personnel to the industry in the area of Accounting, Finance, Taxation, Cost and Management Accounting.
3. To enhance the employability skills of the commerce students.
4. To enhance the capability of the students improve their decision-making skills.
5. To enhance the capability of the students to make decisions at personal andprofessional level.
6. To encourage entrepreneurship among students pursuing education in the field of Commerce.
7. To empower students for pursuing professional courseslike CharteredAccountancy, Cost and Management Accountancy, Company Secretary, etc.,
8. To ensure holistic development of Commerce students.

II. ELIGIBILITY FOR ADMISSION:

Candidates who have passed Two Year Pre University Course of Karnataka State in any discipline or its equivalent (viz., 10+2 of other states, ITI, Diploma etc.) are eligible for admission into this program.

III. DURATION OF THE PROGRAM:

The program of study is Four years of Eight Semesters. A candidate shall complete his/her degree within eight academic years from the date of his/her admission to the first semester. The NEP 2020 provides multiple exit options for students as specified below:

EXIT OPTION:

a. The students who successfully complete ONE year/ 2 Semesters and leave the program, will be awarded Certificate in Commerce.
b. The students who successfully complete TWO years/ 4 Semesters and leave the program, will be awarded Diploma in Commerce.
c. The students who successfully complete THREE years/ 6 Semesters and leave the program, will be awarded Bachelors Degree in Commerce (B.COM)
d. An option is given to the students to continue their education to the Fourth year and those who successfully complete FOUR years/ 8 Semesters will be awarded Bachelors Degree in Commerce (Hons) . [B.COM (Hons)]

IV. MEDIUM OF INSTRUCTION

The medium of instruction shall be English. However a candidate will be permitted to write the examination either in English or in Kannada.

V. ATTENDANCE

a. For the purpose of calculating attendance, each semester shall be taken as a Unit.
b. A student shall be considered to have satisfied the requirement of attendance for the semester, if he/she has attended not less than 75% in aggregate of the number of working periods in each of the subjects compulsorily.
c. A student who fails to complete the course in the manner stated above shall not be permitted to take the University Examination.

VI. TEACHING AND EVALUATION

M.Com graduates with B.Com, BBM/BBA and BBS as basic degree from a recognized university are only eligible to teach and to evaluate all the Commerce courses including Digital Fluency (except Languages, Constitution of India, Environmental Studies, Health Wellness/Social and Emotional learning, Sports/NCC/NSS/Other)

VII. SKILL DEVELOPMENT / RECORD MAINTENANCE

a. Every college is required to establish a dedicated business lab for the purpose of conducting practical/ assignments to be written in the record.

b. In every semester, the student should maintain a record book in which a minimum of 5 exercise or activities per course are to be recorded.

VIII. SCHEME OF EXAMINATION

a. There shall be an University examination at the end of each semester. The maximum marks for the university examination in each paper shall be 60 marks for DSC, DSE, Vocational, SEC and OEC.

b. Internal Assessment 40 marks for DSC, DSE, Vocational, SEC and OEC.

Guidelines for Continuous Internal Evaluation and Semester End Examination:

The CIE and SEE will carry 40% and 60% weightage each, to enable the course to be evaluated for a total of 100 marks, irrespective of its credits. The evaluationsystem of the course is comprehensive & continuous during the entire period of the Semester. For a course, the CIE and SEE evaluation will be on the following parameters:

Sl. No.	Parameters for the Evaluation	Marks
	Continuous Internal Evaluation (CIE)	
1	Continuous & Comprehensive Evaluation (CCE) – (A)	20 Marks
2	Internal Assessment Tests (IAT) –(B)	20 Marks
	Total of CIE (A+B)	40 Marks
3	Semester End Examination (SEE) – (C)	60 Marks
	Total of CIE and SEE (A + B + C)	100 Marks

Continuous Internal Evaluation:

a. **Continuous & Comprehensive Evaluation (CCE):** The CCE will carry a maximum of 20% weightage (20 marks) of total marks of a course. Before the start of the academic session in each semester, a faculty member should choose for his/her course, minimum of two of the following assessment methods with 10 marks each (2x10=20 marks)

   i. Individual Assignments/Group Assignments
   ii. Seminars/Class Room Presentations/ Quizzes
   iii. Participatory activities & Industry-Integrated Learning/ Industrial visits
   iv. Practical activities / Problem Solving Exercises

b. **Internal Assessment Tests (IAT):** The IAT will carry a maximum of 20% weightage (20 marks) of total marks of a course. Under this component, two tests will have to be conducted in a semester for 30 marks each and the same is to be scaled down to 10 marks each.

Internal Assessment Test

Course Code: Name of the Course:

Duration: 1 Hour Total Marks: 30

PART-A

Answer any one of the following questions. 5 marks (1x 5 = 5)

1.----------

2.----------

PART- B

Answer any one of the following questions. 10 marks (1x 10 = 10)

3.----------

4.----------

SECTION- C

Answer any one of the following questions. 15 marks (1x 15 = 15)

5,----------

6.----------

SEMESTER END EXAMINATION (SEE):

The Semester End Examination for all the courses for which students who get registered during the semester shall be conducted. SEE of the course shall be conducted after fulfilling the minimum attendance requirement as per the University norms. The BOS of the University has prepared the SEE framework and the question paper pattern for SEE is presented below for 60 marks.

PATTERN OF QUESTION PAPER

TIME : 2 HOURS MARKS: 60

PART – A

Answer any FIVE of the following questions. Each question carries 2 marks.

(5x2= 10)

1. .....
2. .....
3. .....
4. .....
5. .....
6. .....
7. .....

PART – B

Answer any TWO of the following questions. Each question carries 10 Marks.

(2x10 =20)

8. .....
9. .....
10. .....
11. .....

PART – C

Answer any TWO of the following questions. Each question carries 15 Marks

(2x15=30)

12. .....
13. .....
14. .....
15. .....

Minimum Marks for a Pass:

Candidates who have obtained a minimum of 35% marks in semester end examination i.e. 21 marks out of 60 marks of theory examination and 40% in aggregate i.e. total 40 marks out of 100 marks of Semester End Examination marks and Continuous Internal Evaluation marks.

Notes:

- One Hour of Lecture is equal to 1 Credit.
- One Hour of Tutorial is equal to 1 Credit (Except Languages).
- Two Hours of Practical is equal to 1 Credit

Acronyms Expanded

- AECC : Ability Enhancement Compulsory Course
- DSC © : Discipline Specific Core (Course)
- SEC-SB/VB : Skill Enhancement Course-Skill Based/Value Based
- OEC : Open Elective Course
- DSE : Discipline Specific Elective
- SEE : Semester End Examination

- **CIE** : Continuous Internal Evaluation
- L+T+P : Lecture+Tutorial+Practical (s)

Note: Practical Classes may be conducted in the Business Lab or in Computer Lab or in Class room depending on the requirement. One batch of students should not exceed half (i.e., 50 or less than 50 students) of the number of students in each class/section. 2 Hours of Practical Class is equal to 1 Hour of Teaching, however, whenever it is conducted for the entire class (i.e., more than 50 students) 2 Hours of Practical Class is equal to 2 Hours of Teaching

PROGRAM STRUCTURE
Proposed Scheme of Teaching and Evaluation for B.Com (Basic/Hons)
with Commerce as Core Subject

I SEMESTER B.COM								
Sl. No.	**Course Code**	**Title of the Course**	**Category of Courses**	**Teaching Hours per week (L+T+P)**	**SEE**	**CIE**	**Total Marks**	**Credits**
1	Lang 1.1	Language – I	AECC	3+1+0	60	40	100	3
2	Lang 1.2	Language - II.	AECC	3+1+0	60	40	100	3
3	B.Com 1.1	Financial Accounting – I	DSC	3+0+2	60	40	100	4
4	B.Com 1.2	Management Principles and Applications	DSC	4+0+0	60	40	100	4
5	B.Com 1.3	Principles of Marketing	DSC	4+0+0	60	40	100	4
6	B.Com 1.4	Digital Fluency **OR** Environmental Studies	SEC-SB AECC	1+0+2 2+0+0	60	40	100	2
7	B. Com1.5	Across the Faculty:* 1. Basics of Accounting **OR** 2. Managing Workforce	OEC	3+0+0	60	40	100	3
8	B.Com 1.6	Yoga **OR** Sports	SEC-VB	0+0+1	-	-	-	1
9	B.Com 1.7	Health and Wellness **OR** NCC/NSS/R&R (S&G)/Culture	SEC-VB	0+0+1	-	-	-	1
	Sub-Total (A)				**420**	**280**	**700**	**25**

Note :

*Across the Faculty: These Courses are meant for other department students and shall be taught by commerce teachers.

	II SEMESTER B.COM							
10	Lang 2.1	Language –I	AECC	3+1+0	60	40	100	3
11	Lang 2.2	Language –II	AECC	3+1+0	60	40	100	3
12	B.Com 2.1	Financial Accounting – II	DSC	3+0+2	60	40	100	4
13	B.Com 2.2	Company Law	DSC	4+0+0	60	40	100	4
14	B Com 2.3	Law and Practice of Banking	DSC	4+0+0	60	40	100	4
15	B.Com 2.4	Digital Fluency **OR** Environmental Studies	SEC-SB AECC	1+0+2 2+0+0	60	40	100	2
16	B.Com 2.6	Across the Faculty:* 1. Financial Literacy **OR** 2. Retail Management	OEC	3+0+0	60	40	100	3
17	B.Com 2.7	Yoga / Sports	SEC-VB	0+0+1	-	-	-	1
18	B.Com 2.8	Health and Wellness **OR** NCC/NSS/R&R (S&G)/Culture	SEC-VB	0+0+1	-	-	-	1
	Sub-Total (B)				**420**	**280**	**700**	**25**

Note :

* Across the Faculty: These courses are meant for other departments students and shall be taught by commerce teachers.

Semester III								
Sl. No.	**Course Code**	**Title of the Course**	**Category of Courses**	**Teaching Hours per Week (L + T + P)**	**SEE**	**CIE**	**Total Marks**	**Credits**
19	Lang.1.1	Language - I	AECC	3+1+0	60	40	100	3
20	Lang.1.2	Language – II	AECC	3+1+0	60	40	100	3
21	B.Com.3.1	Corporate Accounting	DSC	3+0+2	60	40	100	4
22	B.Com.3.2	Business Statistics	DSC	3+0+2	60	40	100	4
23	B.Com.3.3	Cost Accounting	DSC	3+0+2	60	40	100	4
24	B.Com.3.4	Artificial Intelligence	SEC	1+0+2	50	50	100	2
25	B.Com.3.5	Advertising Skills/Entrepreneurial Skills	OEC	3+0+0	60	40	100	3
Sub –Total (C)					410	290	700	23

Semester IV								
Sl. No.	**Course Code**	**Title of the Course**	**Category of Courses**	**Teaching Hours per Week (L + T + P)**	**SEE**	**CIE**	**Total Marks**	**Credits**
26	Lang.1.1	Language - I	AECC	3+1+0	60	40	100	3
27	Lang.1.2	Language – II	AECC	3+1+0	60	40	100	3
28	B.Com.4.1	Advanced Corporate Accounting	DSC	3+0+2	60	40	100	4
29	B.Com.4.2	Costing Methods & Techniques	DSC	3+0+2	60	40	100	4
30	B.Com.4.3	Business Regulatory Framework	DSC	4+0+0	60	40	100	4
31	B.Com.4.4	Constitution of India	AECC	2+0+0	50	50	100	2
32	B.Com.4.5	NCC/NSS/Culture/Health Wellness/ Social & Emotional learning/others	SEC-VB	1+0+2	-	100	100	2
33	B.Com.4.6	Business Ethics / Corporate Governance	OEC	3+0+0	60	40	100	3
Sub –Total (D)					410	390	800	25

I Semester Discipline Specific Course (DSC)

FINANCIAL ACCOUNTING – I

LTP: 3+0+2 More than 50 students -5 Hours per week
Less than 50 students – 4 Hours per week

OBJECTIVE:

- To enable the students to understand the system of preparing financial statement of sole trading concern and to create an awareness in the students about Financial Reporting Standards.

OUTCOME:

- The students will be able to prepare and analyse financial statements of sole trading concerns.

UNIT – I Introduction to Financial Accounting: Meaning, Definition and scope of Accounting – Objectives of Accounting – Functions of Accounting – Branches of Accounting – Accounting Principles - Accounting Concepts and Conventions – Accounting Standards: Meaning and Objectives - Indian Accounting Standards, IND AS, IFRS – Distinction between IND AS and IFRS.

UNIT – II Accounting for Hire Purchase System: Meaning – Features of Hire purchase system – Calculation of interest under different methods – ascertainment of cash price of an asset – repossession (theory) - problems on hire purchase system (assets accrual method only)

UNIT – III Accounting for Instalment System: Meaning – Features of instalment system – differences between hire purchase and instalment system – problems on instalment system.

UNIT – IV Royalty Accounts: Meaning and Definition – Terms used – Royalty – Minimum rent – Short workings – surplus royalty – recoupment of short workings – stoppage of work due to abnormal causes – problems on royalty including minimum rent account.

UNIT – V Final accounts of Sole Trading Concern: Financial statements – Preparation of Trading and Profit and loss account and Balance sheet with adjustments.

SKILL DEVELOPMENT

1. Visit three Sole Trading Concerns and Collect the Financial Statements of a Sole Trading concerns.
2. Collect a copy of Hire Purchase agreement.
3. Identify the businesses where Royalty accounting is applied
4. Prepare Royalty Analytical Table with imaginary figures.
5. Identify the differences between IND AS and IFRS with respect to IAS 1, IAS 16, IAS 36, IAS 37 and IAS 38

Books for Reference:

1. Accounting Principles; Anthony, R.N. and Reece, J.S.: Richard Irwin Inc.
2. Financial Accounting; Gupta, R.L and Radhaswamy, M: Sultan Chand and Sons, New Delhi.
3. Financial Accounting; Prof B.H Suresh and Dr. G.H Mahadevaswamy
4. Advanced Accounts; Shukla. M.C., Grewal T.S., and Gupta, S.C.: S. Chand & Co. New Delhi.
5. Compendium of Statement and Standards of Accounting: The Institute of Chartered Accountants of India, New Delhi.

I Semester **Discipline Specific Course (DSC)**

Management Principles and Applications

LTP: 4+0+0 4 Hours per week

OBJECTIVE:

- To enable the students to understand the various functions of management• various types of organisations and to create an awareness in the students about application of management principles in business organizations.

OUTCOMES:

- The students will be able to understand and identify the different theories of organization, which are relevant in the present context.
- Compare and chose the different types of motivation factors and leadership styles.

UNIT – I Introduction to Management: Meaning and Definition – Nature and Characteristics of Management – Scope of Management – Levels of Management - Administration Vs. Management – Functions of Management – Evolution of management thought: contributions of F.W. Taylor and Henry Fayol.

UNIT – II Planning: Meaning and Definition – Characteristics of Planning, Importance and Benefits of Planning – Steps in planning – Types of Planning – Limitations of Planning – Decision making concept.

UNIT – III Organizing: Meaning and Definition – Principles of Organisation – Formal Vs. Informal Organisation - Types of Orgnisation - Functional Organisation – Matrix Organisation – Team based Organisation – Departmentation – Decentralisation and Delegation of authority.

UNIT – IV Leadership: Meaning – Qualities of a good leader – Types of Leadership styles – Motivation concept and theories – Maslow's hierarchy of needs – Herzberg's dual factor theory – McGregor's theory X and theory Y.

UNIT – V Controlling: Meaning and Definition – Importance of control – Steps in controlling - techniques of control – PERT, CPM, JIT – Co-ordination – Need for Co-ordination - Principles of Co-ordination.

SKILL DEVELOPMENT

1. Visit any business organization and collect the type of planning adopted by them.
2. Collect bio-data and photographs of any two leading contributors of management thoughts.
3. Analyse the leadership styles of any selected five companies of different sectors.
4. Visit any manufacturing unit and identify the controlling system followed.
5. Draw the Organisation chart of any two business concern.

Books for Reference:

1. Principles of Management by Koontz and O'Donnell, McGraw Hill Education.
2. Business Management by C.B.Gupta, Sultan Chand and sons
3. Principles and practice of Management by L.M. Prasad, Sultan Chand and Sons
4. Management, Stoner A F and Freeman R.E, Prentice Hall
5. P.C. Tripathi & P N Reddy, Principles of Management, TMH Publications
6. Management: Principles and Practices by Ricky W. Giffin.

I Semester **Discipline Specific Course**

(DSC)Principles of Marketing

OBJECTIVE:

LTP: 4+0+0 4 Hours per week

- To enable students to understand the basic concepts and principles of Marketing

OUTCOME:

- Students will be able to learn the application of Principles of marketing by business firms

UNIT – I Introduction to Marketing: Meaning and Definition of Market, Marketing- Core Marketing Concepts - Marketing Mix - Marketing environment - Functions of Marketing. 4Ps and 7Ps of marketing mix. Online Marketing- Relationship between Technology, Globalisation , Social Responsibility and online marketing.

UNIT – II Product : Meaning of a Product - Product Plan -–Diffusion (Adoption) of Innovations- New Product idea - Stages in New Product Development- Causes for Failure of a new product - Product life cycle and Marketing strategy.

UNIT – III Price and Promotion: Price: Meaning – Pricing Strategy – Types of Pricing Strategies. Promotion: Meaning and Role of Promotion – Types of Promotion – Personal selling – Advertising – Publicity and Sales promotion - Elements of Promotional mix – Factors affecting Promotion Mix.

UNIT - IV Place in Marketing mix : Channels of Distribution – Types of Channels of Distribution - Middlemen and Distribution- Selection of the type of Channel - Retailing –Nature and Importance –Non-store retailing-Wholesaling and Physical Distribution-Nature and Importance of Wholesaling and Physical Distribution.

UNIT – V Consumer Behaviour: Meaning - Features – Scope- Importance- Models of Consumer Behaviour - Consumer reference groups and their types – Consumer behavior in Online marketing.

SKILL DEVELOPMENT

1. Name any five FMCG companies in India and identify the pricing strategy used by each one of them.
2. Select any five firms in automobile industry and identify the promotional methods used by each of the firm.
3. Identify any five products that failed in the market and identify the causes of failure for each of the products.
4. Select any five products and identify the various channels of distribution used for each of them.
5. Identify a product in the growth stage and write about 4Ps of marketing in it.

Books for Reference

1. Principle of Marketing- Philip Kotler, Gary Armstrong and Prafulla Agnihotri, Pearson Publication
2. Principles of Marketing – Robert H. Utaraid and Brajendra Kr Gupta
3. Principles of Marketing – Charles W Lamb, Cengage India Learning P Ltd
4. Principles of Marketing – Dr Amit Kumar, Sahitya Bhawan Publications

5. Marketing – Grewal and Levy, Mc Graw Hill Publication.

I Semester Open Elective Course (OEC)

1.5 1. Basics ofAccounting

(Across the Faculty)

LTP: 3+0+0 3 Hours per week

OBJECTIVE:

- To enable the students to understand the basics of accounting, need for accounting in business and the system of preparing financial statements - to create an awareness in the students about Financial Reporting Standards

OUTCOME:

- The students will be able to prepare subsidiary books and to prepare and analyse financial statements of sole trading concern.

UNIT – I. Introduction to Accounting: Meaning – Need for accounting – Internal and External users of Accounting – Accounting Concepts and Conventions – Indian Accounting Standards (IND AS) – International Financial Reporting Standards (IFRS) Distinction between IND AS and IFRS.

UNIT – II – Accounting Systems and Process: Nature of accounting – Systems of accounting: Single entry and Double entry – Process of accounting – Business transactions – Journal entries - Ledger (simple problems)

UNIT – III. Subsidiary Books: Sales book – Sales returns book – Purchases book – Purchase returns book – Bills Receivable book – Bills Payable book – Cash book – Petty Cash book – Journal proper – Problems on preparation of Sales book, Sales returns book, Purchases book, Purchase returns book, Cash book (single column, double column, three column) and Petty Cash book (simple problems)

UNIT – IV. Final Accounts of Sole Trading Concern: Preparation of Trial Balance – Preparation of Trading and Profit and Loss account and Balance sheet (simple problems)

SKILL DEVELOPMENT

1. Collect the final accounts of a Sole Trading concern.
2. Prepare Subsidiary books with imaginary figures.
3. Collect Cash book prepared by Sole Trading Concern.
4. Identify the businesses where Single entry and Double entry systems of Book-keeping is followed.

Books for Reference:

1. Accounting Principles; Anthony, R.N. and Reece, J.S.: Richard Irwin Inc.
2. Financial Accounting; Gupta, R.L and Radhaswamy, M: Sultan Chand and Sons, New Delhi.
3. Accountancy; B.S.Raman, United Publishers, Mangalore.
4. Advanced Accounts; Shukla. M.C., Grewal T.S., and Gupta, S.C.: S. Chand & Co. New Delhi.
5. Compendium of Statement and Standards of Accounting: The Institute of Chartered Accountants of India, New Delhi.

I Semester Open Elective Course (OEC)

1.5 2. Managing Workforce

(Across the Faculty)

LTP: 3+0+0 3 Hours per week

OBJECTIVE:

- To enable the students to understand the basics of managing workforce at work place and know the process of selection, training and development.

OUTCOME:

- The students will be able to manage themselves at work place and know the nuances of managing human resources.

UNIT – I Introduction: Concepts of human resource management- Meaning - Objectives-Scope and functions.

UNIT – II Human Resources Planning and Procurement: Human resource planning - importance- objectives and problems. Recruitment-meaning - recruitment policy - sources – factors affecting recruitment - selection decision - selection procedure.

UNIT - III Human Resource development: Meaning-concepts of HRD-objectives of training-organization of training programmers – methods of training - advantages and limitations of training

UNIT - IV Compensation: Meaning - Factors determining employee compensation and rewards - dearness allowance - employee benefits-bonus and social security - managerial compensation. Performance Appraisal: concepts - objectives - Types

SKILL DEVELOPMENT

1. Collect information regarding the recruitment and selection process adopted by any one of the Companies/organisations located in your District.
2. Visit and collect the training method adopted by a company.
3. Visit and collect the methods of compensation adopted by any company.
4. Identify the methods of Performance appraisal adopted by any company.

Books for Reference:

1. Human Resource Management- P.Subba Rao
2. Human Resource Management -Dr.Ashwathappa
3. Personnel and Human Resource Management -D.A. Deonz and F.P. Robins
4. Human Resource Management – Prasanna Chandra.

II Semester Discipline Specific Course (DSC)

FINANCIAL ACCOUNTING – II

OBJECTIVE:

LTP: 3+0+2More than 50 students -5 Hours per week
Less than 50 students – 4 Hours per week

- To enable the students to understand the maintaining of accounts for various types of business firms including non- profit organizations.

OUTCOME:

- The students will be able to prepare the final accounts of business firms and NPO and theywill be able to account for loss of stock.

UNIT – I Branch Accounts: Meaning – Objectives – Types of Branches – Dependent Branches – Features – Goods Sent to branch at Cost price and Invoice price – Preparation of Branch account and other relevant ledger accounts in the books of Head Office (Debtors system only)

UNIT – II Departmental Accounts: Meaning – Objectives – Basis of apportionment of expenses and incomes – Preparation of Trading and Profit and loss account in columnar method and Common Balance sheet (Sole trading concerns only)

UNIT – III Consignment Accounts: Meaning – Consignor – Consignee – Goods consigned at Cost price and Invoice price – Commission – Types of Commission - Abnormal loss – Valuation of Stock – creation of stock reserve account – Problems on Consignment both Cost price and Invoice price.

UNIT – IV Fire Insurance Claims: Meaning of fire insurance – need – Loss of stock by fire – steps involved in the computation of fire claims – Average clause – Treatment of abnormal line goods – Problems on computation of fire insurance claims including average clause and abnormal line of goods.

UNIT – V Final accounts of Non-Profit Organisations: Meaning of Non-profit organisations – objectives – need – capital receipts and capital expenditure - revenue receipts and revenue expenditure – treatment of special items – Problems on preparation of Income and Expenditure account and Balance sheet from Receipts and Payments account.

SKILL DEVELOPMENT

1. Preparation of account sales with imaginary figures.
2. Calculation of fire insurance claims with imaginary figures.
3. Collection of final accounts of a Non-Profit Organisation and identifying Capital and revenue items
4. Visit any branch and collect the financial statements of the branch.
5. Preparation of Departmental Trading and Profit/Loss account with imaginary figures.

Books for Reference:

1. Accounting Principles; Anthony, R.N. and Reece, J.S.: Richard Irwin Inc.
2. Financial Accounting; Gupta, R.L and Radhaswamy, M: Sultan Chand and Sons.
3. Financial Accounting; Prof B.H Suresh and Dr. G.H Mahadevaswamy
4. Compendium of Statement and Standards of Accounting: The Institute of Chartered Accountants of India, New Delhi.

5. Financial Accounts, Mishra A.K.: Sahitya Bhawan Publishers and Distributors.
6. Financial Accounting – II: S.Anil kumar, V. Rajesh kumar and B.Mariappa, HPH

II Semester **Discipline Specific Course (**

DSC)Company Law

LTP: 4+0+0 4 Hours per week

OBJECTIVE:

- To enable the students to understand the types of companies incorporated in India and the promoters involved in forming a company and Company administration till its Liquidation.

OUTCOMES:

- The students will understand the frame work of Companies Act of 2013.
- Identify the stages of formation and documents involved in the formation of a company.
- Role of Managerial Personnel and procedure of conducting company meetings.

UNIT – I Introduction to Company: Meaning and Definition – Features of Companies Act of 2013 – Types of Companies –Private Company - Public Company - Company Limited by Shares – Company Limited by Guarantee – Unlimited Companies – One Person Company – Holding and Subsidiary Companies – Government Company - Associate Company.

UNIT – II Formation of Companies: Introduction – Steps involved in formation of a company – Position and Functions of Promoters – Meaning and contents of Prospectus, Memorandum of Association and Articles of Association – Alteration of MOA and AOA - Certificate of Commencement of Business – Formation of Global Companies – Features – Legal formalities.

UNIT – III Company Administration: Managerial Personnel – Managing director appointment, powers, duties and responsibilities – Whole time Director – Independent Director – Auditor's appointment: Qualification, duties and responsibilities – Company Secretary: Qualifications, Appointment, Rights, Duties, Liabilities and Removal.

UNIT – IV Company Meetings: Meaning – Types of company meetings – Importance — Requisites of a valid meeting – Notice – Quorum – Resolutions – Voting - Proxy – Role of a Company Secretary in convening the meetings.

UNIT – V Liquidation of Companies: Meaning – Modes of Liquidation – Consequence of Liquidation – Appointment of Official Liquidator – Duties and Responsibilities of Liquidator.

SKILL DEVELOPMENT

1. Collect the Prospectus, Memorandum of Association and Articles of Association of a Company.
2. Collect a notice of a meeting from any company.
3. List the names of Directors and Managing Director of any five companies.
4. List the names of full time company secretaries in India.
5. Name any five companies liquidated during last 2 years in India.

Books for Reference:

1. Company Law and Secretarial Practice by N.D. Kapoor, Sultan Chand and Sons
2. Company Law and Secretarial Practice by S.C. Kuchal
3. Elements of Corporate Law by S.N.Maheshwari, Himalaya Publication House
4. Corporate Administration by K.Venkataramana, SHBP
5. Business Law for Management by Balachandran, Himalaya Publishing House.

II Semester **Discipline Specific Course (DSC)Law and Practice of Banking**

LTP: 4+0+0 4 Hours per week

OBJECTIVE: To enable students to acquire specialized knowledge of law and practice relating to Banking.

OUTCOME: Students will understand the conceptual frame work of Banking, classification of Banking, banker and customer relationship and E-Banking services.

UNIT – I Introduction to Banking: Origin and Evolution of banks - Meaning and definition of banking - Classification of Banks – Commercial Bank, Investment/Industrial Bank- Co-operative Bank - Land Development Bank -Exchange Bank - Central Bank -Saving Bank. Banking system – Branch Banking, Unit Banking, Group Banking, Chain Banking, Mixed Banking, Narrow Banking, Universal Banking and offshore Banking

UNIT – II Reserve Bank of India: – Constitution – Nationalisation – Management of RBI – organisation restructuring – Main functions of RBI – Measures of Credit control. RBI and Agricultural credit – RBI and Industrial Finance. Demonetisation and its impact.

UNIT – III Banking Regulation Act, 1949: Origin of the Act - objectives and features. Banking sector reforms - Narasimhan Committee Report I and II – Prudential norms: Capital Adequacy norms. NPA: – Meaning - factors contributing to NPAs- remedies available- recent measures.

UNIT – IV Banker and Customer: – Banker - Customer – the relationship between a banker and a customer: general relationship and special relationship. Cheque: – statutory obligation to honour cheques- bankers lien- A bankers duty to maintain secrecy of customer's account-right to claim incidental charges- right to charge compound interest.

UNIT – V E –Banking: Meaning - traditional banking v/s E- banking- Electronic delivery channels- facets of E –banking- E-banking transactions – Truncated cheque and Electronic Cheque – Mobile Banking – Inter Bank Mobile Payment Service (IMPS) – Virtual Currency – Models for E-banking – Advantages of E-Banking – Constraints in E-Banking – Security Measures – Real Time Gross Settlement (RTGS) – National Electronic Fund Transfer (NEFT).

SKILL DEVELOPMENT

1. Identify the Commercial Banks in your area
2. List out the Investment Banks in your District
3. Visit a Bank and list out the steps followed to avail E-Banking facility
4. Visit a Bank and prepare a report with respect to NPA
5. Identify the beneficiaries of MUDRA Scheme in your locality

Books for Reference:

1. Banking Theory, Law and Practice **-** E.Gordan and K.Natarajan
2. Money, Banking, International Trade and Public Finance – M L Jhingan
3. Indian Financial System - Vasanth Desai
4. Marketing of Financial Services - V.A. Avadhani

5. Indian Financial System - Varshenoy and Mittal
6. The Law and Practice of Banking – J M Holden

II SEMESTER Open Elective Course (OEC)

2.6 1. Financial Literacy(Across the Faculty)

L+T+P: 3+0+0 3 Hours per week

OBJECTIVE:

- To create awareness in student about the need for possessing financial literacy education.

OUTCOMES:

- The students will be able to understand the importance of financial literacy and prepare financial plans and budgets.
- The student will be able to describe the importance of insurance services as social security measures.

UNIT – I Introduction: Financial Literacy- Meaning and Importance - Components of Financial Literacy- Financial Institutions : Meaning, Banking and Non Banking Financial Institutions, Post offices . Investment: Meaning, Difference between Investment Vs Gambling- Risk and Return **-** Principles of investment - Investment Avenues –Financial Planning and Budgets , Family Budget, Business Budget and National Budget. Budget deficit and Surplus.

UNIT – II Banking: Meaning and Types of Banks, Various services offered by banks, types of bank deposit accounts, Formalities to open various types of bank accounts, KYC norms. Various types of Loans: Short-term, Medium term and Long term loans. Cashless banking, e-banking, ATM, Debit and Credit cards, banking Complaints.

UNIT – III Financial Services from Post Office: Post office Savings Schemes: Savings account - Recurring deposit -Term Deposit - Monthly Income Scheme - Kissan Vikas Pathra – NSC – PPF - Senior Citizen Savings Scheme - Sukanya Samriddhi Yojana/Account - Indian Post Payments Bank - Money Transfer - Money Order.

UNIT – IV Insurance Services: Life Insurance – Life Insurance Policies - Term Insurance and Endowment Policies - Pension Policies - Health Insurance Plans – ULIP - Property Insurance - General Insurance - Types, Postal Life Insurance Schemes- Housing Loans - Institutions providing Housing Loans, Pradhanmantri Awas Yojana: Rural and Urban.

SKILL DEVELOPMENT

1. Visit a nationalized bank near your area and collect information regarding services offered by the bank.
2. Visit a post office in your area and collect information about various deposit schemes available.
3. Collect an account opening form from a nationalized bank and fill up the form with necessary enclosures. Collect an account opening form from a post office and fill the form.
4. Prepare an annualfamily budget considering the income of your family. Also prepare a personal budget for six months.
5. Visit a LIC branch in your area and collect information regarding any five insurance policies (with its features)

Books for Reference:

1. Avadhani, V A (2019), Investment Management , Mumbai: Himalaya Publishing House Pvt Ltd
2. Chandra, P (2012), Investment Game: How to Win . New Delhi: Tata McGraw Hill Education.
3. Kothari , R (2010), financial Services in India: Concept and application. New Delhi: Sage Publication India Pvt td
4. Milling B. E, (2003), The Basics of Finance: Financial Tools for Non Financial Managers, Indiana : Universe Company.
5. Zokaityte , A (2017), Financial Literacy Education. London: Palgrave Macmillan.

II SEMESTER Open Elective Course (OEC)

2.6 2. Retail Management(Across the Faculty)

L+T+P: 3+0+0 3 Hours per week

OBJECTIVE:

- To enable students to understand how the retail business functions and highlight the scope of retail business in India and across the world

OUTCOME:

- Students will be able to acquire skills required for managing retail business and start their own retail business in the future

UNIT I Retailing: Meaning –Definition - Nature - Importance - Functions of Retailing - Factors influencing retailing - Types of Retailing – Forms of Retail Business ownership, Theory of Retail Development - Wheel of Retailing - Retail Life Cycle - Retail Business in India - Globalization of Retailing - Reasons for globalization - Problems in Globalisation of Retailing .

UNIT II Retail Organisation and Management: Introduction - Classification of Retail Organization. Store Operations: Retail Store Planning - Factors influencing location of a store - Store Layout – Merchandise Management - Category Management - Shelf Management - POS (Point of Sale) /Cash Process.

UNIT III Human Resource Management in Retailing: Manpower Planning – Recruitment in Retail sector - Problems in Retail Recruitment - Retail Training - Retail Managers : Roles – Skill - Employment Opportunities in Retail Industry.

UNIT IV E-Retailing: Meaning of E Retailing - Types of Technology in Retailing - Factors Influencing use of IT in Retailing - Electronic Article Surveillance – Electronic Shelf Labels - Effective Management of Online catalogues - Customer Relationship Management: Customer data base - Identifying information - Analysing customer data base and identifying target customers - Customer pyramid - Customer retention.

SKILL DEVELOPMENT

1. Visit a modern retail store in your area and identify its organization structure
2. Visit a mall and identify the various types of shops in the mall
3. Name any ten e-retailers in the world
4. Visit a super market in your area and collect information about the roles andresponsibilitiesof the manager
5. Name any Ten Global retailers.

Books for Reference:

1. Suja R Nair , Retail Management, V Edition, HPH, Mumbai, 2006
2. Swapna Pradhan , Retailing Management -Text and Cases, II Edition, Tata Mc GrawHill,India, 2007
3. S. K. Pradhan and Others, Retail Management , VPH.
4. Piyush Kumar Sinha and Dwarika Prasad Uniyal- Managing Retailing, OxfordUniversityPress, Delhi
5. R. S. Tiwari, Retail Management , Himalaya Publishing House.
6. Levy Michael,Weitz Barton - Retailing Management, V Edition, Tata McGraw Hill,NewYork, 2006
7. Lucas G.H., Bush Robert, Gresham Larry- Retailing, Houghton Mifflin Company,Boston,1994.

SYLLABUS FOR B.COM DEGREE AS PER NEP – 2020 REGULATIONS
IMPLEMENTED FROM THE ACADEMIC YEAR 2021-22

I. OBJECTIVES:

1. To develop the skills required for the application of accounting concepts andtechniques learned in the classroom at the workplace.
2. To provide competent and technical skills personnel to the industry in the area of Accounting, Finance, Taxation, Cost and Management Accounting.
3. To enhance the employability skills of the commerce students.
4. To enhance the capability of the students improve their decision-making skills.
5. To enhance the capability of the students to make decisions at personal andprofessional level.
6. To encourage entrepreneurship among students pursuing education in the field of Commerce.
7. To empower students for pursuing professional courseslike CharteredAccountancy, Cost and Management Accountancy, Company Secretary, etc.,
8. To ensure holistic development of Commerce students.

II. ELIGIBILITY FOR ADMISSION:

Candidates who have passed Two Year Pre University Course of Karnataka State in any discipline or its equivalent (viz., 10+2 of other states, ITI, Diploma etc.) are eligible for admission into this program.

III. DURATION OF THE PROGRAM:

The program of study is Four years of Eight Semesters. A candidate shall complete his/her degree within eight academic years from the date of his/her admission to the first semester. The NEP 2020 provides multiple exit options for students as specified below:

EXIT OPTION:

a. The students who successfully complete ONE year/ 2 Semesters and leave the program, will be awarded Certificate in Commerce.
b. The students who successfully complete TWO years/ 4 Semesters and leave the program, will be awarded Diploma in Commerce.
c. The students who successfully complete THREE years/ 6 Semesters and leave the program, will be awarded Bachelors Degree in Commerce (B.COM)
d. An option is given to the students to continue their education to the Fourth year and those who successfully complete FOUR years/ 8 Semesters will be awarded Bachelors Degree in Commerce (Hons) . [B.COM (Hons)]

IV. MEDIUM OF INSTRUCTION

The medium of instruction shall be English. However a candidate will be permitted to write the examination either in English or in Kannada.

V. ATTENDANCE

a. For the purpose of calculating attendance, each semester shall be taken as a Unit.
b. A student shall be considered to have satisfied the requirement of attendance for the semester, if he/she has attended not less than 75% in aggregate of the number of working periods in each of the subjects compulsorily.
c. A student who fails to complete the course in the manner stated above shall not be permitted to take the University Examination.

VI. TEACHING AND EVALUATION

M.Com graduates with B.Com, BBM/BBA and BBS as basic degree from a recognized university are only eligible to teach and to evaluate all the Commerce courses including Digital Fluency (except Languages, Constitution of India, Environmental Studies, Health Wellness/Social and Emotional learning, Sports/NCC/NSS/Other)

VII. SKILL DEVELOPMENT / RECORD MAINTENANCE

a. Every college is required to establish a dedicated business lab for the purpose of conducting practical/ assignments to be written in the record.

b. In every semester, the student should maintain a record book in which a minimum of 5 exercise or activities per course are to be recorded.

VIII. SCHEME OF EXAMINATION

a. There shall be an University examination at the end of each semester. The maximum marks for the university examination in each paper shall be 60 marks for DSC, DSE, Vocational, SEC and OEC.

b. Internal Assessment 40 marks for DSC, DSE, Vocational, SEC and OEC.

Guidelines for Continuous Internal Evaluation and Semester End Examination:

The CIE and SEE will carry 40% and 60% weightage each, to enable the course to be evaluated for a total of 100 marks, irrespective of its credits. The evaluationsystem of the course is comprehensive & continuous during the entire period of the Semester. For a course, the CIE and SEE evaluation will be on the following parameters:

Sl. No.	Parameters for the Evaluation	Marks
	Continuous Internal Evaluation (CIE)	
1	Continuous & Comprehensive Evaluation (CCE) – (A)	20 Marks
2	Internal Assessment Tests (IAT) –(B)	20 Marks
	Total of CIE (A+B)	40 Marks
3	Semester End Examination (SEE) – (C)	60 Marks
	Total of CIE and SEE (A + B + C)	100 Marks

Continuous Internal Evaluation:

a. **Continuous & Comprehensive Evaluation (CCE):** The CCE will carry a maximum of 20% weightage (20 marks) of total marks of a course. Before the start of the academic session in each semester, a faculty member should choose for his/her course, minimum of two of the following assessment methods with 10 marks each (2x10=20 marks)

   i. Individual Assignments/Group Assignments
   ii. Seminars/Class Room Presentations/ Quizzes
   iii. Participatory activities & Industry-Integrated Learning/ Industrial visits
   iv. Practical activities / Problem Solving Exercises

b. **Internal Assessment Tests (IAT):** The IAT will carry a maximum of 20% weightage (20 marks) of total marks of a course. Under this component, two tests will have to be conducted in a semester for 30 marks each and the same is to be scaled down to 10 marks each.

Internal Assessment Test

Course Code: Name of the Course:

Duration: 1 Hour Total Marks: 30

PART-A

Answer any one of the following questions. 5 marks (1x 5 = 5)

1.----------

2.----------

PART- B

Answer any one of the following questions. 10 marks (1x 10 = 10)

3.----------

4.----------

SECTION- C

Answer any one of the following questions. 15 marks (1x 15 = 15)

5,----------

6.----------

SEMESTER END EXAMINATION (SEE):

The Semester End Examination for all the courses for which students who get registered during the semester shall be conducted. SEE of the course shall be conducted after fulfilling the minimum attendance requirement as per the University norms. The BOS of the University has prepared the SEE framework and the question paper pattern for SEE is presented below for 60 marks.

PATTERN OF QUESTION PAPER

TIME : 2 HOURS MARKS: 60

PART – A

Answer any FIVE of the following questions. Each question carries 2 marks.

(5x2= 10)

1. .....
2. .....
3. .....
4. .....
5. .....
6. .....
7. .....

PART – B

Answer any TWO of the following questions. Each question carries 10 Marks.

(2x10 =20)

8. .....

9. .....

10. .....
11. .....

PART – C

Answer any TWO of the following questions. Each question carries 15 Marks

(2x15=30)

12. ..... 13. .....

14. .....
15. .....

Minimum Marks for a Pass:

Candidates who have obtained a minimum of 35% marks in semester end examination i.e. 21 marks out of 60 marks of theory examination and 40% in aggregate i.e. total 40 marks out of 100 marks of Semester End Examination marks and Continuous Internal Evaluation marks.

Notes:

- One Hour of Lecture is equal to 1 Credit.
- One Hour of Tutorial is equal to 1 Credit (Except Languages).
- Two Hours of Practical is equal to 1 Credit

Acronyms Expanded

- AECC : Ability Enhancement Compulsory Course
- DSC © : Discipline Specific Core (Course)
- SEC-SB/VB : Skill Enhancement Course-Skill Based/Value Based
- OEC : Open Elective Course
- DSE : Discipline Specific Elective
- SEE : Semester End Examination

- **CIE** : Continuous Internal Evaluation
- L+T+P : Lecture+Tutorial+Practical (s)

Note: Practical Classes may be conducted in the Business Lab or in Computer Lab or in Class room depending on the requirement. One batch of students should not exceed half (i.e., 50 or less than 50 students) of the number of students in each class/section. 2 Hours of Practical Class is equal to 1 Hour of Teaching, however, whenever it is conducted for the entire class (i.e., more than 50 students) 2 Hours of Practical Class is equal to 2 Hours of Teaching

PROGRAM STRUCTURE
Proposed Scheme of Teaching and Evaluation for B.Com (Basic/Hons)
with Commerce as Core Subject

I SEMESTER B.COM								
Sl. No.	**Course Code**	**Title of the Course**	**Category of Courses**	**Teaching Hours per week (L+T+P)**	**SEE**	**CIE**	**Total Marks**	**Credits**
1	Lang 1.1	Language – I	AECC	3+1+0	60	40	100	3
2	Lang 1.2	Language - II.	AECC	3+1+0	60	40	100	3
3	B.Com 1.1	Financial Accounting – I	DSC	3+0+2	60	40	100	4
4	B.Com 1.2	Management Principles and Applications	DSC	4+0+0	60	40	100	4
5	B.Com 1.3	Principles of Marketing	DSC	4+0+0	60	40	100	4
6	B.Com 1.4	Digital Fluency **OR** Environmental Studies	SEC-SB AECC	1+0+2 2+0+0	60	40	100	2
7	B. Com1.5	Across the Faculty:* 1. Basics of Accounting **OR** 2. Managing Workforce	OEC	3+0+0	60	40	100	3
8	B.Com 1.6	Yoga **OR** Sports	SEC-VB	0+0+1	-	-	-	1
9	B.Com 1.7	Health and Wellness **OR** NCC/NSS/R&R (S&G)/Culture	SEC-VB	0+0+1	-	-	-	1
	Sub-Total (A)				**420**	**280**	**700**	**25**

Note :

*Across the Faculty: These Courses are meant for other department students and shall be taught by commerce teachers.

	II SEMESTER B.COM							
10	Lang 2.1	Language –I	AECC	3+1+0	60	40	100	3
11	Lang 2.2	Language –II	AECC	3+1+0	60	40	100	3
12	B.Com 2.1	Financial Accounting – II	DSC	3+0+2	60	40	100	4
13	B.Com 2.2	Company Law	DSC	4+0+0	60	40	100	4
14	B Com 2.3	Law and Practice of Banking	DSC	4+0+0	60	40	100	4
15	B.Com 2.4	Digital Fluency **OR** Environmental Studies	SEC-SB AECC	1+0+2 2+0+0	60	40	100	2
16	B.Com 2.6	Across the Faculty:* 1. Financial Literacy **OR** 2. Retail Management	OEC	3+0+0	60	40	100	3
17	B.Com 2.7	Yoga / Sports	SEC-VB	0+0+1	-	-	-	1
18	B.Com 2.8	Health and Wellness **OR** NCC/NSS/R&R (S&G)/Culture	SEC-VB	0+0+1	-	-	-	1
	Sub-Total (B)				**420**	**280**	**700**	**25**

Note :

* Across the Faculty: These courses are meant for other departments students and shall be taught by commerce teachers.

I Semester Discipline Specific Course (DSC)

FINANCIAL ACCOUNTING – I

LTP: 3+0+2 More than 50 students -5 Hours per week
Less than 50 students – 4 Hours per week

OBJECTIVE:

- To enable the students to understand the system of preparing financial statement of sole trading concern and to create an awareness in the students about Financial Reporting Standards.

OUTCOME:

- The students will be able to prepare and analyse financial statements of sole trading concerns.

UNIT – I Introduction to Financial Accounting: Meaning, Definition and scope of Accounting – Objectives of Accounting – Functions of Accounting – Branches of Accounting – Accounting Principles - Accounting Concepts and Conventions – Accounting Standards: Meaning and Objectives - Indian Accounting Standards, IND AS, IFRS – Distinction between IND AS and IFRS.

UNIT – II Accounting for Hire Purchase System: Meaning – Features of Hire purchase system – Calculation of interest under different methods – ascertainment of cash price of an asset – repossession (theory) - problems on hire purchase system (assets accrual method only)

UNIT – III Accounting for Instalment System: Meaning – Features of instalment system – differences between hire purchase and instalment system – problems on instalment system.

UNIT – IV Royalty Accounts: Meaning and Definition – Terms used – Royalty – Minimum rent – Short workings – surplus royalty – recoupment of short workings – stoppage of work due to abnormal causes – problems on royalty including minimum rent account.

UNIT – V Final accounts of Sole Trading Concern: Financial statements – Preparation of Trading and Profit and loss account and Balance sheet with adjustments.

SKILL DEVELOPMENT

1. Visit three Sole Trading Concerns and Collect the Financial Statements of a Sole Trading concerns.
2. Collect a copy of Hire Purchase agreement.
3. Identify the businesses where Royalty accounting is applied
4. Prepare Royalty Analytical Table with imaginary figures.
5. Identify the differences between IND AS and IFRS with respect to IAS 1, IAS 16, IAS 36, IAS 37 and IAS 38

Books for Reference:

1. Accounting Principles; Anthony, R.N. and Reece, J.S.: Richard Irwin Inc.
2. Financial Accounting; Gupta, R.L and Radhaswamy, M: Sultan Chand and Sons, New Delhi.
3. Financial Accounting; Prof B.H Suresh and Dr. G.H Mahadevaswamy
4. Advanced Accounts; Shukla. M.C., Grewal T.S., and Gupta, S.C.: S. Chand & Co. New Delhi.
5. Compendium of Statement and Standards of Accounting: The Institute of Chartered Accountants of India, New Delhi.

I Semester **Discipline Specific Course (DSC)**

Management Principles and Applications

LTP: 4+0+0 4 Hours per week

OBJECTIVE:

- To enable the students to understand the various functions of management• various types of organisations and to create an awareness in the students about application of management principles in business organizations.

OUTCOMES:

- The students will be able to understand and identify the different theories of organization, which are relevant in the present context.
- Compare and chose the different types of motivation factors and leadership styles.

UNIT – I Introduction to Management: Meaning and Definition – Nature and Characteristics of Management – Scope of Management – Levels of Management - Administration Vs. Management – Functions of Management – Evolution of management thought: contributions of F.W. Taylor and Henry Fayol.

UNIT – II Planning: Meaning and Definition – Characteristics of Planning, Importance and Benefits of Planning – Steps in planning – Types of Planning – Limitations of Planning – Decision making concept.

UNIT – III Organizing: Meaning and Definition – Principles of Organisation – Formal Vs. Informal Organisation - Types of Orgnisation - Functional Organisation – Matrix Organisation – Team based Organisation – Departmentation – Decentralisation and Delegation of authority.

UNIT – IV Leadership: Meaning – Qualities of a good leader – Types of Leadership styles – Motivation concept and theories – Maslow's hierarchy of needs – Herzberg's dual factor theory – McGregor's theory X and theory Y.

UNIT – V Controlling: Meaning and Definition – Importance of control – Steps in controlling - techniques of control – PERT, CPM, JIT – Co-ordination – Need for Co-ordination - Principles of Co-ordination.

SKILL DEVELOPMENT

1. Visit any business organization and collect the type of planning adopted by them.
2. Collect bio-data and photographs of any two leading contributors of management thoughts.
3. Analyse the leadership styles of any selected five companies of different sectors.
4. Visit any manufacturing unit and identify the controlling system followed.
5. Draw the Organisation chart of any two business concern.

Books for Reference:

1. Principles of Management by Koontz and O'Donnell, McGraw Hill Education.
2. Business Management by C.B.Gupta, Sultan Chand and sons
3. Principles and practice of Management by L.M. Prasad, Sultan Chand and Sons
4. Management, Stoner A F and Freeman R.E, Prentice Hall
5. P.C. Tripathi & P N Reddy, Principles of Management, TMH Publications
6. Management: Principles and Practices by Ricky W. Giffin.

I Semester **Discipline Specific Course (**

DSC)Principles of Marketing

OBJECTIVE:

LTP: 4+0+0 4 Hours per week

- To enable students to understand the basic concepts and principles of Marketing

OUTCOME:

- Students will be able to learn the application of Principles of marketing by business firms

UNIT – I Introduction to Marketing: Meaning and Definition of Market, Marketing- Core Marketing Concepts - Marketing Mix - Marketing environment - Functions of Marketing. 4Ps and 7Ps of marketing mix. Online Marketing- Relationship between Technology, Globalisation , Social Responsibility and online marketing.

UNIT – II Product : Meaning of a Product - Product Plan -–Diffusion (Adoption) of Innovations- New Product idea - Stages in New Product Development- Causes for Failure of a new product - Product life cycle and Marketing strategy.

UNIT – III Price and Promotion: Price: Meaning – Pricing Strategy – Types of Pricing Strategies. Promotion: Meaning and Role of Promotion – Types of Promotion – Personal selling – Advertising – Publicity and Sales promotion - Elements of Promotional mix – Factors affecting Promotion Mix.

UNIT - IV Place in Marketing mix : Channels of Distribution – Types of Channels of Distribution - Middlemen and Distribution- Selection of the type of Channel - Retailing –Nature and Importance –Non-store retailing-Wholesaling and Physical Distribution-Nature and Importance of Wholesaling and Physical Distribution.

UNIT – V Consumer Behaviour: Meaning - Features – Scope- Importance- Models of Consumer Behaviour - Consumer reference groups and their types – Consumer behavior in Online marketing.

SKILL DEVELOPMENT

1. Name any five FMCG companies in India and identify the pricing strategy used by each one of them.
2. Select any five firms in automobile industry and identify the promotional methods used by each of the firm.
3. Identify any five products that failed in the market and identify the causes of failure for each of the products.
4. Select any five products and identify the various channels of distribution used for each of them.
5. Identify a product in the growth stage and write about 4Ps of marketing in it.

Books for Reference

1. Principle of Marketing- Philip Kotler, Gary Armstrong and Prafulla Agnihotri, Pearson Publication
2. Principles of Marketing – Robert H. Utaraid and Brajendra Kr Gupta
3. Principles of Marketing – Charles W Lamb, Cengage India Learning P Ltd
4. Principles of Marketing – Dr Amit Kumar, Sahitya Bhawan Publications

5. Marketing – Grewal and Levy, Mc Graw Hill Publication.

I Semester Open Elective Course (OEC)

1.5 1. Basics of Accounting(Across the Faculty)

LTP: 3+0+0 3 Hours per week

OBJECTIVE:

- To enable the students to understand the basics of accounting, need for accounting in business and the system of preparing financial statements - to create an awareness in the students about Financial Reporting Standards

OUTCOME:

- The students will be able to prepare subsidiary books and to prepare and analyse financial statements of sole trading concern.

UNIT – I. Introduction to Accounting: Meaning – Need for accounting – Internal and External users of Accounting – Accounting Concepts and Conventions – Indian Accounting Standards (IND AS) – International Financial Reporting Standards (IFRS) Distinction between IND AS and IFRS.

UNIT – II – Accounting Systems and Process: Nature of accounting – Systems of accounting: Single entry and Double entry – Process of accounting – Business transactions – Journal entries - Ledger (simple problems)

UNIT – III. Subsidiary Books: Sales book – Sales returns book – Purchases book – Purchase returns book – Bills Receivable book – Bills Payable book – Cash book – Petty Cash book – Journal proper – Problems on preparation of Sales book, Sales returns book, Purchases book, Purchase returns book, Cash book (single column, double column, three column) and Petty Cash book (simple problems)

UNIT – IV. Final Accounts of Sole Trading Concern: Preparation of Trial Balance – Preparation of Trading and Profit and Loss account and Balance sheet (simple problems)

SKILL DEVELOPMENT

1. Collect the final accounts of a Sole Trading concern.
2. Prepare Subsidiary books with imaginary figures.
3. Collect Cash book prepared by Sole Trading Concern.
4. Identify the businesses where Single entry and Double entry systems of Book-keeping is followed.

Books for Reference:

1. Accounting Principles; Anthony, R.N. and Reece, J.S.: Richard Irwin Inc.
2. Financial Accounting; Gupta, R.L and Radhaswamy, M: Sultan Chand and Sons, New Delhi.
3. Accountancy; B.S.Raman, United Publishers, Mangalore.
4. Advanced Accounts; Shukla. M.C., Grewal T.S., and Gupta, S.C.: S. Chand & Co. New Delhi.

5. Compendium of Statement and Standards of Accounting: The Institute of Chartered Accountants of India, New Delhi.

I Semester Open Elective Course (OEC)

1.5 2. Managing Workforce

(Across the Faculty)

LTP: 3+0+0 3 Hours per week

OBJECTIVE:

- To enable the students to understand the basics of managing workforce at work place and know the process of selection, training and development.

OUTCOME:

- The students will be able to manage themselves at work place and know the nuances of managing human resources.

UNIT – I Introduction: Concepts of human resource management- Meaning - Objectives-Scope and functions.

UNIT – II Human Resources Planning and Procurement: Human resource planning - importance- objectives and problems. Recruitment-meaning - recruitment policy - sources – factors affecting recruitment - selection decision - selection procedure.

UNIT - III Human Resource development: Meaning-concepts of HRD-objectives of training-organization of training programmers – methods of training - advantages and limitations of training

UNIT - IV Compensation: Meaning - Factors determining employee compensation and rewards - dearness allowance - employee benefits-bonus and social security - managerial compensation. Performance Appraisal: concepts - objectives - Types

SKILL DEVELOPMENT

1. Collect information regarding the recruitment and selection process adopted by any one of the Companies/organisations located in your District.
2. Visit and collect the training method adopted by a company.
3. Visit and collect the methods of compensation adopted by any company.
4. Identify the methods of Performance appraisal adopted by any company.

Books for Reference:

1. Human Resource Management- P.Subba Rao
2. Human Resource Management -Dr.Ashwathappa
3. Personnel and Human Resource Management -D.A. Deonz and F.P. Robins
4. Human Resource Management – Prasanna Chandra.

II Semester Discipline Specific Course (DSC)

FINANCIAL ACCOUNTING – II

OBJECTIVE:

LTP: 3+0+2More than 50 students -5 Hours per week
Less than 50 students – 4 Hours per week

- To enable the students to understand the maintaining of accounts for various types of business firms including non- profit organizations.

OUTCOME:

- The students will be able to prepare the final accounts of business firms and NPO and theywill be able to account for loss of stock.

UNIT – I Branch Accounts: Meaning – Objectives – Types of Branches – Dependent Branches – Features – Goods Sent to branch at Cost price and Invoice price – Preparation of Branch account and other relevant ledger accounts in the books of Head Office (Debtors system only)

UNIT – II Departmental Accounts: Meaning – Objectives – Basis of apportionment of expenses and incomes – Preparation of Trading and Profit and loss account in columnar method and Common Balance sheet (Sole trading concerns only)

UNIT – III Consignment Accounts: Meaning – Consignor – Consignee – Goods consigned at Cost price and Invoice price – Commission – Types of Commission - Abnormal loss – Valuation of Stock – creation of stock reserve account – Problems on Consignment both Cost price and Invoice price.

UNIT – IV Fire Insurance Claims: Meaning of fire insurance – need – Loss of stock by fire – steps involved in the computation of fire claims – Average clause – Treatment of abnormal line goods – Problems on computation of fire insurance claims including average clause and abnormal line of goods.

UNIT – V Final accounts of Non-Profit Organisations: Meaning of Non-profit organisations – objectives – need – capital receipts and capital expenditure - revenue receipts and revenue expenditure – treatment of special items – Problems on preparation of Income and Expenditure account and Balance sheet from Receipts and Payments account.

SKILL DEVELOPMENT

1. Preparation of account sales with imaginary figures.
2. Calculation of fire insurance claims with imaginary figures.
3. Collection of final accounts of a Non-Profit Organisation and identifying Capital and revenue items
4. Visit any branch and collect the financial statements of the branch.
5. Preparation of Departmental Trading and Profit/Loss account with imaginary figures.

Books for Reference:

1. Accounting Principles; Anthony, R.N. and Reece, J.S.: Richard Irwin Inc.
2. Financial Accounting; Gupta, R.L and Radhaswamy, M: Sultan Chand and Sons.
3. Financial Accounting; Prof B.H Suresh and Dr. G.H Mahadevaswamy
4. Compendium of Statement and Standards of Accounting: The Institute of Chartered Accountants of India, New Delhi.

5. Financial Accounts, Mishra A.K.: Sahitya Bhawan Publishers and Distributors.
6. Financial Accounting – II: S.Anil kumar, V. Rajesh kumar and B.Mariappa, HPH

II Semester **Discipline Specific Course (**

DSC)Company Law

LTP: 4+0+0 4 Hours per week

OBJECTIVE:

- To enable the students to understand the types of companies incorporated in India and the promoters involved in forming a company and Company administration till its Liquidation.

OUTCOMES:

- The students will understand the frame work of Companies Act of 2013.
- Identify the stages of formation and documents involved in the formation of a company.
- Role of Managerial Personnel and procedure of conducting company meetings.

UNIT – I Introduction to Company: Meaning and Definition – Features of Companies Act of 2013 – Types of Companies –Private Company - Public Company - Company Limited by Shares – Company Limited by Guarantee – Unlimited Companies – One Person Company – Holding and Subsidiary Companies – Government Company - Associate Company.

UNIT – II Formation of Companies: Introduction – Steps involved in formation of a company – Position and Functions of Promoters – Meaning and contents of Prospectus, Memorandum of Association and Articles of Association – Alteration of MOA and AOA - Certificate of Commencement of Business – Formation of Global Companies – Features – Legal formalities.

UNIT – III Company Administration: Managerial Personnel – Managing director appointment, powers, duties and responsibilities – Whole time Director – Independent Director – Auditor's appointment: Qualification, duties and responsibilities – Company Secretary: Qualifications, Appointment, Rights, Duties, Liabilities and Removal.

UNIT – IV Company Meetings: Meaning – Types of company meetings – Importance — Requisites of a valid meeting – Notice – Quorum – Resolutions – Voting - Proxy – Role of a Company Secretary in convening the meetings.

UNIT – V Liquidation of Companies: Meaning – Modes of Liquidation – Consequence of Liquidation – Appointment of Official Liquidator – Duties and Responsibilities of Liquidator.

SKILL DEVELOPMENT

1. Collect the Prospectus, Memorandum of Association and Articles of Association of a Company.
2. Collect a notice of a meeting from any company.
3. List the names of Directors and Managing Director of any five companies.
4. List the names of full time company secretaries in India.
5. Name any five companies liquidated during last 2 years in India.

Books for Reference:

1. Company Law and Secretarial Practice by N.D. Kapoor, Sultan Chand and Sons
2. Company Law and Secretarial Practice by S.C. Kuchal
3. Elements of Corporate Law by S.N.Maheshwari, Himalaya Publication House
4. Corporate Administration by K.Venkataramana, SHBP
5. Business Law for Management by Balachandran, Himalaya Publishing House.

II Semester **Discipline Specific Course (DSC)Law and Practice of Banking**

LTP: 4+0+0 4 Hours per week

OBJECTIVE: To enable students to acquire specialized knowledge of law and practice relating to Banking.

OUTCOME: Students will understand the conceptual frame work of Banking, classification of Banking, banker and customer relationship and E-Banking services.

UNIT – I Introduction to Banking: Origin and Evolution of banks - Meaning and definition of banking - Classification of Banks – Commercial Bank, Investment/Industrial Bank- Co-operative Bank - Land Development Bank -Exchange Bank - Central Bank -Saving Bank. Banking system – Branch Banking, Unit Banking, Group Banking, Chain Banking, Mixed Banking, Narrow Banking, Universal Banking and offshore Banking

UNIT – II Reserve Bank of India: – Constitution – Nationalisation – Management of RBI – organisation restructuring – Main functions of RBI – Measures of Credit control. RBI and Agricultural credit – RBI and Industrial Finance. Demonetisation and its impact.

UNIT – III Banking Regulation Act, 1949: Origin of the Act - objectives and features. Banking sector reforms - Narasimhan Committee Report I and II – Prudential norms: Capital Adequacy norms. NPA: – Meaning - factors contributing to NPAs- remedies available- recent measures.

UNIT – IV Banker and Customer: – Banker - Customer – the relationship between a banker and a customer: general relationship and special relationship. Cheque: – statutory obligation to honour cheques- bankers lien- A bankers duty to maintain secrecy of customer's account-right to claim incidental charges- right to charge compound interest.

UNIT – V E –Banking: Meaning - traditional banking v/s E- banking- Electronic delivery channels- facets of E –banking- E-banking transactions – Truncated cheque and Electronic Cheque – Mobile Banking – Inter Bank Mobile Payment Service (IMPS) – Virtual Currency – Models for E-banking – Advantages of E-Banking – Constraints in E-Banking – Security Measures – Real Time Gross Settlement (RTGS) – National Electronic Fund Transfer (NEFT).

SKILL DEVELOPMENT

1. Identify the Commercial Banks in your area
2. List out the Investment Banks in your District
3. Visit a Bank and list out the steps followed to avail E-Banking facility
4. Visit a Bank and prepare a report with respect to NPA
5. Identify the beneficiaries of MUDRA Scheme in your locality

Books for Reference:

1. Banking Theory, Law and Practice **-** E.Gordan and K.Natarajan
2. Money, Banking, International Trade and Public Finance – M L Jhingan
3. Indian Financial System - Vasanth Desai
4. Marketing of Financial Services - V.A. Avadhani

5. Indian Financial System - Varshenoy and Mittal
6. The Law and Practice of Banking – J M Holden

II SEMESTER Open Elective Course (OEC)

2.6 1. Financial Literacy(Across the Faculty)

L+T+P: 3+0+0 3 Hours per week

OBJECTIVE:

- To create awareness in student about the need for possessing financial literacy education.

OUTCOMES:

- The students will be able to understand the importance of financial literacy and prepare financial plans and budgets.
- The student will be able to describe the importance of insurance services as social security measures.

UNIT – I Introduction: Financial Literacy- Meaning and Importance - Components of Financial Literacy- Financial Institutions : Meaning, Banking and Non Banking Financial Institutions, Post offices . Investment: Meaning, Difference between Investment Vs Gambling- Risk and Return **-** Principles of investment - Investment Avenues –Financial Planning and Budgets , Family Budget, Business Budget and National Budget. Budget deficit and Surplus.

UNIT – II Banking: Meaning and Types of Banks, Various services offered by banks, types of bank deposit accounts, Formalities to open various types of bank accounts, KYC norms. Various types of Loans: Short-term, Medium term and Long term loans. Cashless banking, e-banking, ATM, Debit and Credit cards, banking Complaints.

UNIT – III Financial Services from Post Office: Post office Savings Schemes: Savings account - Recurring deposit -Term Deposit - Monthly Income Scheme - Kissan Vikas Pathra – NSC – PPF - Senior Citizen Savings Scheme - Sukanya Samriddhi Yojana/Account - Indian Post Payments Bank - Money Transfer - Money Order.

UNIT – IV Insurance Services: Life Insurance – Life Insurance Policies - Term Insurance and Endowment Policies - Pension Policies - Health Insurance Plans – ULIP - Property Insurance - General Insurance - Types, Postal Life Insurance Schemes- Housing Loans - Institutions providing Housing Loans, Pradhanmantri Awas Yojana: Rural and Urban.

SKILL DEVELOPMENT

1. Visit a nationalized bank near your area and collect information regarding services offered by the bank.
2. Visit a post office in your area and collect information about various deposit schemes available.
3. Collect an account opening form from a nationalized bank and fill up the form with necessary enclosures. Collect an account opening form from a post office and fill the form.
4. Prepare an annualfamily budget considering the income of your family. Also prepare a personal budget for six months.
5. Visit a LIC branch in your area and collect information regarding any five insurance policies (with its features)

Books for Reference:

1. Avadhani, V A (2019), Investment Management , Mumbai: Himalaya Publishing House Pvt Ltd
2. Chandra, P (2012), Investment Game: How to Win . New Delhi: Tata McGraw Hill Education.
3. Kothari , R (2010), financial Services in India: Concept and application. New Delhi: Sage Publication India Pvt td
4. Milling B. E, (2003), The Basics of Finance: Financial Tools for Non Financial Managers, Indiana : Universe Company.
5. Zokaityte , A (2017), Financial Literacy Education. London: Palgrave Macmillan.

II SEMESTER Open Elective Course (OEC)

2.6 2. Retail Management(Across the Faculty)

L+T+P: 3+0+0 3 Hours per week

OBJECTIVE:

- To enable students to understand how the retail business functions and highlight the scope of retail business in India and across the world

OUTCOME:

- Students will be able to acquire skills required for managing retail business and start their own retail business in the future

UNIT I Retailing: Meaning –Definition - Nature - Importance - Functions of Retailing - Factors influencing retailing - Types of Retailing – Forms of Retail Business ownership, Theory of Retail Development - Wheel of Retailing - Retail Life Cycle - Retail Business in India - Globalization of Retailing - Reasons for globalization - Problems in Globalisation of Retailing .

UNIT II Retail Organisation and Management: Introduction - Classification of Retail Organization. Store Operations: Retail Store Planning - Factors influencing location of a store - Store Layout – Merchandise Management - Category Management - Shelf Management - POS (Point of Sale) /Cash Process.

UNIT III Human Resource Management in Retailing: Manpower Planning – Recruitment in Retail sector - Problems in Retail Recruitment - Retail Training - Retail Managers : Roles – Skill - Employment Opportunities in Retail Industry.

UNIT IV E-Retailing: Meaning of E Retailing - Types of Technology in Retailing - Factors Influencing use of IT in Retailing - Electronic Article Surveillance – Electronic Shelf Labels - Effective Management of Online catalogues - Customer Relationship Management: Customer data base - Identifying information - Analysing customer data base and identifying target customers - Customer pyramid - Customer retention.

SKILL DEVELOPMENT

1. Visit a modern retail store in your area and identify its organization structure
2. Visit a mall and identify the various types of shops in the mall
3. Name any ten e-retailers in the world
4. Visit a super market in your area and collect information about the roles andresponsibilitiesof the manager
5. Name any Ten Global retailers.

Books for Reference:

1. Suja R Nair , Retail Management, V Edition, HPH, Mumbai, 2006
2. Swapna Pradhan , Retailing Management -Text and Cases, II Edition, Tata Mc GrawHill,India, 2007
3. S. K. Pradhan and Others, Retail Management , VPH.
4. Piyush Kumar Sinha and Dwarika Prasad Uniyal- Managing Retailing, OxfordUniversityPress, Delhi
5. R. S. Tiwari, Retail Management , Himalaya Publishing House.
6. Levy Michael,Weitz Barton - Retailing Management, V Edition, Tata McGraw Hill,NewYork, 2006
7. Lucas G.H., Bush Robert, Gresham Larry- Retailing, Houghton Mifflin Company,Boston,1994.

JSS COLLEGE OF ARTS COMMERCE & SCIENCE

(Autonomous)

Ooty Road, Mysuru – 25

DEPARTMENT OF COMMERCE AND MANAGEMENT

Syllabus

CHOICE BASED CREDIT SYSYTEM

B.COM Programme

(II & III Year)

2019-20 Scheme

ENC22001

SEMESTER III

DISCIPLINE SPECIFIC COURSE - 8

3.4 INCOME TAX-I

L:T:P-3:1:0

Course Outcome:

On successful completion of this course the students able:

CO1: Learn in depth Income Tax Act of 1961 and able to practice as Tax Consultant and Tax Practitioner

CO2: Understand in detail the provisions for computation of taxable salary

CO3: Learn the provisions of IT Act relation to income from house property and able compute income from house property

CO4: Learn in detail the provisions of depreciation under IT ACT

CO5: Identify in detail the different expenses allowable and inadmissible for computation of Business income

CO6: Compute Taxable income from business

Unit 1: Introduction

Brief History of Income Tax Act, Finance Act, Scheme of Income Tax, Basic Concepts- Income, Assessee, person, Assessment year, Previous Year, Gross Total Income, Total Income, Marginal rate of Tax—Agricultural Income-Residential Status of individual, Incidence of Tax (including problems)- Incomes which do not form part of Total Income U/S 10.

Unit 2: Heads of Income

Income from Salary -features of salary income-allowances, perquisites, provident fund, computation of Taxable salary income

Unit 3: Income from Salary: Retirement benefits

Gratuity, Commutation of Pension, Leave encashment - problems

Unit 4: **Income from House Property**

Basis of charge - deemed ownership - exemptions determination of annual value- Deductions u/s 24-computation of income from house property.

Unit 5: - **a) Depreciation**- Meaning, computation of Deprecation

b) Profits and gains of Business and profession (Individual Assessees)- Expenses expressly allowable and inadmissible, General Deductions/ expenditures u/s 37, losses, deemed profits, Method of accounting-computation of taxable income from business. Computation of Income from profession in Case of Advocates, Doctors, Chartered Accountant.

References:

1.Direct Taxation-T.N.Manoharan
2.Direct Taxation- Girish Ahuja, & Ravi Gupta
3.Direct Taxation- Dr. Vinod.k.singania
4.Income Tax law and practice-Gaur & Narang
5.Income Tax Law- Dinakar Pagare
6.Income Tax Law & Accounts-Bhagavati Prasad
7.Income Tax Law and Accounts – H.C. Mehrothra

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SEMESTER III

DISCIPLINE SPECIFIC COURSE - 9

3.5 CORPORATE GOVERNANCE

L:T:P-3:1:0

Course Outcome:

On successful completion of this course the students can:

CO1: Deliberate in depth to uphold ethics and morality in business

CO2: Learn the details of practicing good corporate governance

CO3: Learn the characteristics of theories of corporate governance

CO4: Understand the details of Corporate Governance in India

CO5: Learn in depth the 4ps of corporate governance

Unit 1: Introduction to corporate governance

Meaning, Definition, need and importance. Benefits of corporate governance. Cadbury Committee Report in UK.

Unit 2: Business Ethics

Concept, importance & benefits – corporate philosophy & ethics – Managing ethics & legal compliance.

Unit 3: Theories of Corporate Governance

Agency theory, Stewardship theory & Stakeholders theory.

Unit 4: Mechanism & Control

4 ps of corporate governance (people, purpose, process & performance) – wealth creation, management & distribution – disclosure in office documents – A brief note on clause 49 of listing agreements of company with stock exchanges. Compliance aspect of corporate governance.

Unit 5: Corporate Governance in India

Reforming constitution of Board of Directors – A brief study of Kumara Birla Mangalam Committee – Naresh Chandra Committee – Narayanmurthy Committee – Corporate Governance code- Board subcommittee for compliance with Corporate Governance regulation.

References:

1. Corporate Governance – Subhash Chandra Das
2. Corporate Governance – Kesho Prasad
3. Corporate Governance – Ashwathappa

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SEMESTER IV

DISCIPLINE SPECIFIC COURSE - 10

4.3 CORPORATE ACCOUNTING- II

L:T:P-5:1:0

Course Outcome:

On successful completion of this course the students can:
CO1: Learn in depth the latest regulation of Insurance for the preparation of final accounts
CO2: Understand the characteristics of Human Resource Accounting
CO3: Identify the characteristics of intermediate in stock exchange and start career as stock Broker
CO4: Prepare final accounts of life insurance as per latest regulations
CO5: Understand the details of Inflation accounting
CO6: Learn in depth about Holding and Subsidiary company and play a vital role in preparation of consolidated Balance Sheet
CO7: Learn the details of Electricity Supply Act 2003 and able to prepare final accounts of electricity companies

Unit 1: Accounting for General Insurance Companies
Fire and marine insurance, preparation of final accounts as per latest regulations

Unit 2: Accounting for Life Insurance
Preparation of valuation balance sheet, preparation of final accounts as per latest regulations.

Unit 3: Final accounts of Electricity Companies
Forms of financial statements, differences between depreciation as per companies act and as per tariff policy under Electricity supply act 2003

Unit 4: Holding Company Accounts
Accounting for Holding Company: Preparation of Consolidated Balance Sheet, Minority interest, Computation of Goodwill/ Capital Reserve, Revaluation of assets of subsidiary Company.

Unit 5: Human Resource Accounting
Accounting Aspects of Human Capital –Meaning, Basic Premises, Need and Significance of HRA, Advantages and Limitation of HRA; Monetary and Non-Monetary Models; Cost Based Models- Acquisition Cost Method, Replacement Cost Model, Opportunity Cost Method, standard cost method, Current Purchasing Power Method (C.P.P.M.).

Unit 6: Inflation accounting and income measurement

Inflation Accounting: Concept – Limitations of historical based-cost financial statements – Methods of Inflation Accounting: Current Purchasing Power Method – Current Cost Accounting Method (Including problems). Income Concepts for financial reporting – Measurement and Reporting of Revenues, Expenses, Gains and Losses (Theory only) – Analysis of Changes in Gross Profit (Including problems).

References:

1. Accounting Principles; Anthony, R.N. and Reece, J.S.: Richard Irwin Inc.
2. Advanced Accounting ; Gupta, R.L and Radhaswamy, M: Sultan Chand and Sons, New Delhi.
3. Advanced Accounts; Shukla. M.C., Grewal T.S., and Gupta,S.C.: S. Chand & Co. New Delhi.
4. Higher Sciences of Accountancy : Agarwala A.N. Agarwala, K.N.:Kitab Mahal, Allahabad.
5. Financial Accounts, MishraA.K :Sahitya Bhawan Publishers and Distributers
6. Chakraborty, S.K., Human Asset Accounting: The Indian Context in Topics in Accounting and Finance, Oxford University Press.

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SEMESTER IV

DISCIPLINE SPECIFIC COURSE - 11

4.4 INCOME TAX-II

L:T:P-3:1:0

Course Outcome:

On successful completion of this course the students can:

CO1: Understand in detail the provisions for computation of capital gain and income from other sources

CO2: Learn in depth the provisions of IT Act for the Assessment of firm and company

CO3: Learn the details of set off and carry forward of losses

CO4: Identify in detail different sections of IT Act to reduce tax liability

CO5: Deliberate in details with examples and appear before IT tribunal on behalf of his clients

CO6: Understand in details with examples IT Authorities and able to work in different position of CBDT

CO7: Learn to compute the taxable capital gain and income from other sources

Unit 1: Capital Gain

Capital Asset, Transfer, cost of acquisition, cost of improvement, indexation, types of Capital gain- exemptions for individual assessee u/s 54-54GB-problmes

Unit 2: Income from other sources

Income from other sources. Set off and carry forward of losses (theory only)

Unit 3: Assessment of Individual

Application of Deductions u/s 80C-80U, Section 87A computation of Tax liability. (Available software package for computation of tax liability, computation using Excel-Work sheet)

Unit 4: Assessment of Partnership Firm

Definition of Firm, Partner U/S 2(23) Residential Status -conditions u/s 184, Provisions u/s 40(b)-Deductions from 80G80JJA- Alternate Minimum Tax(AMT)-Computation of tax liability of Firms (Use of available software package for computation of tax liability, Related Forms and Challans-Computation using excel work- sheet)

Unit 5: Assessment of Company

Definition of Company, Closely-held company, Widely-held Company, Indian Company, Foreign Company-Residential Status of company-Applicable Deductions u/s 80G -80JJA-

Computation of Tax Liability (Including Minimum Alternate Tax) (Use of Software package- Quick Books/ Electrocom)

References:

1.Direct Taxation-T.N.Manoharan
2.Direct Taxation- Girish Ahuja, & Ravi Gupta
3.Direct Taxation- Dr. Vinod.k.singania
4.Income Tax law and practice-Gaur & Narang
5.Income Tax Law- Dinakar Pagare
6.Income Tax Law & Accounts-Bhagavati Prasad
7.Income Tax Law and Accounts – H.C. Mehrothra

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SEMESTER IV

DISCIPLINE SPECIFIC COURSE - 12

4.5 QUANTITATIVE TECHNIQUES

L:T:P-3:1:0

Course Outcome:

On successful completion of this course the students can:
CO1: Understand in depth the classification and operation of matrices and determinants
CO2: Learn the details of progression and their application to business
CO3: Understand in detail the concept of Ratio, proportion and variation
CO4: Learn in depth the Laws of indices and logarithms and its application to solve business problem
CO5: Understand the details of simple interest and compound interest
CO6: Find the value of present worth, bankers gain, banker's and true discount

Unit 1: Indices and logarithms
Meaning-Basic laws of Indices and their application for simplification, laws of logarithms-common logarithms, application of log table for simplification.

Unit 2: Progression
Meaning of sequence, progression; types of progressions; arithmetic progression and geometric progression-general terms and sum of 'n' term of Arithmetic progression and Geometric progression-Application problems on Arithmetic progression and geometric progression.

Unit 3: Ratio, proportion, variation, and percentages
Meaning and their application to business

Unit 4: Simple interest and compound interest-Bills discounting-
Meaning-concepts; Bankers discount, true discount, bankers' gain and present worth of bill.

Unit 5: Matrices and determinants
Meaning and types of matrices, matrix operation - addition, subtraction and multiplication Determinants of a matrix and its evaluation; solutions of linear equations by using cramer's rule.

References:

1. Dr. B H Suresh and Mahadevaswamy G H, Quantitative Techniques,Nithya Publications, Mysore.
2. P.R. Vittal, Business Mathematics, Revised Edition,Margham Publications, New Delhi, 2001.
3. V.K.Kapoor, Introductory to Business Mathematics, S.CHAND, New Delhi, 2009.
4. Sancheti and Kapoor, Business Mathematics, Sultan chand and Sons, New Delhi-42.
5. G.K.Ranganath and T.V. Narsimha Rao Basic Mathematics- Volume II.

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SEMESTER V

DISCIPLINE SPECIFIC COURSE - 13

5.1 ENTREPRENEURSHIP DEVELOPMENT

L: T: P-3:1:0

Course Outcome:

On successful completion of this course the students can:

CO1: Understand in depth the required characteristics and procedure to become an young entrepreneur

CO2: Specify in details with application, if applicable, easily access different financial scheme to small business

CO3: Identify in detail with examples to easily different financial schemes offered by Banks and Government Agencies

CO4: Understand in depth and identify the social responsibility of an entrepreneur towards different sectors

CO5: Learn in depth the Self employment opportunities

CO6: Learn in detail the ethics in business

CO7: Identify the content of project report

CO8: Understand in depth the procedure of setting up of new business

Unit 1: Introduction

Meaning, definition of Entrepreneur, Enterprise, Entrepreneurship, Characteristics of successful entrepreneur, Functions, Role of entrepreneur in economic development, women entrepreneur, Rural entrepreneur, Agricultural entrepreneur-meaning and challenges.

Unit 2: Entrepreneurship Development Program (EDP)

Meaning, objective, importance, institutions doing EDP in India, DIC, CEDOCK, SSI, NSIC, EDII, AWAKE, KVIC,RUDSET, Industrial estate-Meaning and importance.

Unit 3: Financing of Small Business in India

Institutional and non institutional assistance SFCs, banks, SIDBI, NBFC-meaning and schemes; venture capital, bills discounting, factoring, state and central government subsidies and incentives for SSI (existing) - recent industrial policy(2011), PM MUDRA YOJANA- meaning, objectives, procedures for obtaining loan under MUDRA.

Unit 4: Setting up of new business, forms for small business

Small proprietorship, partnership, private company, cooperative society-meaning and nature, project formulation, project report-meaning, importance, general format of project

report, project appraisal, financial, technical, marketing, social feasibility study, obtaining license, clearance certificate, registration procedure.

Unit 5: Business Ethics

Meaning, ethics in business, importance, various social responsibility of an entrepreneur towards customers, suppliers, government and society, self- employment-recent trends in the areas of self employment-event management-meaning and areas of business in event management (party organizing , catering, wedding plan and corporate event plan) tourism-meaning, tourism products, E-marketing as self employment opportunity.

Reference:

1.Entrepreneurship And Small Business Management- C B Guptha And S S Khanka
2.Entrepreneruship Development – C B Guptha And Srinivasan 3.Entreprenership development development –Shankaraiah
4.Entrepreneurship development-S S Khanka

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SEMESTER V

DISCIPLINE SPECIFIC COURSE -14

5.2 IFRS (IND - AS)

L:T:P-3:1:0

Course Outcome:

On successful completion of this course the students can:

CO1: Deliberate the characteristics of IFRS
CO2: Understand in depth frame work for the preparation and presentation of financial statement
CO3: Learn in details with examples Accounting for assets and liabilities
CO4: Learn in details with examples IND AS on business combination
CO5: Understand the details of IND AS in relation to accounting for Revenue and Expenses

Unit 1: IFRS

Meaning, Need for IFRS, IASB, IASB Current Structure, IFRS Due Process, Benefits and limitations of IFRS; Introduction to Indian Accounting Standards (IND-ASs - Converged IFRSs), Accounting Regulations in New Companies Act – 2013, IFRSs issued by IASB (1-17),List of IND-ASs.

Unit 2: Framework for the Preparation and Presentation of Financial Statements

Meaning of Framework, Purpose and status - Scope - Application - Uses and their information and needs – objectives - Underlying assumptions – Qualitative characteristics – Elements of Financial statements – Recognition and Measurement of the elements of financial statement Balance sheet, Statement of changes in Equity, Statement of Profit and Loss consolidated financial statements, other comprehensive income as per schedule III of the Companies Act, 2013 – **Simple problems on each statement**.

Unit 3: Accounting for Assets and Liabilities

Recognition and Measurement criteria for Investment Property (IND-AS 40) – Borrowing Cost (IND-AS 23) –– Provisions, Contingent Assets and Contingent Liabilities (IND-AS 37) - Share-based Payment (IND-AS 102) - . Recognition and Measurement for Property, Plant and Equipment (IND-AS 16) – Intangible Assets (IND-AS 38) - Inventories (IND-AS 2) - Leases (IND-AS 17) – Impairment of Assets (IND-AS 36) - **Theory and Simple Problems only**

Unit 4: Accounting for Revenue and Expenses

Income Taxes (IND-AS 12) – Employee Benefits (IND-AS 19) -Construction contracts (IND-AS 11) - Revenue (IND-AS 18) - Revenue from Contracts with Customers (IND-AS 115).

Unit 5: IND-AS on Business Combination

IND-AS on Business Combination, Consolidation and Disclosure-Consolidated Financial Statements (IND-AS 110) – Joint Arrangements (IND-AS 111) – Business Combinations (IND-AS 103) - Related Party Disclosures (IND-AS 24) – Operating Segments (IND-AS 108) – First-time adoption of International Financial Reporting Standards (IND-AS101)– Financial Instruments: Disclosures (IND-AS 107) – Disclosure of interests in Other Entities (IND-AS 112) –Earning Per Share (IND-AS 33) – Interim Financial Reporting (IND-AS34)– Insurance Contracts (IND-AS 104)– **Theory and Simple Problems only**.

References:

1. A Quick Guide to Indian Accounting Standards (Ind-AS) by Chethan N. Patel and BhupendraMantri, Taxmann Publication (P.) Ltd.
2. Students' Guide to Ind ASs – Converged IFRSs by Dr. D.S. Rawat, Taxmann Publication (P.) Ltd.
3. IFRS for India, Dr.A.L. Saini, Snow white publications
4. Roadmap to IFRS and Indian Accounting Standards by CA ShibaramaTripathy
5. IFRS concepts and applications by Kamal Garg, Bharath law house private limited
6. IFRS: A quick reference guide by Robert J Kirk, Elsevier Ltd.

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SEMESTER VI

DISCIPLINE SPECIFIC COURSE - 15

6.1 PRINCIPLES AND PRACTICE OF AUDITING

L:T:P-3:1:0

Course Outcome:

On successful completion of this course the students can:

CO1: Learn in depth to practice as an Auditor

CO2: Learn the characteristics of errors and frauds and minimize them in maintenance of books of accounts

CO3: Identify in detail the importance of Internal Control and Internal Check

CO4: Identify the details of audit planning

CO5: Learn in depth verification and valuation of Assets and Liabilities

CO6: Deliberate in details with examples audit of different types of organizations

Unit 1: Introduction

Meaning and definition of auditing- Nature and importance of auditing objectives of auditing-advantages, different types of audit, qualities of an auditor- audit report-auditing in a computerized environment.

Unit 2: Audit planning and control

Factors affecting audit planning - audit programme advantages-audit note book-appointment of a company auditor- qualifications, disqualifications-rights and duties of a company auditor.

Unit 3: Internal check and internal control

Meaning and objective-internal check for various transactions-limitations of internal control. Vouching-meaning and importance – vouching of cash transactions.

Unit 4: verification and valuation of assets and liabilities

Meaning- problems in valuation of assets, verification and valuation of assets and liabilities- goodwill, Stock in trade, Investments, Patents, Copy rights and trademarks, plant and machinery- capital, creditors, debentures, outstanding expenses, contingent liabilities.

Unit 5: Audit of different types of organizations

Audit of sole trader, audit of partnership firms, audit of hotels, audit of educational institutions, audit of trust, audit of co-operative societies.

References:

1. Auditing T R Sharma
2. Practical auditing B N Tandon
3. Practical auditing- Spicer and Spegler
4. Auditing Jagadeesh prakash

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SEMESTER VI

DISCIPLINE SPECIFIC COURSE -16

6.2: BUSINESS LAWS

L:T:P-3:1:0

Course Outcome:

On successful completion of this course the students can:

CO1: Understand in details various laws related to business and able to work as legal adviser of business enterprises

CO2: Understand the characteristics of legal environment and practice business ethics

CO3: Learn in depth and apply the basic legal knowledge to business enterprises

CO4: Understand the characteristics of different intellectual properties and protect them

CO5: Identify and appointed as member of various commerce and legal boards / committee

CO6: Specify the details of Information technologies Act

CO7: Learn the provisions of Special Contract

Unit 1: Introduction

Concept of law, Sources Of Law- Mercantile Law; Agreement, Contract-Definition, Essentials Of a Contract, Legal Rules As To Valid Offer And Acceptance; Termination Of An Offer.

Unit 2: Contractual Capacity

Minor's Agreement, Consideration-Definition, Essentials and Exceptions. Free Consent-Coercion, Undue Influence, Fraud, Misrepresentation, Mistake, Definition and Features only.

Unit 3: Special Contract

Contingent contract, quasi contracts, Wagering Agreement, Discharge of a Contract, Remedies for Breach of Contract.

Unit 4: Intellectual Property Act

Definition and Registration Procedure for Patent, Copy Right, Trademarks.

Unit 5: Information Technology Act 2000

Definition of Information-Digital Signature, Legal Recognition of Electronic Records, License to issue Digital Signature Certificate And Acceptance Of Digital Signature.

References:

1. Mercantile Law - N.D.Kapoor P C Tulsian and Bharat
2. Business Law - Tulsian
3. Mercantile Law - P P S Gogna .

ENC24001 / END24001

GROUP A1

SKILL ENHANCEMENT COURSE-1

COMPUTERIZED ACCOUNTING SYSTEM

L: T: P- 2:0:2

Course Outcome:

On successful completion of this course the students can:
CO1: Learn in depth the characteristics of computerized accounting system
CO2: Identify the reason for differences between cash book and bank statement
CO3: Learn in details with examples computerised accounting software
CO4: Specify in details with examples periodic reports
CO5: Learn the classification and characteristics of data entry system
CO6: Prepare the quotation, purchase order etc., using computer software

Unit 1: a) – Computerised Accounting System
Meaning of computerised Accounting Traditional / Manual System of Accounting; process of Computerised Accounting; features of Computerised Accounting; difference between manual accounting system and computerised accounting. Process/Steps in Computerised Financial Accounting; Advantages of the Computerised Financial Accounting System; Various Components of a Computerised Financial Accounting System
b) - Voucher Types of Voucher; Bank Payment Voucher; Bank Receipt Voucher; Cash Payment Voucher ; Cash Receipt Voucher ; General Voucher.

Unit 2: - Bank Reconciliation Statement
Common transactions with bank; Cashbook and bank statement ; Reasons for difference between cash book and bank statement ; Bank reconciliation statement

Unit 3: Computerized Accounting
Scope of Computerized Accounting; Computerized Accounting Software; Creating a Corporation in Computerized Accounting Software. Chart of Accounts ; Creating Chart of Accounts ; Update Chart of accounts ; Charts of accounts Beginning Balances ; Organizational codes ; Editing charts of accounts;

Unit 4: Periodic Reports
General Journal ; Ledger; Trial Balance ; Income Statement ; Balance Sheet Inventory report; Account Receivable report; Account Payable report

Unit 5: Data Entry System

Voucher and Entry of vouchers ; Sales Entries ; Purchase Entries; Cash Receipt Entries ; Cash Payment Entries ; Bank transaction Entries Maintain the Records of Sales &

Customers ; Quotations to customers ; Sales orders ; Sales Invoices ; Sales receipts ; Record of Customers ; Sales report ; Customer Report.

Unit 6: Maintain the Records of Purchases and Vendors/ Suppliers

Preparing the Quotations; Purchase orders; Payment to vendors; Record of vendors; Utility Bills Payable; Purchase Report; Vendors Report.

References:

1.Computer Accounting (Accounting & Finance) Paperback – Michael Fardon
2.Computerized Accounting Spiral-bound – 2008- Arens and Ward (Author)
3.Computerized Accounting -Prof.C.M.Tembhurnekar, Dr.Alok Dwivedi
4.https://margcompusoft.com/Free_accounting_software.html

ENC25001 / END25001

GROUP A1

SKILL ENHANCEMENT COURSE-2

E-FILLING OF RETURNS

L:T:P-2:0:2

Course Outcome:

On successful completion of this course the students can:
CO1: Learn in depth the types of e-filing and e-verification of returns
CO2: Specify in details with examples E-filling of returns
CO3: Understand the details of steps involved in e- filling of different forms of IT Return
CO4: Learn the details of E-filling of returns under GST
CO5: Learn the details of returns to be filled by composition tax payer

Unit 1: **E-filing of Returns**
Meaning- objectives- advantages, features of E-filing; Types of e- filing, e-filing Process flow, Types of e-Verification of Returns, How to e-file, who should file e-return;

Unit 2: ITR-1 and ITR2- ITR-3- ITR-4 introduction
Format- Heads of income covered- contents- filling the return- steps involved in filing of ITR-1, ITR-2, ITR-3, ITR-4

Unit 3: ITR-5- ITR-6; ITR-7- introduction
Format- Heads of income covered- contents- filling the return- steps involved in filing of ITR-5, ITR-6, ITR 7.

Unit 4: E-filing of returns under GST
GSTR-1- GSTR-1A, GSTR-2, GSTR 2A; GSTR-3, GSTR 3A, GSTR-3B, GSTR 9, Assesses required to file, contents to be filled, Documents required, steps in filing the above returns;

Unit 5: **Returns to be filed by composition tax payers**
GSTR-4A, GSTR-4, GSTR-9; Returns to be submitted by an input service distributor-GSTR 6, GSTR-6A; Returns to be filed by Tax Deductor-GSTR-7, GSTR-7A;Contents- steps to be followed in filing the above returns

References:

1.https://incometaxindiaefiling.gov.in/eFiling/Portal

2.https://www.bankbazaar.com/tax/step-by-step-guide-efile-income-tax-return-online.html

3.https://www.icicibank.com/knowledge-base/tax/steps-for-e-filing

4.https://taxguru.in/income-tax/download-free-ebook-the-process-efiling-income-tax-returns.html

5.Students Guide To e-Returns- vinod K singhania- taxmann

6.https://www.profitbooks.net/gst-returns/

ENC26001 / END26001

GROUP A1

SKILL ENHANCEMENT COURSE -3

PRINCIPLES AND PRACTICE OF GENERAL INSURANCE

L: T: P-3:1:0

Course Outcome:

On successful completion of this course the students can:

CO1: Identify the classification and characteristics of General insurance

CO2: Learn the details of fire insurance policies, insurance coverage and consequential loss

CO3: Deliberate in details with examples underwriting and settlement of claims

CO4: Understand in depth the details of claim procedure and Settlement limitation

CO5: Learn in detail with examples non life miscellaneous insurance

Unit 1: **Introduction**

Meaning of General Insurance – The Evolution and Growth of General Insurance – Types of General Insurance – Fundamentals of General Insurance –Recent innovations. Organization and Management of General Insurance Companies – Regulatory Framework for General Insurance in India.

Unit 2: **Fire Insurance**

Standard policies – Fire Insurance coverage – Consequential loss (fire) Insurance policies – Declaration policies, Marine Insurance: Marine Cargo policies – Hull policies – Institute cargo clauses – Institute hull clauses – Open policies – Accumulation of risk per location - Motor Insurance: Types of policies – Third party Insurance – Comprehensive coverage – Conditions and Exclusions – premium.

Unit 3: **Non life miscellaneous insurances**

Personal Accident Insurance, Health Insurance and Mediclaim policies, Liability Insurance, Burglary Insurance other Miscellaneous Insurances, Rural Insurance covers, Engineering Insurance and its Consequential loss covers, Aviation hull and Aviation liability.

Unit 4: **Underwriting and Settlement of Claims**

Proposal forms, Cover notes, Certificates of Insurance, Endorsements, Moral and Physical Hazards, Statistics Spreading of Risks, Premium Rating, Premium Loading.

Unit 5: **Settlement of Claims**

Claim procedure, TPAs: Claim forms, Investigation / Assessment, Essential Claim Documents, Settlement Limitation, Arbitration, Loss Minimization and Salvage.

References:

1. Insurance Institute of India – IC 34 – General Insurance
2. Insurance Institute of India – IC 45- General Insurance Underwriting
3. Module I, Principles and Practice of General Insurance, The Institute of Chartered Accountants of India: New Delhi.
4. H Narayanan, Indian Insurance: A Profile, Jaico Publishing House: Mumbai.
5. K.C. Mishra and G.E. Thomas, General Insurance - Principles and Practice, Cengage Learning: New Delhi

ENC27001 / END27001

GROUP A1

SKILL ENHANCEMENT COURSE - 4

LOGISTICS AND SUPPLY CHAIN MANAGEMENT

L: T: P-3:1:0

Course Outcome:

On successful completion of this course the students can:

CO1: Understand in depth supply chain management

CO2: Write down the details of designing the supply chain network

CO3: Learn in details with examples designing and planning transportation network

CO4: Learn the details of Information technology in supply chain

CO5: Identify the dimensions of logistics

CO6: Understand in depth the details of demand management and customer care

Unit 1: **Introduction to Supply Chain Management**

Supply chain – objectives, importance, decision phases, process view, competitive and supply chain strategies, achieving strategic fit, supply chain drivers, obstacles, framework, facilities, inventory, transportation, information, sourcing, pricing.

Unit 2: **Designing the Supply Chain Network**

Designing the distribution network, role of distribution, factors influencing distribution, design options – e-business and its impact, distribution networks in practice, network design in the supply chain, role of network, factors affecting the network design decisions, modelling for supply chain.

Unit 3: **Designing and Planning Transportation Networks**

Role of transportation, modes and their performance, transportation, infrastructure and policies, design options and their trade-offs, tailored transportation. SOURCING AND PRICING: Sourcing, In-house or Outsource – 3rd and 4th PLs – supplier scoring and assessment, selection, design collaboration, procurement process, sourcing planning and analysis. Pricing and revenue management for multiple customers, perishable products, seasonal demand, bulk and spot contracts.

Unit 4: **Information Technology in the Supply Chain - IT Framework**

Customer relationship management, internal supply chain management – supplier relationship management, transaction management, future of IT. Coordination in a supply chain: Lack of supply chain coordination and the Bullwhip effect, obstacle to coordination,

managerial levers, building partnerships and trust , continuous replenishment and vendor-managed inventories, collaborative planning, forecasting and replenishment.

Unit 5: **Dimensions of Logistics**

Introduction: A macro and micro dimension, logistics interfaces with other areas, approach to analysing logistics systems, logistics and systems analysis, techniques of logistics system analysis – factors affecting the cost and importance of logistics.

Unit 6: **Demand Management and Customer Service**

Outbound to customer logistics systems, Demand Management, Traditional Forecasting, CPFRP, customer service, expected cost of stock-outs, channels of distribution.

References:

1. Sunil Chopra and Peter Meindl, Supply Chain Management – Strategy, Planning and Operation, Pearson.
2. Coyle, Bardi, Longley, The management of Business Logistics – A supply Chain Perspective, Thomson Press.
3. Supply Chain Management by Janat Shah Pearson Publication.
4. Donald J Bowersox, Dand J Closs, M Bixby Coluper, Supply Chain Logistics Management, TMH, Second Edition.

ENE23001 / ENF23001

GROUP A2

SKILL ENHANCEMENT COURSE-5

CORPORATE TAX PLANNING

L: T: P-3:1:0

Course Outcome:

On successful completion of this course the students can:

CO1: Learn in depth and specify the tax saving strategies for decision making

CO2: Understand in depth the provisions and laws of tax and able to become tax consultant

CO3: Identify the tax provisions and deductions and able to become tax planner with reference to business restructuring

CO4: Write down the details and identify special provisions in respect of Free Trade Zone, Infrastructure Development and Backward areas

CO5: Learn in detail the provision of Income Tax Act relating to amalgamation

CO6: Understand the classification and characteristics of taxation relief

CO7: Deliberate the provisions of IT Act in relation to managerial decisions

Unit 1: Introduction:
Corporation tax, Tax Planning, Tax Evasion, Tax Avoidance, Tax Management, Dividend Tax, Domestic Company, Foreign Company.

Unit 2: a) **Tax Planning for new Business:** Location and Nature of Business, Forms of Business Organization

b)**Tax Planning and Financial Management Decisions**: Tax Planning relating to Capital Structure Decision, Dividend Policy, Inter-Corporate Dividends and Bonus Shares

Unit 3: **Tax Planning and Managerial Decisions**
Tax planning in respect of Own or Lease, sale of assets used for scientific research, make or buy decisions, repair, replace, renewal or renovation of an asset, shut-down or continue decisions.

Unit 4: Special Tax Provisions

Tax provisions in respect of Free Trade Zone, Tax provisions in respect of Infrastructure Development, Tax provisions in respect of Backward Areas, Tax provisions in respect of Tax Incentives to Exporters.

Unit 5: **Amalgamation**

Meaning of amalgamation under the Income-tax Act, Transactions not treated as amalgamation, Actual cost and written down value when assets are transferred in a scheme of amalgamation, When a capital asset (other than a block of assets) is transferred, When a block of asset is transferred, Assets in amalgamation not treated as transfer, Transfer of capital assets to amalgamated Indian company.

Unit 6: Tax Payment

Tax deduction at source, Tax collection at source, and Advance payment of tax, Relief for double taxation [Secs. 90, 90A and 91], ADT agreements [Sec. 90], Modes of granting relief under ADT agreements , Unilateral relief [Sec. 91], Double taxation relief in case of specified associations [Sec. 90A]

References:

1.Direct Tax Laws and Practices- Vibnod K. Singhania
2.Direct Taxes – H C Meharothra
3.Corporate tax planning & business tax procedures- Vinod K songhania

ENE24001 / ENF24001

GROUP A2

SKILL ENHANCEMENT COURSE-6

COMPANY LAW AND SECRETARIAL PRACTICE

L: T: P-3:1:0

Course Outcome:

On successful completion of this course the students can:

CO1: Understand in depth features of Companies Act -2013 and types of companies

CO2: Learn in details the promotion of a Joint Stock Company and conversion

CO3: Write down the details of conducting the Board of Directors and Subcommittee meetings

CO4: Understand the procedure for alteration of Articles of Association and Memorandum of Association

CO5: Learn in detail the appointment of company secretary

CO6: Learn the preparation of minutes of various meetings

Unit 1: **Companies Act**

Introduction- companies Act 2013- features of companies Act - 2013, Types of companies- Public companies, Pvt company, statutory corporation, One person company, Dormant company, Associate company, Small company, Limited Liability Partnership- Application of Company Law to banking/insurance sector- Registrar of companies- functions, Ministry of Corporate affairs-functions; SEBI-functions of SEBI.

Unit 2: **Secretary**

Definition, Who can be company secretary, Appointment, General Legal position, Duties of a Company Secretary, Rights of Company Secretary, Liabilities of Company Secretary, Qualification for Appointment as secretary, Dismissal of the Secretary, Secretary in the Whole time practice, Secretarial Compliance certificate, Specimen form

Unit 3: Company Formation and Conversion

Company Formation and Conversion Choice of the form of the business entity, Conversion/reconversion of one form of business entity into another, Procedure for incorporation of private/public companies, Companies limited by guarantee and unlimited companies and their conversion/re-conversion registration., Obtaining certificate of commencement of business, obtaining certificate of re-registration, Commencement of new business and certification,

Unit 4: **Procedure for alteration of various clauses of memorandum**

Procedures for alteration of articles, Effect of alteration, specimen forms: Procedure for issue of Shares – Public Issue, Rights Issue and Bonus Shares, Issue of Shares at Par/Premium/Discount; Issue of Shares on Preferential /Private Placement Basis – Allotment, Calls on Shares and Issue of Certificates – Issue of Sweat Equity Shares,

Employees Stock Option Scheme (ESOPs), Employees Stock Purchase Scheme (ESPS), Shares with Differential Voting Rights

Unit 5: Meetings

Collective Decision Making Forums, Authority, Accountability, Delegation and Responsibility ; Board Meetings , Convening and Management of Meetings of Board and Committees; Preparation of Notices and Agenda Papers, General Meetings, Convening and Management of Statutory Meeting, Annual and Extra-Ordinary General Meetings, Voting through Electronic Means; Conducting a Poll and Adjournment of a Meeting; Post-Meeting Formalities, Preparation of Minutes and Dissemination of Information and Decisions

References:

1. S. Srikanth , Shanti Rekha Rajagopal ,Revathy Blakrishnan, Corporate Laws and Secretarial Practice, Jain Book
2. M C Kuchhal, Secretarial Practice, Vikas Publishing House, New Delhi.
3. Sangeet Kedia, Advanced Company Law And Practice, Pooja Law Publishing Company,

ENE25001 / ENF25001

GROUP A2

SKILL ENHANCEMENT COURSE-7

QUANTITATIVE DECISION TOOLS

L: T: P-3:1:0

Course Outcome:

On successful completion of this course the students can:
CO1: Understand in depth the characteristics and features of statistics
CO2: Learn the details of methods and sources of collection of data
CO3: Understand in details with examples Measures of central tendency
CO4: Understand in detail the characteristics and application of correlation and regression
CO5: Understand in details the classification and application of correlation
CO6: Deliberate the characteristics of Index numbers
CO7: Learn the characteristics of Testing of hypothesis with application
CO8: Learn the creation of variables and entering data using SPSS

Unit 1: **Introduction**
Meaning and definition of statistics, functions, advantages, limitations- collection of data - methods of collecting primary data, and sources of secondary data - classification and tabulation-SPSS –Introduction, uses, creation of variables and entering data.

Unit 2: **Measure of central tendency**
Meaning and Definition of Averages-Arithmetic mean, Median, Mode [grouping method], standard deviation, Calculation of mean, median and Standard deviation using SPSS.

Unit 3: **Correlation**
Meaning and Definition, types of correlation, Methods of calculating correlation co-efficient [Karl pear sons and Spearman's correlation] calculation of correlation using SPSS; Regression-Meaning and Definition, Distinction between correlation and Regression, Regression equations and estimations Calculation of Regression using SPSS.

Unit 4: **Index Numbers**
Definition – Types – Methods of Construction and Problems in the Construction – Cost of living index numbers.

Note-Besides solving problems chapter-wise in class rooms, teach using SPSS in computer lab.

Unit 5: **Testing of Hypothesis**

Meaning of hypothesis, types of hypotheses, test of Significance Procedure of testing hypothesis – Z test, one sample t test, Chi square test.

References:

1. Fundamentals of Statistics: D. N. Elhance, Veena Elhance and B. M. Aggarwal
2.Statistical Methods: S. P Gupta.
3.Fundamentals of Statistics: S.C Gupta
4.Practical Statistics: R S N Pillai and Bhagavathi
5.Statistics (Theory, Methods and Application): D.C. Sancheti and V.K. Kapoor
6.Statistics for Management: Richard I. Levin and David S. Rubin
7. Statistics: Dr. B.H. Suresh, Dr. G.H. Mahadevaswamy, Nithya Publications, Mysore.

ENE26001 / ENF26001

GROUP A2

SKILL ENHANCEMENT COURSE-8

BUSINESS RESEARCH METHODS

L: T: P-3:1:0

Course Outcome:

On successful completion of this course the students can:

CO1: Learn in depth different methods of research, methodology, data collection, analysis and interpretation of data to become a good business researcher

CO2: Understand and able to report about various issues of different organisations through research report

CO3: Understand the details of types of Business Research and Research design

CO4: Identify and contribute to the discipline of commerce and management through the research

CO5: Deliberate the details of Data analysis

CO6: Identify the details of Research Report

CO7: Specify in details with examples sampling and hypothesis testing

Unit 1: **Introduction to Business Research**

Meaning, types, criteria of good research, scientific approach to research in physical and management science, limitations of applying scientific methods in business research problems, ethical issues in business research, research process, problem formulation, preparation of business research plan/proposal.

Unit 2: **Business Research Design**

Types of business research, Exploratory, Descriptive, and Causal research, Exploratory research: Meaning, suitability, collection, hypothesis, formulation, Descriptive research: Meaning, types of descriptive studies, data collection methods, Causal research: Meaning, various types of experimental designs, types of errors affecting research design.

Unit 3: **Data Collection**
Primary and Secondary data – Sources – advantages/disadvantages, Data collection Methods – Observations, Survey, Interview and Questionnaire design, Qualitative Techniques of data collection. Measurement and Scaling Techniques: Nominal Scale, Ordinal Scale, Interval Scale, Rating Scale, Criteria for good measurement, attitude measurement.

Unit 4: **Sampling and Hypothesis Testing**
Sampling: Meaning, Steps in Sampling process, Types of Sampling – Probability and non probability Sampling Techniques, Errors in sampling. Hypothesis: Meaning, Types, characteristics, sources, Formulation of Hypothesis, Errors in hypothesis testing.

Unit 5: **Data Analysis**
Editing, Coding, Classification, Tabulation, Univariate, Bivariate and multivariate Analysis, Interpretation.

Unit 6: **Research Report**
Types, advantages, disadvantages, Components of research reports, format, chapterisation, language, referencing.

References:

1. Marketing Research – Naresh K Malhotra – Pearson Education.
2. Business Research Methods- S.N.Murthy/U.Bhojanna- Excel Books.
3 .Business Research Methods–Donald R. Cooper & Pamela S Schindler,TMH.
4. Marketing research: Text and cases- Rajendra Nargundkar – TMH.
5. Business Research Methods – Alan Bryman & Emma Bell, Oxford.
6. Research Methodology – C R Kothari- Vishwa Prakashan.
7. Business Research Methods – William G Zikmund- Thomson,
8. Methodology of Research in Social Sciences – O R Krishnaswami, M Ranganatham, HPH.

ENE27001 / ENF27001

GROUP A2

SKILL ENHANCEMENT COURSE-9

PROJECT WORK

L:T:P- 1:0:3

C1 – Proposal of Project Work - 15 Marks
C2 – Progress of Project Work - 15 Marks
Viva - 20 Marks
Valuation of Report – 50 Marks

Course Outcome:

On successful completion of the project work the students are able to:
CO1: Understand in depth the gap between theory and practical through internship
CO2: Understand in detail with examples the procedure and able to write a report on the various issues of an organization
CO3: Convince and communicate effectively
CO4: Learn in detail and able to absorb as an employee by the employer
CO5: Specify and analyze the components of project report and prepare the report effectively
CO6: develop leadership qualities

ENE28001

GROUP B

SEMESTER V

DISCIPLINE SPECIFIC ELECTIVE

CONSUMER AFFAIRS

L: T: P-4:1:0

Course Outcome:

On successful completion of the project work the students are able to:
CO1: Learn conceptual frame work of consumer and consumer market
CO2: Understand in depth the characteristics of consumer protection law in India
CO3: Deliberate the details of role played by the advisory bodies at different level
CO4: Indentify the grievance redressal mechanism
CO5: Specify the details of role played by industry regulator in consumer protection
CO6: Understand in depth the consumer movement in India

Unit 1: Conceptual Framework
Consumer and Markets: Concept of Consumer, Nature of markets: Liberalization and Globalization of markets with special reference to Indian Consumer Markets, E-Commerce with reference to Indian Market, Concept of Price in Retail and Wholesale, Maximum Retail Price (MRP), Fair Price, GST, labelling and packaging along with relevant laws, Legal Metrology. Experiencing and Voicing Dissatisfaction: Consumer buying process, Consumer Satisfaction/dissatisfaction-Grievances-complaint, Consumer Complaining Behaviour: Alternatives available to Dissatisfied Consumers; Complaint Handling Process: ISO 10000 suite

Unit 2: The Consumer Protection Law in India
Objectives and Basic Concepts: Consumer rights and UN Guidelines on consumer protection, Consumer goods, defect in goods, spurious goods and services, service, deficiency in service, unfair trade practice, restrictive trade practice. Organizational set-up under the Consumer Protection Act

Unit 3: Advisory Bodies

Consumer Protection Councils at the Central, State and District Levels; Adjudicatory Bodies: District Forums, State Commissions, National Commission: Their Composition, Powers, and Jurisdiction (Pecuniary and Territorial), Role of Supreme Court under the CPA with important case law.

Unit 4: Grievance Redressal Mechanism

Grievance Redressal Mechanism under the Indian Consumer Protection Law , Who can file a complaint? Grounds of filing a complaint; Limitation period; Procedure for filing and hearing of a complaint; Disposal of cases, Relief/Remedy available; Temporary Injunction, Enforcement of order, Appeal, frivolous and vexatious complaints; Offences and penalties. Leading Cases decided under Consumer Protection law by Supreme Court/National

Commission: Medical Negligence; Banking; Insurance; Housing & Real Estate; Electricity and Telecom Services; Education; Defective Products; Unfair Trade Practices.

Unit -5: Role of Industry Regulators in Consumer Protection.

Banking: RBI and Banking Ombudsman. ii. Insurance: IRDA and Insurance Ombudsman iii. Telecommunication: TRAI iv. Food Products: FSSAI v. Electricity Supply: Electricity Regulatory Commission vi. Real Estate Regulatory Authority

Unit 6: **Contemporary Issues in Consumer Affairs**

Consumer Movement in India: Evolution of Consumer Movement in India, Formation of consumer organizations and their role in consumer protection, Misleading Advertisements and sustainable consumption, National Consumer Helpline, Comparative Product testing, Sustainable consumption and energy ratings.

Quality and Standardization: Voluntary and Mandatory standards; Role of BIS, Indian Standards Mark (ISI), Ag-mark, Hallmarking, Licensing and Surveillance; Role of International Standards: ISO an Overview

Note: Unit 2, 3 and 4 refer to the Consumer Protection Act, 1986. Any change in law would be added appropriately after the new law is notified

References:

1. Khanna, Sri Ram, Savita Hanspal, Sheetal Kapoor, and H.K. Awasthi. (2007) Consumer Affairs, Universities Press.
2. Choudhary, Ram Naresh Prasad (2005). Consumer Protection Law Provisions and Procedure, Deep and Deep Publications Pvt Ltd.
3. G. Ganesan and M. Sumathy. (2012). Globalisation and Consumerism: Issues and Challenges, Regal Publications
4. Suresh Misra and Sapna Chadah (2012). Consumer Protection in India: Issues and Concerns, IIPA, New Delhi
5. Rajyalaxmi Rao (2012), Consumer is King, Universal Law Publishing Company
6. Girimaji, Pushpa (2002). Consumer Right for Everyone Penguin Books.
7. E-books :- www.consumereducation.in
8. Empowering Consumers e-book,

9. e-book, www.consumeraffairs.nic.in

ENE29001

GROUP B

SEMESTER V

DISCIPLINE SPECIFIC ELECTIVE

INTERNATIONAL BUSINESS

L: T: P-4:1:0

Course Outcome:

On successful completion of this course the students can:

CO1: Learn in detail about import and export and able to become an importer and exporter

CO2: Specify in detail the application of foreign trade policies and analyse how international factors affect domestic concern

CO3: Learn in depth and analyse legal issues related to international business

CO4: Identify and analyse various social culture and responsibility awareness on global issues

CO5: Understand in detail and identify sources of trade finance and forms of payment

CO6: Identify the function of WTO and regional integrations

CO7: Understand in depth characteristics of foreign exchange market

CO8: Identify the details of facilities provided by the International monetary institutions

Unit 1: Introduction

Globalisation – Meaning and implications - Globalisation of markets and production – The emerging global economy - Drivers of Globalisation. Modes and entry strategies of international business – arguments for and against – trends in international trade. Differences between domestic and international business.

Unit 2: International Business Environment

Cultural aspects, values and norms, social structure, religious and ethical systems, language, education, implications of cultural differences on business. International business environment, Political and legal factors, political systems, legal systems, International business environment, Economic factors, the determinants of economic development. Tariffs, subsidies, local content requirements, administrative policies, anti dumping policies, political and economic arguments for intervention ,Development of the world trading system.

Unit 3: WTO and Regional Integrations

GATT, the Uruguay round of negotiations. WTO, genesis and functions, the future of WTO. Regional Integrations, Trading Blocks, nature and levels of integration, arguments for and against regional integration, Trading blocks, European Union, ASEAN, APEC, NAFTA, SAARC.

Unit 4: Multinational Corporations

Organisation, design and structures, head quarters and subsidiary relations in multinational corporations.

Unit5: Foreign Exchange Market

Functions, nature of foreign exchange market, the trading mechanism, exchange rate determination, balance of trade, stability of exchange rate, currency convertibility

Unit 6: International Monetary System

Funding facilities and strategies of IMF and World Bank, Expatriation and Repatriation, Ethical dimensions in International Business.

References:

1. Charles W L Hill. And Arun Kumar Jain. International Business: competing in the global market place, Mc Graw-Hill.
2. John D. Daniels Lee H Radebaugh, International Business: Environments and Operations Addison Wesley.
3. Justin Paul – International Business – Prentice Hall of India.
4. Oded Shenkar Yadong Luo: International Business – John Wiley and Co.
5. Wild J. John, Wild L. Keneth and Han C. Y. Jerry, International Business: An integrated approach, Prentice Hall
6. Alan M. Rugman and Richard M. Hodgetts – International Business by Pearson Education.

ENE30001

GROUP B

SEMESTER V

DISCIPLINE SPECIFIC ELECTIVE

GOODS AND SERVICES TAX-I

L: T: P-4:1:0

Course Outcome:

On successful completion of this course the students can:

CO1: Understand the technology and flow of return filing under GST

CO2: Learn in details and gain knowledge to practice as GST Consultant

CO3: Learn in details provisions of GST to handle TDS and POS online and off line more efficiently

CO4: Understand in depth tax provisions to make managerial decisions effectively in various tax related matters

CO5: Understand the provisions of integrated goods and service Tax Act, 2017

CO6: Learn in depth the provisions relating to place of supply of goods imported into, or exported from India

CO7: Identify the details of provisions in relation to Time of supply of goods

Unit 1: Introduction to GST

Indirect tax Structure in India, Issues in Indirect Tax, Rationale for Transition to GST; GST-Meaning, Definition of GST, Types of GST, Features of GST, Benefits of GST, Problems on Computation of GST.

Unit 2: Definitions

Actionable claim, Address of Delivery, Aggregate Turnover, Agriculturist, Associated enterprises, Business, GST Council, Credit note and Debit note, Deemed exports, Draw-back, Electronic Credit ledger, Exempt Supplies, Input, Input service, Input Service Distributor, Input Tax, Input tax Credit, Intra-state supply of Goods, Job work, Reverse Charge, Invoice, Composition Levy, Mixed Supply, outward supply, Person, Turnover in State

Unit 3: Levy and Collection of Tax

Scope of supply; Levy of GST; Liability of tax payable person, Rate and value of tax, meaning and conditions of supply, list of transactions without consideration list of neither a supply of goods, nor supply of services; meaning and treatment of mixed supply: meaning and treatment of composite supply: reverse charge mechanism: Composition levy.

Unit 4 : The Integrated Goods and Service Tax Act,2017

Short title, extent and commencement; Definitions; Central tax, Customs frontier of India, Export of Goods and Services, Import of goods and services; Location of Recipient of service, Location of supplier of service; Appointment of officers; Levy and Collection; Power to grant exemption from tax; Inter-State supply;. Intra-State supply; Supplies in territorial waters

Unit 5: Place of supply of goods other than supply of goods imported into, or exported from India

Place of supply of goods imported into, or exported from India; Place of supply of services where location of supplier and recipient1 is in India; Place of supply of services where location of supplier or location of recipient is outside India; Special provision for payment of tax by a supplier of online information and database access or retrieval services

Unit 6: Time of supply

Introduction, time of supply-forward charge, reverse charge, residuary, special charges-Time of supply of service- forward charge, reverse charge, Vouchers, Residuary, Special charges. Problems on determination of time of supply.

References:

1. Taxmann publications
2. Compendium on Goods and service tax-Dr. Manju S 3.www.cbec.gov.in/
4. www.ICSI.edu.in
5. www.icai.org.
6. Students Guide To GST & Customs Law Vinod K Singhania

ENE31001

GROUP B

SEMESTER V

DISCIPLINE SPECIFIC ELECTIVE

FINANCIAL MANAGEMENT-I

L: T: P-4:1:0

Course Outcome:

On successful completion of this course the students can:
CO1: Identify the details of various sources of finance
CO2: Learn the characteristics of different methods of time value of money and its application to investment decision
CO3: Learn the classification and characteristics of cost of capital
CO4: Identify the characteristics of capital structure and factors affecting the capital structure
CO5: Learn the details of Capital Budgeting
CO6: Understand the classification and characteristics of Dividend theories

Unit 1: Introduction to financial management
Meaning – scope – goals of financial management – sources of finance.

Unit 2: Time value of Money
Present value and future value concepts-present value of annuity, application of present and future value to investment decisions, preparation of amortization table.

Unit 3: Cost of capital

Meaning- importance of cost of capital in financial decisions, determination of specific costs-cost of debt- cost of preference share capital-cost of equity, cost of retained earnings-weighted average cost of capital-Leverages- meaning- types problems on Leverages.

Unit 4: Capital Structure

Meaning-optimum capital structure-features of appropriate capital structure-factors influencing capital structure-theories of capital structure-NI approach-NOI approach, MM approach, traditional approach, determination of optimal debt-equity mix.

Unit 5: Capital budgeting

Meaning-features, role of capital budgeting, techniques of capital budgeting-payback period, average rate of return, net present value, profitability index, internal rate of return, discounted pay back method. Application of excel in capital budgeting techniques.

Unit 6: **Dividend decisions**

Meaning, Dividend decisions, Dividend policies - objectives of dividend policy-determinants of dividend policy-dividend relevance- Walter's model, Gordon model-Dividend irrelevance-MM hypothesis.

References:

1. Financial Management I.M.Pandey.
2. Financial Management Ravi Kishore
3. Financial Management Dr.V.R.Palanivelu
4. Financial Management Kulkarni
5. Financial Management Tulsian P C
6. Financial Management Khan and Jain

ENE32001

GROUP B

SEMESTER V

DISCIPLINE SPECIFIC ELECTIVE

ADVANCED COST AND MANAGEMENT ACCOUNTING-I

L: T: P-4:1:0

Course Outcome:

On successful completion of this course the students can:

CO1: Learn in depth various Costing methods

CO2: Understand the details of contract costing and process costing

CO3: Identify reasons for reconciliation of cost and financial accounts

CO4: Learn in depth the details of Activity based costing

CO5: prepare the operating cost sheet

Unit 1: Introduction to Costing Methods

Meaning, Importance and Categories, Cost accounting Standards- Generally Accepted Cost Accounting Principles (GACAP)- Purpose, Objective and Applicability.

Unit 2: Contract costing

Introduction- Contract account, Profit on incomplete contracts, work in progress, Contractee's Accounts, Escalation clause.

Unit 3: Process costing: Introduction, Distinction between Job costing, and process costing, process losses, inter-process profits, Joint products and by-products- Meaning, features, differences, problems on process accounts including joint and by products.

Unit 4: **Operating Costing**
Introduction, transport costing, standing charges, operating/running charges, and preparations of operating cost sheet.

Unit 5: Reconciliation of cost and financial accounts
Meaning, need for reconciliation, reasons for disagreement, reconciliation procedure, problems on reconciliation.

Unit 6: Activity based costing (ABC)
Definition, Features, Advantages, Differences between ABC and traditional costing, Allocation of overheads; Objectives of ABC, Development of ABC, Implementation of ABC, Problems on Computation of Activity Based Costing and Traditional Costing;

References:

1.Cost Accounting: N.K. Prasad
2.Cost Accounting: Nigam & Sharma :
3.Practical Costing: Khanna, Pandey & Ahuja
4: Cost Accounting: M.L. Agarwal
5.Cost Accounting: Jain & Narang
6.Cost Accounting: S.P. Iyengar

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GROUP B

SEMESTER V

DISCIPLINE SPECIFIC ELECTIVE

RETAIL MANAGEMENT

L: T: P-4:1:0

Course Outcome:

On successful completion of this course the students can:

CO1: Learn in depth the characteristics of retailing

CO2: Understand in depth the details of retail consumer

CO3: Identify and basis of retail market segmentation and strategies

CO4: Specify the factors determining the retail location selection

CO5: Understand in depth merchandise and managing them

CO6: Learn in depth the details of retail operation and retail pricing

Unit 1: **Introduction to Retailing**

Concept of retailing, Functions of retailing, Terms and Definition, retail formats and types, Retailing Channels, Retail industry in India, Importance of retailing, Changing trends in retailing.

Unit 2: **Understanding the Retail Consumer**

Retail consumer behaviour, Factors influencing the Retail consumer, Customer decision making process, Types of decision making, Market research for understanding retail consume.

Unit 3: Retail Market Segmentation and Strategies

Market Segmentation and its benefits, kinds of markets, definition of Retail strategy, Strategy for effective market segmentation, Strategies for penetration of new markets, Growth strategies, Retail value chain.

Unit 4: Retail Location Selection

Importance of Retail locations, Types of retail locations, Factors determining the location decision, Steps involved in choosing a retail locations, Measurement of success of location.

Unit 5: **Merchandise Management**

Meaning of Merchandising, Factors influencing Merchandising, Functions of Merchandising Manager, Merchandise planning, Merchandise buying, Analyzing Merchandise performance.

Unit 6: **Retail Operations and Retail Pricing**

Store administration, Premises management, Inventory Management, Store Management, receipt Management, Customer service, Retail Pricing, Factors influencing retail prices pricing strategies, controlling costs.

References:

1. Retail Management 01 Edition S. C. Bhatia
2. Retail Management: Text and Cases (English, Paperback, Swapna Pradhan
3. Retail Management; Principles and Practices – R. Sudarshan
4. Retail Management PB (English, Paperback, Mathur U C)

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GROUP C

SEMESTER VI

DISCIPLINE SPECIFIC ELECTIVE

INVESTMENT ANALYSIS AND PORTFOLIO MANAGEMENT

L: T: P-4:1:0

Course Outcome:

On successful completion of this course the students can:

CO1: Learn in depth the characteristics of investment

CO2: Understand in depth characteristics of financial system and stock market

CO3: Identify and use different models for portfolio analysis

CO4: Learn in depth capital asset pricing model

CO5: Identify the risk and return of investment

CO6: Understand in depth portfolio selection

CO7: Understand in depth the efficient market hypothesis and portfolio analysis

Unit 1: Introduction to Investment

Meaning, Financial and Economic Meaning, Characteristics, Objectives, Investment v/s Speculation, Investment v/s Gambling, Types of Investors and Investment avenues.

Unit 2: **Indian Financial System and Stock Market-Investment Planning,**

Introduction to Stock Market, Overview of Indian Financial System, Market Indices, Methods of Computation of Market Indices.

Unit 3: Portfolio Management

Meaning, Phases, Evolution, Role of Portfolio Management, Calculation of Risk and Return, Fundamental Analysis: Economic Analysis, Industry analysis and Company analysis and Technical Analysis: Meaning, Dow Theory, basic Principles, Trends and charts.

Unit 4: Share and Bond Valuation-Share

Concepts and present value, share valuation model, constant Growth Model, Multiple Growth Model, Discount rate, Multiplier Approach to share values and Regression Analysis. Bonds: Bond Returns, Prices, Pricing Theories, Bond Risks and Bond Duration.

Unit 5: Efficient Market Hypothesis and Portfolio Analysis

EMH: Random Walk Theory, the Efficient Market Hypothesis, Forms of Market Efficiency. Portfolio Analysis: Expected Return and Risk of Portfolio, Reduction of Portfolio Risk through Diversification, Portfolio with more than two Securities – solved examples.

Unit 6: Portfolio Selection

Feasible set of Portfolios, Selection of Optimal Portfolio, Limitations of Markowitz Model and Single Index Model and Multi Index Model. Capital Asset Pricing Model and Arbitrage Pricing Theory.

References:

1.Investment analysis and Portfolio Management Prasanna Chandra
2.Security Analysis and Portfolio Management Punithavathi pandian
3.Security Analysis and portfolio Management Ambika Prasad Dash
4.Security Analysis and Portfolio Management, M. Ranganatham, R. Madhumathi

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GROUP C

SEMESTER VI

DISCIPLINE SPECIFIC ELECTIVE

FINANCIAL DERIVATIVES

L: T: P-4:1:0

Course Outcome:

On successful completion of this course the students can:

CO1: Learn in depth the characteristics of financial derivatives and derivatives market

CO2: Deliberate the characteristics of futures and forwards
CO3: Understand in details with examples options
CO4: Deliberate the classification and characteristics of financial swaps
CO5: Write down the details of commodity market
CO6: Identify in depth credit derivatives

Unit 1: Financial Derivatives

Introduction, -meaning- Types of financial derivatives - Features of derivatives market - Factors contributing to the growth of derivatives - functions of derivative markets - traders in derivatives markets - Derivatives market in India

Unit 2: Futures and forwards

Meaning, differences-valuation of futures, Mechanics of buying & selling futures, Margins, Hedging using futures -specification of futures - Commodity futures, Index futures, interest rate futures – arbitrage opportunities.

Unit 3: **Options:**
Types of options, option pricing, factors affecting option pricing – call and put options on dividend and non-dividend paying stocks put-call parity - mechanics of options - stock options - options on stock index - options on futures – interest rate options. Concept of exotic option. Hedging & Trading strategies involving options, valuation of option: basic model, one step binomial model, Black and Scholes Model,

Unit 4: Financial Swaps
features and uses of swaps - Mechanics of interest rate swaps – valuation of interest rate swaps – currency swaps – valuation of currency swaps

Unit 5: Commodity derivatives
Commodity futures market-exchanges for commodity futures in India, Forward Market Commissions and regulation-commodities traded – trading and settlements – physical delivery of commodities

Unit6: Credit Derivatives
Meaning, common credit derivatives, types of credit dervates, Credit Default swaps(CDS), Total Return swaps, Collateralized debt obligations(CDO), Indian scenario.

References:

1. Financial Derivatives- Vohra and Bagri
2. Capital Market Instruments Kotreshwar G
3. Fundamental Financial Derivatives N R Parasuraman
4. Financial Derivatives S L Guptha

ENF30001

GROUP C

SEMESTER VI

DISCIPLINE SPECIFIC ELECTIVE

GOODS AND SERVICES TAX AND CUSTOM DUTY-II

L: T: P-4:1:0

Course Outcome:

On successful completion of this course the students can:

CO1: Understand the technology and flow of return filing under GST

CO2: Learn in details and gain knowledge to practice as GST Consultant

CO3: Learn in details provisions of GST in relation to value of taxable supply and input tax credit

CO4: Understand in depth tax provisions to make managerial decisions effectively in various tax related matters

CO5: Learn in detail the procedure to be followed to assess the value and determine customs duty

CO6: Understand the procedure of registration under GST

CO7: Prepare tax invoice, credit and debit notes

Unit 1: Value of taxable supply

Conditions, inclusions, Consideration not wholly in money, Supply between two related persons, Supply through agent, cost based value, Residual valuation, specific supplies, Service of pure agent. Problems on determination of value of supply.

Unit 2: Input tax credit

Meaning, conditions for taking credit, ineligible input tax credit, availability of credit in special circumstances, Input tax credit and change in constitution of registered person, Taking input tax credit in respect of inputs and capital goods sent for job work, Manner of Distribution of Credit by Input Service Distributor (ISD)

Unit 3: Tax Invoice, Credit and Debit Notes

Tax invoice; Prohibition of un authorised collection of tax; Amount of tax to be indicated in tax invoice and other documents ; Credit and debit notes.

Unit 4: Registration under GST

Persons liable for registration, compulsory registration, Procedure for Registration, Rejection of application for registration, cancellation of Registration

Unit 5: Returns

Brief introduction to various GSTRS-procedure for filing various returns.

Unit 6: Customs Act 1962

Meaning- Notified goods –specified goods- Prohibition of importation and exportation under sec 11- types of customs duty- Basic customs duty, Education Cess, Anti dumping duty, Safeguard Duty, IGST, GST Compensation Cess- Computation of Assessable value and applicable duties. Exports – Meaning- zero rated supply.

References:

1. Taxmann publications
2. Compendium on Goods and service tax-Dr. Manju S
3. www.cbec.gov.in/
4. Systematic Approach GST- Dr. Ravi. Gupta, Dr. Girish. Ahuja

ENF31001

GROUP C

SEMESTER VI

DISCIPLINE SPECIFIC ELECTIVE

FINANCIAL MANAGEMENT –II

L: T: P-4:1:0

Course Outcome:

On successful completion of this course the students can:

CO1: Deliberate the details of working capital management

CO2: Learn in depth the details of cash management

CO3: Understand the details of working capital financing

CO4: Deliberate in details with examples Venture capital financing

CO5: Learn in depth the details of shareholders value creation

CO6: Deliberate in depth International financial management

Unit 1: Working Capital Management

Meaning, Features, types of working capital, factors influencing working capital, level of current assets, operating cycle and cash cycle, current assets financing policy

Unit 2: Cash Management

Cash budget cash collection and disbursement, options for investment of surplus funds, credit management- credit policy variables-credit evaluation. Inventory management- need for inventories; order quantity-EOQ model- monitoring and control of inventories-ABC- JIT techniques.

Unit 3: Working Capital Financing

Leasing-types of leases, Rationale for leasing, operating leases, leasing as a financing decision; hire purchase financing- Hire purchase financing v/s lease financing, instalment sale, evaluation of Hire purchase financing

Unit 4: V**enture Capital Financing**

Meaning, features, development of venture capital in India, stages in venture financing- the business plan- essentials of a business plan, the process of venture capital financing- Methods of venture financing; Disinvestment mechanisms

Unit 5: Share Holder Value Creation

Financial goals and strategy, shareholder value creation- market value added, Market to book value, Economic value added(EVA)- Balanced scorecard- the learning and growth perspective, significance of balanced score card , implementation of score card.

Unit 6: International Financial Management

Foreign exchange market, foreign exchange rates- spot exchange rates, bid-ask rate, forward exchange rates- foreign exchange risk- transaction exposure, economic exposure, translation exposure, hedging of foreign exchange risk- foreign currency option, money market operations- financing international operations.

References:

1. Financial Management I.M.Pandey.
2. Financial Management Ravi Kishore
3. Financial Management Dr.V.R.Palanivelu
4. Financial Management Kulkarni
5. Financial Management Tulsian P C
6. Financial Management Khan and Jain

ENF32001

GROUP C

SEMESTER VI

DISCIPLINE SPECIFIC ELECTIVE

ADVANCED COST AND MANAGEMENT ACCOUNTING-II

L: T: P-4:1:0

Course Outcome:

On successful completion of this course the students can:

CO1: Understand the details of management accounting

CO2: Learn in depth the details of financial statement analysis techniques

CO3: Analyze the inflow and outflow of cash and able to prepare cashflow statement

CO4: Understand the characteristics of different types of ratios

CO5: Learn in depth budget and budgetary control and prepare various budget for different activities of the business

CO6: Learn in depth marginal costing and able to effective decision regarding make or buy, accepting foreign order, continuance or discontinuance of manufacturing a products

Unit 1: Introduction

Meaning and Definition of Management Accounting, Scope and Objectives of Management Accounting-Differences between Management Accounting and Financial Accounting –Management accounting and Cost accounting-Limitations of Management Accounting.

Unit 2: Analysis of Financial Statements

Common Size Statements, Comparative Statement, Trend analysis.

Unit 3: Ratio Analysis

Meaning and Objectives-Types of rations - (A) Profitability Ratios-GP ratio - NP Ratio-Operating ratio- Operating profit ration-Return on capital employed ratio- EPS, (B) Turnover Ratios-working capital turnover ratio- Stock Turnover ratio-Fixed assets turnover ratio-Debtors turnover Ratio-Creditors turnover Ratio, (C) Financial ratios –

Current Ratio-liquidity ratio-Debt-equity ratio-Proprietary Ratio-Capital gearing Ration-Advantagesand Limitations of Ratios- Construction of Balance sheet using ratios.

Unit 4: Cost Flow Statement

Meaning, Definition, Uses and Limitations-Differences between funds flow statement and cash flow statement-Preparation of Cash flow statement (AS-7): Direct method and Indirect Method.

Unit 5: Marginal Costing

Definition - Basic concepts – Assumptions - Marginal Cost statement – Contribution-Break Even Analysis-P/V Ratio-Margin of Safety - Decision areas - Make or Buy and Pricing.

Unit 6: Budget and Budgeting Control

Definition - Basic Concepts - Budget Manual - Key factor - Classification of Budgets - Problems on cash budget, sales budget, Flexible Budget, Cash Planning and Motives for holding cash.

References:

1. Cost Accounting: N.K. Prasad
2. Cost Accounting: Nigam & Sharma :
3. Practical Costing: Khanna, Pandey & Ahuja
4. Cost Accounting: M.L. Agarwal
5.Cost Accounting: Jain & Narang
6.Cost Accounting: S.P. Iyengar

ENF33001

GROUP C

VI SEMESTER

DISCIPLINE SPECIFIC ELECTIVE

ORGANISATIONAL BEHAVIOUR

L: T: P-4:1:0

Course Outcome:

On successful completion of this course the students can:

CO1: Understand in detail behaviour of employees and able to manage them efficiently

CO2: Identify in details employees performance and able to motivate for effective performance

CO3: Learn in depth and analyse the behaviour of employees

CO4: Understand in details key positions in an organisation and able to occupy them

CO5: Learn in details with examples frame policies and strategies in organisation

Unit 1: Introduction
Meaning, definition, historical development, fundamental principles of OB, contributing disciplines, approaches, challenges and opportunities.

Unit 2: Foundations of Individual Behaviour
Individual behaviour: Foundations of individual behaviour. Ability: Intellectual abilities, Physical ability, the role of disabilities. Personality: Meaning, formation, determinants, traits of personality, personality attributes influencing OB. Attitude: Formation, components of attitudes, relation between attitude and behaviour.

Unit 3: Perception and Emotions- Perception: Process of perception, factors influencing perception, link between perception and individual decision making. Emotions: Affect, mood and emotion and their significance, basic emotions, emotional intelligence, self-awareness, self-management, social awareness, relationship management.

Unit 4: Motivation and Leadership

Motivation- meaning, theories of motivation-needs theory, two factor theory, Theory X and Y, application of motivational theories. Leadership: Meaning, styles of leadership, leadership theories, trait theory, behavioural theories, managerial grid, situational theories-Fiedler's model, SLT, transactional and transformation leadership.

Unit 5: Group Behaviour

Definition, types, formation of groups, building effective teams. Conflict: Meaning, nature, types, process of conflict, conflict resolution. Power and politics: Basis of power, effectiveness of power tactics.

Unit 6: Emerging Challenges

Emerging challenges, managing diversity, globalisation, technology transformation, e - business, promoting ethical behaviour.

References:

1.Organisational behaviour, Stephen P Robbins, Timothy A. Judge, Neharika Vohra, 14th Edition, Pearson
2. Organization Behaviour – Ashwathappa, Himalaya Publication House
3. Organisational Behaviour: A modern approach - Arun Kumar and Meenakshi, Vikas Publishing House
4. Organisational Behaviour - Fred Luthans, 12/e, McGraw Hill International
5 Management and Organisational Behaviour - Laurie J Mullins, Pearson education
6. Fundamentals of Organisational Behaviour - Slocum/Hillriegel, Cengene Learning

B.COM

Question Paper Pattern

(For all courses except Quantitative Techniques, Computerised Accounting and E-filling of returns)

PART-A

Answer the following. Each question carries 15 marks. 2X15=30

1. …… ……

OR

2. ……..…….

3. ……..……..

OR

4. ……..…….

PART-B

Answer the following. Each question carries 10 marks. 2X10=20

5. …….…….

OR

1. …….……..……

7. …….…….

OR

8. …….…….

PART-C

Answer any four of the following. Each question carries 5 marks. 4X5=20

9. …….……

10. …….…….…….

11. …….

12. …….

13. …….

14 …….

****

B.COM

Question Paper Pattern
4.5 Quantitative Techniques

Time: 3 hrs **Max. Marks: 70**

Part-A

Answer the following. Each question carries two marks 10X2=20

1. a. …….
   b. …….
   c.……..
   d. ……....
   e.……..
   f.…….
   g.…….
   h. …….
   i. ……..
   j. ……..

Part-B

Answer any four of the following. Each question carries five marks 4X5=20

2. ……...

3. ……..……..

4. ……..……..

5. ……

6. ……...……

Part-C

Answer any three of the following. Each question carries ten marks 3X10=30

7. ……

8. ……

9. ……

10. ……

B.COM

Question Paper Pattern
3.6 Computerized Accounting System (SEC-1) / 4.6 E-filling of returns (SEC-2)

Time: 3 hrs **Max. Marks:70**

Part-A

Answer the following. Each question carries two marks. **10X2=20**

1. a. ……
b. ……
c. ……
d. ……
e. ……
f. ……
g. ……
h. ……
i. ……
j. ……

Part-B

Answer any four of the following. Each question carries five marks. **4X5=20**

2. ……
3. ……
4. ……
5. ……
6. ……

Part-C

Answer any three of the following. Each question carries ten marks 3X10=30

5. ……
6. ……
7. ……
8. ……

JSS COLLEGE OF ARTS COMMERCE & SCIENCE
(Autonomous)
Ooty Road, Mysuru – 25

DEPARTMENT OF COMMERCE AND MANAGEMENT

BBA Pragramme
(I Year)

Syllabus as per NEP
2021-22 Scheme

BBA PROGRAM

Semester I								
Sl. No.	Course Code	Title of the Course	Category of Courses	Teaching Hours per Week (L + T + P)	SEE	CIE	Total Marks	Credits
1	Lang.1.1	Language - I	AECC	3+1+0	60	40	100	3
2	Lang.1.2	Language - II	AECC	3+1+0	60	40	100	3
3	BBA.1.1	Management Principles & Practice	DSC	4+0+0	60	40	100	4
4	BBA.1.2	Fundamentals of Business Accounting	DSC	3+0+2	60	40	100	4
5	BBA.1.3	Marketing Management	DSC	4+0+0	60	40	100	4
6	BBA.1.4	Digital Fluency	SEC-SB	1+0+2	50	50	100	2
7	BBA.1.5	Business Organization and Management / Skills For Management	OEC	3+0+0	50	50	100	3
Sub –Total (A)					450	250	700	23
Semester II								
Sl. No.	Course Code	Title of the Course	Category of Courses	Teaching Hours per Week (L + T + P)	SEE	CIE	Total Marks	Credits
8	Lang.2.1	Language - I	AECC	3+1+0	60	40	100	3
9	Lang.2.2	Language - II	AECC	3+1+0	60	40	100	3
10	BBA.2.1	Financial Accounting and Reporting	DSC	3+0+2	60	40	100	4
11	BBA.2.2	Human Resource Management	DSC	4+0+0	60	40	100	4
12	BBA.2.3	Business Environment/ Business Mathematics	DSC	4+0+0/ 3+0+2	60	40	100	4
13	BBA.2.4	Health Wellness/ Social & Emotional Learning	SEC-VB	1+0+2	-	100	100	2
14	BBA.2.5	Environmental Studies	AECC	2+0+0	50	50	100	2
15	BBA.2.6	People Management / Functional Areas of Management	OEC	3+0+0	50	50	100	3
Sub –Total (B)					450	350	800	25

Notes:

- **One Hour of Lecture is equal to 1 Credit.**
- **One Hour of Tutorial is equal to 1 Credit (Except Languages).**
- **Two Hours of Practical is equal to 1 Credit**

Acronyms Expanded

- **AECC : Ability Enhancement Compulsory Course**
- **DSC © : Discipline Specific Core (Course)**
- **SEC-SB/VB : Skill Enhancement Course-Skill Based/Value Based**
- **OEC : Open Elective Course**
- **DSE : Discipline Specific Elective**
- **SEE : Semester End Examination**
- **CIE : Continuous Internal Evaluation**
- **L+T+P : Lecture+Tutorial+Practical(s)**

Note: Practical Classes may be conducted in the Business Lab or in Computer Lab or in Class room depending on the requirement. One batch of students should not exceed half (i.e., 30 or less than 30 students) of the number of students in each class/section. 2 Hours of Practical Class is equal to 1 Hour of Teaching, however, whenever it is conducted for the entire class (i.e., more than 30 students) 2 Hours of Practical Class is equal to 2 Hours of Teaching.

Revised Syllabus for 1st And 2nd Semester BBA Degree as Per NEP Regulations to be implemented From the Academic Year 2023-2024

I. OBJECTIVES OF THE COURSE:

1. To develop the skills required for the application of business concepts and techniques learnedin the classroom at the workplace.
2. To provide competent and technical skills personnel to the industry in the area of Marketing, Finance, Human Resource, Data Analytics, Retailing and Logistics And Supply Chain Management. To enhance the employability skills of the management students.
3. To enhance the capability of the students improve their decision-making skills.
4. To encourage entrepreneurship among students pursuing education in the field of BusinessAdministration.
5. To empower students for pursuing professional courses like MBA, Chartered Accountancy, Company Secretary, etc.,
6. To ensure holistic development of Business administration students.

II. ELIGIBILITY FOR ADMISSION:

Candidates who have passed Two Year Pre University Course of Karnataka State in any discipline or its equivalent (viz., 10+2 of other states, ITI, Diploma etc.) are eligible for admission into this program.

III. DURATION OF THE PROGRAM:

The program of study is Four years of Eight Semesters. A candidate shall complete his/her degree within eight academic years from the date of his/her admission to the first semester. The NEP 2020 provides multiple exit options for students as specified below:

EXIT OPTION:

a. The students who successfully complete ONE year/ 2 Semesters and leave the program, will be awarded Certificate in Business Administration.
b. The students who successfully complete TWO years/ 4 Semesters and leave the program, will be awarded Diploma in Business Administration.
c. The students who successfully complete THREE years/ 6 Semesters and leave the program, will be awarded Bachelors Degree in Business Administration (BBA)

IV. MEDIUM OF INSTRUCTION

The medium of instruction shall be English.

V. ATTENDANCE

a. For the purpose of calculating attendance, each semester shall be taken as a Unit.
b. A student shall be considered to have satisfied the requirement of attendance for the semester, if he/she has attended not less than 75% in aggregate of the number of working periods in eachof the subjects compulsorily.

c. A student who fails to complete the course in the manner stated above shall not be permitted totake the University Examination.

VI. TEACHING AND EVALUATION

MBA graduates with BBM/BBA, B.Com and BBS as basic degree from a recognized University are only eligible to teach and to evaluate all the Business Administration courses except Languages, Constitution of India, Environmental Studies, Health Wellness/Social and Emotional learning, Sports/NCC/NSS/Other)

VII. SKILL DEVELOPMENT / RECORD MAINTENANCE

a. Every college is required to establish a dedicated business lab for the purpose of conducting practical/ assignments to be written in the record.
b. In every semester, the student should maintain a record book in which a minimum of 5exercise or activities per course are to be recorded.

VIII. SCHEME OF EXAMINATION

a. There shall be an University examination at the end of each semester. The maximum marks for the university examination in each paper shall be 60 marks for DSC, DSE, Vocational,SEC and OEC.
b. Internal Assessment 40 marks for DSC, DSE, Vocational, SEC and OEC.

IX. GUIDELINES FOR CONTINUOUS INTERNAL EVALUATION AND SEMESTER END EXAMINATION:

The CIE and SEE will carry 40% and 60% weightage each, to enable the course to be evaluated for a total of 100 marks, irrespective of its credits. The evaluation system of the course is comprehensive & continuous during the entire period of the Semester. For a course, the CIE and SEE evaluation will be on the following parameters:

Sl No.	Parameters for the Evaluation	Marks
	Continuous Internal Evaluation (CIE)	
1	Continuous and Comprehensive Evaluation (CCE) – (A)	20 Marks
2	Internal Assessment test (IAT) – (B)	20 Marks
	Total of CIE (A+B)	**40 Marks**
3	Semester End Examination (SEE) – (C)	60 Marks
	Total of CIE and SEE (A+B+C)	**100 Marks**

Continuous Internal Evaluation (CIE)

a. **Continuous & Comprehensive Evaluation (CCE):** The CCE will carry a maximum of 20% weightage (20 marks) of total marks of a course. Before the start of the academic session in each semester, a faculty membershould choose for his/her course, minimum of the following assessment methods with 5markse each (4x5=20 marks)

   i. Individual Assignments

   ii. Seminars/Class room Presentations/Quizzes

iii. Group Discussions/Class Discussion / group assignments

iv. Casestudies/ Caselets

v. Participatory &Industry-Integrated Learning/Industrial visits

vi. Practical Activities / Problem Solving Exercises

vii. Parucipation in seminars/ academic events /symposia

viii. Mini project / Capstone projects

b. Internal Assessment Test (IAT):

The IAT will carry a maximum of 20% weightage (20 marks) of total marks of a course. Under this component, two tests will have to be conducted in a semester for 30 marks each and the same is to be scaled down to 10 marks each.

c. Semester End Examination (SEE):

The semester end examination for all the students for which students who get registered during the semester shall be conducted for 60 marks. SEE of the course shall be conducted subject to their fulfillment of minimum attendance requirement as per the university norms. The BOS of the university shall prepare the SEE framework and the question paper pattern.

d. Minimum marks for a Pass:

Candidates who have obtained 35% marks in semester end examination i.e., 21 marks out of 60 marks of theory examination and 40% in aggregate i.e., total 40 marks out of 100 marks of semester end examination marks and continuous internal evaluation marks.

Name of the Program: Bachelor of Business Administration (BBA)
Course Code: BBA 1.1
Name of the Course: Management Principles & Practice

Course Credits	No. of Hours per Week	Total No. of Teaching Hours
4 Credits	**4 Hrs**	**56 Hrs**

Pedagogy: Classrooms lecture, tutorials, Group discussion, Seminar, Case studies & field work etc.,

Course Outcomes: On successful completion of the course, the Students will demonstrate

a) The ability to understand concepts of business management, principles and functionof management.
b) The ability to explain the process of planning and decision making.
c) The ability to create organization structures based on authority, task and responsibilities.
d) The ability to explain the principles of direction, importance of communication,barrier of communication, motivation theories and leadership styles.
e) The ability to understand the requirement of good control system and control techniques.

Syllabus:	**Hours**
Module No. 1: INTRODUCTION TO MANAGEMENT	**10**

Introduction –Meaning, Evolution of management thought, Pre-Scientific Management Era, Classical Management Era, Neo-Classical Management Era, Modern Management Era; Nature and Characteristics of Management - Scope and Functional areas of Management; Management as a Science, Art or Profession; Management and Administration; Principles of Management.

Module No. 2: PLANNING AND DECISION MAKING	**08**

Nature, Importance and Purpose of Planning - Planning Process; Objectives; Types of plans (Meaning only); Decision making- Importance and steps; MBO and MBE (Meaning only)

Module No. 3: ORGANIZING AND STAFFING	**12**

Nature and purpose of Organization; Principles of Organizing; Delegation of Authority; Types of Organization - Departmentation, Centralization vs Decentralization ofAuthority and Responsibility, Span of Control; Nature and importance of Staffing

Module No. 4: DIRECTING AND COMMUNICATING	**12**

Meaning and Nature of Direction, Principles of Direction; Communication - Meaning and Importance, Communication Process, Barriers to Communication, Steps to overcome Communication Barriers, Types of Communication; Motivation theories – Maslow's Need Hierarchy Theory, Herzberg's Two Factor Theory, Mc.Gregor's X and Y theory. Leadership – Meaning, Formal and Informal Leadership, Characteristics of Leadership; Leadership Styles – Autocratic Style, Democratic Style, Participative Style, Laissez Faire Leadership Styles, Transition Leadership, Charismatic Leadership Style.

Module No. 5: COORDINATING AND CONTROLLING	**10**

Coordination–Meaning, Importance and Principles. Controlling-Meaning and steps in controlling, Essentials of Effective Control system, Techniques of Control (in brief).

Module No. 6: BUSINESS SOCIAL RESPONSIBILITY AND MANAGERIAL ETHICS	**04**

Business Social Responsibility - Meaning, Arguments for and against Business Social Responsibility; Green management - Meaning, Green Management Actions; Managerial Ethics – Meaning - Importance of Ethics in Business, Factors that determine Ethical or Unethical behavior.

Skill Developments Activities:

1. Two cases on the above syllabus should be analyzed by the teacher in the classroom and the same needs to be recorded by the student in the Skill Development Book.
2. Draft different types of Organization structure.
3. Draft Control charts.

Text Books:

1. Stephen P. Robbins, Management, Pearson
2. Koontz and O‟‟Donnell, Management, McGraw Hill.
3. L M Prasad, Principles of management, Sultan Chand and Sons
4. V.S.P Rao/Bajaj, Management process and organization, Excel Books.GH25
5. Appanniah and Reddy, Management, HPH.
6. T. Ramaswamy : Principles of Management, HPH.

Note: Latest edition of text books may be used.

Name of the Program: Bachelor of Business Administration (BBA)

Course Code: BBA 1.2

Name of the Course: Fundamentals of Business Accounting

Course Credits	No. of Hours per Week	Total No. of Teaching Hours
4 Credits	**4 Hrs**	**56 Hrs**

Pedagogy: Classrooms lecture, tutorials, and problem solving.

Course Outcomes: On successful completion of the course, the Students will demonstrate

a) Understand the framework of accounting as well accounting standards.
b) The Ability to pass journal entries and prepare ledger accounts
c) The Ability to prepare subsidiaries books
d) The Ability to prepare trial balance and final accounts of proprietary concern.
e) Construct final accounts through application of tally.

Syllabus:	**Hours**
Module No. 1: INTRODUCTION TO FINANCIAL ACCOUNTING	**08**
Introduction – Meaning and Definition – Objectives of Accounting – Functions of Accounting – Users of Accounting Information – Limitations of Accounting – Accounting Cycle - Accounting Principles – Accounting Concepts and Accounting Conventions. Accounting Standards – objectives- significance of accounting standards. List of Indian Accounting Standards.	
Module No. 2: ACCOUNTING PROCESS	**12**
Meaning of Double entry system − Process of Accounting − Kinds of Accounts − Rules - Transaction Analysis − Journal − Ledger − Balancing of Accounts − Trial Balance − Problems on Journal, Ledger Posting and Preparation of Trial Balance.	
Module No. 3: SUBSIDIARY BOOKS	**14**
Meaning − Significance − Types of Subsidiary Books −Preparation of Purchases Book, Sales Book, Purchase Returns Book, Sales Return Book, Bills Receivable Book, Bills Payable Book. Types of Cash Book- Simple Cash Book , Double Column Cash Book , Three Column Cash Book and Petty Cash Book(Problems only on Three Column Cash Book and Petty Cash Book), Bank Reconciliation Statement − Preparation of Bank Reconciliation Statement (Problems on BRS)	
Module No. 4: FINAL ACCOUNTS OF PROPRIETARY CONCERN	**10**
Preparation of Statement of Profit and Loss and Balance Sheet of a proprietary concern with special adjustments like depreciation, outstanding and prepaid expenses, outstanding and received in advance of incomes, provision for doubtful debts, drawings and interest on capital.	
Module No. 5: ACCOUNTING SOFTWARE	**12**

Introduction-meaning of accounting software, types accounting software-accounting software Tally-Meaning of Tally software − Features − Advantages, Creating a New Company, Basic Currency information, other information, Company features and Inventory features. Working in Tally: Groups, Ledgers, writing voucher, different types of voucher, voucher entry Problem on Voucher entry - Generating Basic Reports in Tally-Trail Balance, Accounts books, Cash Book, Bank Books, Ledger Accounts, Group Summary, Sales Register and Purchase Register, Journal Register, Statement of Accounts, and Balance Sheet**.**

Skill Developments Activities:

1. List out the accounting concepts and conventions.
2. Prepare a Bank Reconciliation Statement with imaginary figures
3. Collect the financial statement of a proprietary concern and record it.
4. Prepare a financial statement of an imaginary company using tally software.

Text Books:

1. Hanif and Mukherjee, Financial Accounting, Mc Graw Hill Publishers
2. Arulanandam & Raman; Advanced Accountancy, Himalaya Publishing House
3. S.Anil Kumar,V.Rajesh Kumar and B.Mariyappa–Fundamentals of Accounting,
4. Himalaya Publishing House.
5. Dr. S.N. Maheswari, Financial Accounting, Vikas Publication
6. S P Jain and K. L. Narang, Financial Accounting, Kalyani Publication
7. Radhaswamy and R.L. Gupta, Advanced Accounting , Sultan Chand
8. M.C. Shukla and Goyel, Advaced Accounting , S Chand.

Note: Latest edition of text books may be used.

Name of the Program: Bachelor of Business Administration (BBA)
Course Code: BBA 1.3
Name of the Course: Marketing Management

Course Credits	No. of Hours per Week	Total No. of Teaching Hours
4 Credits	4 Hrs	56 Hrs

Pedagogy: Classrooms lecture, tutorials, Group discussion, Seminar, Case studies & field work etc.,

Course Outcomes: On successful completion of the course, the Students will demonstrate

a) Understand the concepts and functions of marketing.
b) Analyse marketing environment impacting the business.
c) Segment the market and understand the consumer behaviour
d) Describe the 4 p's of marketing and also strategize marketing mix
e) Describe 7 p's of service marketing mix.

Syllabus:	Hours
Module No. 1: INTRODUCTION TO MARKETING	**10**

Meaning and Definition, Concepts of Marketing, Approaches to Marketing, Functions of Marketing. **Recent trends in Marketing**-E- business, Tele-marketing, M-Business, Green Marketing, Relationship Marketing, Concept Marketing, Digital Marketing, social media marketing and E-tailing (Meaning only).

Module No. 2: MARKETING ENVIRONMENT	**10**

Micro Environment – The company, suppliers, marketing intermediaries competitors, public and customers; **Macro Environment**- Demographic, Economic, Natural, Technological, Political, Legal, Socio-Cultural Environment.

Module No. 3: MARKET SEGMENTATION AND CONSUMER BEHAVIOUR	**10**

Meaning and Definition, Bases of Market Segmentation, Requisites of Sound Market Segmentation; Consumer Behavior-Factors influencing Consumer Behavior; Buying Decision Process.

Module No. 4: MARKETING MIX	**20**

Meaning, Elements of Marketing Mix (Four P's) – Product, Price, Place, Promotion.
Product-Product Mix, Product Line, Product Lifecycle, New Product Development, Reasons for Failure of New Product, Branding, Packing and Packaging, Labeling,
Pricing – Objectives, Factors influencing Pricing Policy, Methods of Pricing;
Physical Distribution–Meaning, Factors affecting Channel Selection, Types of Marketing Channels.
Promotion – Meaning and Significance of Promotion, Personal Selling and Advertising (Meaning Only)

Module No. 5: SERVICES MARKETING	**06**

Meaning and definition of services, difference between goods and services, features of services, seven P's of services marketing (concepts only).

Skill Developments Activities:

1. Two cases on the above syllabus should be analyzed and recorded in the skill development
2. Design a logo and tagline for a product of your choice
3. Develop an advertisement copy for a product.
4. Prepare a chart for distribution network for different products.

Text Books:

1. Philip Kotler, Marketing Management, Prentice Hall.
2. Lovelock Christopher, Services Marketing: People, Technology, Strategy, PHI
3. William J. Stanton, Michael J.Etzel, Bruce J Walker, Fundamentals of Marketing, McGraw Hill Education.
4. Bose Biplab, Marketing Management, Himalaya Publishers.
5. J.C. Gandhi, Marketing Management, Tata McGraw Hill.
6. Ramesh and Jayanti Prasad: Marketing Management, I.K. International
7. Sontakki, Marketing Management, Kalyani Publishers.
8. P N Reddy and Appanniah, Marketing Management

Note: Latest edition of text books may be used.

Name of the Program: Bachelor of Business Administration (BBA)
Course Code: BBA 1.5 (OEC)
Name of the Course: Business Organization and Management

Course Credits	No. of Hours per Week	Total No. of Teaching Hours
3 Credits	3 Hrs	45 Hrs

Pedagogy: Classrooms lecture, tutorials, Group discussion, Seminar, Case studies & field work etc.,

Course outcomes: on successful completion of the course, the Students will demonstrate:

a) To Understand the concepts of Business organizations and Social Responsibilities of Business
b) To Describe the various forms of Business organization
c) To Understand the levels of managements and Describe the contribution of management thinkers
d) To demonstrate the functions of management effectively
e) To describe the technology driven work Place and some recent trends in Management

Syllabus:	Hours
Module No. 1: NATURE AND SCOPE OF BUSINESS	**08**
Meaning and Definition of Business, Characteristics, Objectives. Classification of Business Activities; Manufacturing, Trading and Services Organizations. Relationship between Trade, Industry and Commerce. Social Responsibilities of business towards stake holders.	
Module No. 2: FORMS OF BUSINESS ORGANISATIONS	**12**
Meaning and Features of Sole Proprietorship, Partnership, One Person Company, Limited Liability Partnerships, Hindu Undivided Family and Joint Stock Companies: Difference between Private and Public companies	
Module No. 3: NATURE OF MANAGEMENT	**08**
Definition , Characteristics- Management as an Art, Science or Profession - Levels of Management – Management Thoughts of FW Taylor , Henry Fayol, Max Weber and Peter Drucker.	
Module No. 4: FUNCTIONS OF MANAGEMENT	**10**
Planning – Importance, Steps in planning, Types of plans. Organising - Meaning, Organisation structure. Directing – Motivation, Leadership, Communication and Coordination – Definition and Meaning. Controlling: Concept and Process	
Module No 5: CURRENT TRENDS IN MANAGEMENT	**07**
Technology Driven Work place, Learning Organisations, Diversity of Work Force, Public Consciousness, Global market place, Community of stake holders	

Skill Developments Activities:

1. Collection of Partnership Deed
2. Collect the nature of business activities of any 10 Private and Public Companies
3. Collect the profiles of FW Taylor and Henry Fayol
4. Preparation of Imaginary Business plan
5. List the latest trends in Management

Text Books:

1. C B. Guptha - Business Organisation and Management, Sultan Chand & Sons.
2. Dr. S. C. Saxena - Business Administration & Management, Sahitya Bhawan.
3. M. C. Shukla - Business Organisation and Management. S Chand & Company Pvt. Ltd.
4. S.A Sherlekar - Business Organization, Himalaya Publishing House.
5. Y.K. Bhushan. Fundamentals of Business Organisation and Management, Sultan Chand& Sons.
6. R.K. Sharma, Business Organisation & Management Kalyani Publishers
7. Dr. I.M. Sahai, Dr. Padmakar Asthana,' Business Organisation & Administration', Sahitya Bhawan Publications Agra.
8. Richard L. Daft – Principles of management

Name of the Program: Bachelor of Business Administration (BBA)
Course Code: BBA 1.5(OEC)
Name of the Course: Skills For Management (OEC)

Course Credits	No. of Hours per Week	Total No. of Teaching Hours
3 Credits	3 Hrs	45 Hrs

Pedagogy: Classrooms lecture, tutorials, Group discussion, Seminar, Case studies & field work etc.,

Course Outcomes: On successful completion of the course, the Students will demonstrate

a) The Ability to communicate and Present effectively by inculcating listing skills
b) To Understand the value of Time through various Time Management tips and strategies
c) To take the right decisions of the enterprise for success and to achieve its predetermined goals
d) To Identify as a Responsible team member and carry out the team activates effectively and abili understand need leadership in management
e) To apply Emotional Intelligence at organization and Overcoming the conflicts using various techniques

Syllabus:	**Hours**
Module No. 1: COMMUNICATION AND PRESENTATION	**08**
Fundamentals, Types - Horizontal, Vertical, Oral, Written, Email Etiquettes; Virtual Meetings; Listening, Importance and Need, Features of a Good Listening**;** Presentation skills, Etiquettes for Effective Presentation	
Module No. 2: TIME MANAGEMENT	**10**
Importance of Discipline & Punctuality – The Pareto Principle, Time Management Matrix – Scheduling - Grouping of Activities, Overcoming Procrastination – Time Circle Planner, Time Management Tips and Strategies.	
Module No. 3: DECISION MAKING	**10**
Decision making, Importance, Types of Decisions, Programmed and Non- programmed decisions - Steps in decision making Process - Decision Making Styles -Participation in decision making.	
Module No. 4: TEAM BUILDING AND LEADERSHIP	**10**
Teams – Types of Teams, Characteristics of an effective team- Stages of team Development- Team cohesiveness and its importance. Leadership- Nature of Leadership, Leadership vs Management-Leadership traits - Leadership styles	
Module No. 5 : EMOTIONAL INTELLIGENCE AND CONFLICT MANAGEMENT	**07**
Emotional Intelligence- Concept, Components and Application of Emotions Intelligence in organizations. Conflict- Types of conflict, Sources of Conflict, Conflict resolution techniques.	

Skill Developments Activities:

1. Preparation of Business presentation
2. Team Building Practices through group exercises, team task.
3. Practice by Game play & other learning methodology for achieving Given targets
4. Writing Business Letters through E-mails

Text Books:

1. Alex K., Managerial Skills, S. Chand
2. V.S.P. Rao Managerial Skills Excel Books, New Delhi
3. David A Whetten, Cameron Developing Management skills, PHI 2008
4. Ramnik Kapoor Managerial Skills Path Makers, Bangalore
5. Kevin Gallagher, Skills development for Business and Management Students,Oxford
6. Monipally,Muttthukutty Business Communication Strategies Tata McGraw Hill.

Note: Latest edition of text books may be used.

Name of the Program: Bachelor of Business Administration (BBA)
Course Code: BBA 2.1
Name of the Course: Financial Accounting and Reporting

Course Credits	No. of Hours per Week	Total No. of Teaching Hours
4 Credits	4 Hrs	56 Hrs

Pedagogy: Classrooms lecture, tutorials, and Problem Solving.

Course Outcomes: On successful completion of the course, the Students will demonstrate

a) The ability to prepare final accounts of partnership firms
b) The ability to understand the process of public issue of shares and accounting for the same
c) The ability to prepare final accounts of joint stock companies.
d) The ability to prepare and evaluate vertical and horizontal analysis of financial statements
e) The ability to understand company's annual reports.

Syllabus:	Hours
Module No. 1: FINAL ACCOUNTS OF PARTNERSHIP FIRM	**10**
Meaning of Partnership Firm, Partnership deed-clauses in partnership deed, Preparation of Final accounts of partnership firm-Trading and Profit and Loss Account, Profit and Loss Appropriation Account, Partners capital account and Balance sheet. Goodwill- Nature, Factors influencing goodwill and methods of valuation of goodwill (Average and super profit methods)	
Module No. 2: ISSUE OF SHARES	**08**
Meaning of Share, Types of Shares – Preference shares and Equity shares – Issue of Shares at par, at Premium, at Discount: Pro-Rata Allotment; Journal Entries relating to issue of shares; Preparation of respective ledger accounts; Preparation of Balance Sheet in the Vertical form (Practical Problems).	
Module No. 3: FINAL ACCOUNTS OF JOINT STOCK COMPANIES	**12**
Statutory Provisions regarding preparation of Company Final Accounts – Treatment of Special Items, Managerial Remuneration, Tax deducted at source, Advance payment of Tax, Provision for Tax, Depreciation, Interest on debentures, Dividends, Rules regarding payment of dividends, Transfer to Reserves, Preparation of Profit and Loss Account and Balance Sheet (Vertical Form Schedule -III) (Practical Problems).	
Module No. 4: FINANCIAL STATEMENTS ANALYSIS	**12**
Comparative Statements - Comparative Income Statement, Comparative Balance Sheet; Common size Statements – Common Size Income Statement, Common Size Balance Sheet – Trend Percentages. (Analysis and Interpretation)	
Module No. 5: CORPORATE FINANCIAL REPORTING PRACTICES	**10**

Corporate Financial Reporting - meaning, types, characteristics of Corporate financial report, users of corporate financial report; Components corporate financial report– general corporate information, financial highlights, management's discussion and analysis; Financial Statements- balance sheet, income statement, cash flow statement, and notes to the financial statements; Auditor's report; Significant Accounting Policies; Corporate Governance Report; Corporate Social Responsibility Report (Discuss only Role and Significance of above components of corporate financial report).

Skill Developments Activities:

1. Collect financial statement of a company for five years and analyse the same using trend analysis.
2. Refer annual reports of two companies and list out the components.
3. Draft a partnership deed as per Partnership Act.
4. List out the accounting policies in annual report of the company

Text Books:

1. Stephen P. Robbins, Management, Pearson
2. Koontz and O‟‟Donnell, Management, McGraw Hill.
3. L M Prasad, Principles of management, Sultan Chand and Sons
4. V.S.P Rao/Bajaj, Management process and organization, Excel Books.GH25
5. Appanniah and Reddy, Management, HPH.
6. T. Ramaswamy : Principles of Management, HPH.

Note: Latest edition of text books may be used.

Name of the Program: Bachelor of Business Administration (BBA)
Course Code: BBA 2.2
Name of the Course: Human Resource Management

Course Credits	No. of Hours per Week	Total No. of Teaching Hours
4 Credits	**4 Hrs**	**56 Hrs**

Pedagogy: Classroom's lecture, tutorials, Group discussion, Seminar, Case studies & field work etc.,

Course Outcomes: On successful completion of the course, the students will be able to demonstrate

a) Ability to describe the role and responsibility of Human resources management functions on business
b) Ability to describe HRP, Recruitment and Selection process
c) Ability to describe to induction, training, and compensation aspects.
d) Ability to explain performance appraisal and its process.
e) Ability to demonstrate Employee Engagement and Psychological Contract.

Syllabus:	**Hours**
Module No. 1: Introduction to Human Resource Management	**10**
Meaning and Definition of HRM – Features Objectives, Differences between Human Resource Management and Personnel Management, Importance, Functions and Process of HRM, Role of HR Manager, Trends influencing HR practices	
Module No. 2: Human Resource Planning, Recruitment & Selection	**14**
Human Resource Planning: Meaning and Importance of Human Resource Planning, Process of HRP **HR Demand Forecasting**- Meaning and Techniques (Meanings Only) and HR supply forecasting. **Succession Planning** – Meaning and Features **Job Analysis**: Meaning and Uses of Job Analysis, Process of Job Analysis – Job Description, Job Specification**,** Job Enlargement, Job Rotation, Job Enrichment (Meanings Only) **Recruitment** – Meaning, Methods of Recruitment, Factors affecting Recruitment, Sources of Recruitment **Selection** – Meaning, Steps in Selection Process, Psychometric tests for Selection, Barriers to effective Selection, Making Selection effective; Placement, Gamification – Meaning and Features	
Module No. 3: Induction, Training and Compensation	**10**
Induction: Meaning, Objectives and Purpose of Induction, Problems faced during Induction, Induction Program Planning. **Training**: Need for training, Benefits of training, Assessment of Training Needs and Methods of Training and Development; Kirkpatrick Model; Career Development. **Compensation:** Direct and Indirect forms of Compensation (Meaning Only), Compensation Structure.	
Module No. 4: Performance Appraisal, Promotion & Transfers	**14**

Performance appraisal: Meaning and Definition, Objectives and Methods of Performance Appraisal – Uses and Limitations of Performance Appraisal, Process of Performance Appraisal

Promotion: Meaning and Definition of Promotion, Purpose of Promotion, Basis of Promotion **ransfer:** Meaning of Transfer, Reasons for Transfer, Types of Transfer, Right Sizing ofWork Force, Need for Right Sizing

Module No. 5: Employee Engagement and Psychological Contract	**08**

Employee Engagement (EE): Meaning and Types of EE, Drivers of Engagement - Measurement of EE, Benefits of EE. **Psychological contract**: Meaning and features

Skill Developments Activities:

1. Preparation of Job Descriptions and Job specifications for a Job profile
2. Choose any MNC and present your observations on training program
3. Develop a format for performance appraisal of an employee.
4. Discussion of any two Employee Engagement models.
5. Analysis of components of pay structure based on the CTC sent by the Corporate to the institute for the various jobs of different sectors.

Textbooks:

Aswathappa, Human Resource Management, McGraw Hill

Edwin Flippo, Personnel Management, McGraw Hill

C.B.Mamoria, Personnel Management, HPH

Subba Rao, Personnel and Human Resources Management, HPH

Reddy & Appanniah, Human Resource Management, HPH

Madhurimalal, Human Resource Management, HPH

S.Sadri & Others: Geometry of HR, HPH

Rajkumar: Human Resource Management I.K. Intl

Michael Porter, HRM and Human Relations, Juta & Co.Ltd.

K. Venkataramana, Human Resource Management, SHBP

Note: Latest edition of textbooks may be used.

Name of the Program: Bachelor of Business Administration (BBA)
Course Code: BBA 2.3
Name of the Course: BUSINESS ENVIRONMENT

Course Credits	No. of Hours per Week	Total No. of Teaching Hours
4 Credits	**4 Hrs**	**56 Hrs**

Pedagogy: Classrooms lecture, tutorials, Group discussion, Seminar, Case studies.

Course Outcomes: On successful completion Student will demonstrate

a) An Understanding of components of business environment.
b) Ability to analyse the environmental factors influencing business organisation.
c) Ability to demonstrate Competitive structure analysis for select industry.
d) Ability to explain the impact of fiscal policy and monetary policy on business.
e) Ability to analyse the impact of economic environmental factors on business.

Syllabus:	**Hours**
Module No. 1: INTRODUCTION BUSINESS ENVIRONMENT	**12**
Meaning of business, scope and objectives Business, business environment, Micro and Macro-environment of business (social, cultural, economic, political, legal technological and natural) Impact of these factors on decision making in business, Environmental analysis.	
Module No. 2: GOVERNMENT AND LEGAL ENVIRONMENT	**16**
Government Functions of the State, Economic role of government, State intervention in business- reasons for and types of state intervention in business. Impact of Monetary policy, Fiscal policy, Exim policy and industrial policy on business. **Legal environment -** Various laws affecting Indian businesses	
Module No. 3: ECONOMIC ENVIRONMENT AND GLOBAL ENVIRONMENT	**13**
An overview of economic environment, structure of economy, factors affecting economic environment. **Globalisation of business;** meaning and dimensions, stages, essential conditions of globalisation, foreign market entry strategies, merits and demerits of globalisation of business, Impact of Globalisation on Indian businesses, Forms of globalisation of businesses - MNCs, TNCs etc..	
Module No. 4: TECHNOLOGICAL ENVIRONMENT	**10**
Meaning and features; types of innovation, Impact of Technological changes on business, Technology and Society, Technological Acquisition modes, IT revolution and business, Management of Technology.	
Module No. 5: NATURAL ENVIRONMENT	**05**
Meaning and nature of physical environment. Impact of Natural environment on business.	

Skill Developments Activities:

a) List out key features of recent Monetary policy published by RBI impacting businesses.
b) Give your observation as to how technology has helped society.
c) Draft Five Forces Model for Imaginary business.
d) Identify the benefits of Digital transformation in India.

Text Books:

1. Dr. K Ashwatappa: Essentials Of Business Environment
2. Sundaram & Black: The International Business Environment; Prentice Hall
3. Chidambaram: Business Environment; Vikas Publishing
4. Upadhyay, S: Business Environment, Asia Books
5. Chopra, BK: Business Environment in India, Everest Publishing
6. Suresh Bedi: Business Environment,Excel Books
7. Economic Environment of Business by M. Ashikary.
8. Business Environment by Francis Cherrinulam

Note: Latest edition of text books may be used.

Name of the Program: Bachelor of Business Administration (BBA)
Course Code: BBA 2.3
Name of the Course: Business Mathematics

Course Credits	No. of Hours per Week	Total No. of Teaching Hours
4 Credits	**4 Hrs**	**56 Hrs**

Pedagogy: Classroom's lecture, tutorials, Problem solving.

Course Outcomes: On successful completion of the course, the students will demonstrate

a) The Understanding of the basic concepts of business maths and apply them to create solve and interpret application problems in business
b) Ability to solve problems on various types of equation.
c) Ability to solve problems on Matrices and execute the laws of indices, law of logarithm and evaluate them.
d) Ability to apply the concept of simple interest and compound interest bills discounted etc. and apply them in day-to-day life.
e) Ability to solve problems on Arithmetic progression, Geometric progression and construct logical application of these concepts.

Syllabus:	**Hours**
Module No. 1: NUMBER SYSTEM	**04**
Introduction – Natural Numbers - Even Numbers – Odd Numbers – Integers – Prime Numbers – Rational and Irrational numbers, Real Numbers, HCF and LCM (Simple problems).	
Module No. 2: THEORY OF EQUATIONS	**10**
Introduction – Meaning - Types of Equations – Simple/ Linear Equations and Simultaneous Equations (only two variables), Elimination and Substitution Methods only. Quadratic Equation - Factorization and Formula Method ($ax^2 + bx + c = 0$ form only). Simple problems.	
Module No.3: INDICIES, MATRICES AND LOGARITHMS	**16**
Meaning – types – operation on matrices – additions – subtractions and multiplication of two matrices – transpose – determinants – minor of an element – co-factor of an element – inverse – crammers rule in two variables – problems. Indices and Logarithms: Meaning- Basic Laws of Indices and their application for simplification. Laws of Logarithms –Common Logarithm, Application of Log Table for Simplification.	
Module No. 4: COMMERCIAL ARITHMETIC	**16**
Simple Interest, Compound Interest including yearly and half yearly calculations, Annuities, Percentages, Bills Discounting, Ratios and proportions, duplicate-triplicate and sub-duplicate of a ratio. Proportions: third, fourth and inverse proportion - problems.	
Module No. 5: PROGRESSIONS	**10**
PROGRESSIONS: Arithmetic Progression - Finding the 'n^{th}' term of AP and Sum to nth term of AP. Insertion of Arithmetic Mean Geometric Progression – Finding the 'n^{th}' term of GP and sum to 'n^{th}' term of GP and insertion of Geometric Mean.	

Skill Developments Activities:

1. Develop an Amortization Table for Loan Amount – EMI Calculation.
2. Secondary overhead distribution summary using Simultaneous Equations Method.
3. Application of Matrix In Business Problems

Text Books:

1. Saha: Mathematics for Cost Accountants, Central Publishers
2. R.G. Saha and Others – Methods and Techniques for Business Decisions, VBH
3. Dr. SanchetiandKapoor: Business Mathematics and Statistics, Sultan Chand
4. Zamarudeen: Business Mathematics, Vikas
5. R.S Bhardwaj :Mathematics for Economics and Business
6. Madappa, mahadi Hassan, M. IqbalTaiyab – Business Mathematics, Subhash
7. G.R. Veena and Seema : Business Mathematics and Statistics I.K. Intl Publishers

Note: Latest edition of text books may be used.

Name of the Program: Bachelor Business Administration (BBA)
Course Code: BBA.2.6 (OEC)
Name of the Course: People Management

Course Credits	No. of Hours per Week	Total No. of Teaching Hours
3 Credits	3 Hrs	45 Hrs

Pedagogy: Classroom's lecture, tutorials, Group discussion, Seminar, Case studies.

Course outcome: On successful completion of the course, student will demonstrate:

1. Ability to examine the difference between People Management with Human resource Management
2. Ability to explain the need for and importance of People Management.
3. Ability to explain role of manager in different stages of performance management process
4. Ability to list modern methods of performance and task assessment.
5. Ability to analyse the factors influencing the work life balance of an working individual.

Syllabus:	Hours
Module No. 1: Introduction to People Management	**06**
Diversity in organisation: age, gender, ethnicity, race, and ability. People Management: Meaning, Features, Significance of people management, Difference between People Management and Human Resource Management, impact of individual and organizational factors on people management.	
Module No. 2: Getting Work Done and Assessment and Evaluation	**12**
Getting work done: Challenges of getting work done, significance of prioritization and assigning work to team members. Performance Management: meaning, role of a manager in the different stages of the performance management process, Types of Performance assessment, Assessment and Evaluation Process of evaluation of tasks in the organisation. Modern tools of assessment and evaluation of tasks and performance.	
Module No. 3: Building Peer Networks and Essentials of Communication	**12**
Building Peer Networks: Understanding the importance of peer networks in an organization; being able to influence those on whom you have no authority; challenges Peer networking and different types of people networking in the workplace. **Essentials of Communication**: Concept of the communication process with reflection on various barriers to effective communication and ways to overcome, Types of Communication and Channels of Communication.	
Module No. 4: Motivation	**08**
Meaning, Importance and need for motivation, team motivation- meaning, importance team motivation, types of Motivators and Modern methods of motivation	
Module No. 5: Managing Self	**07**
Reflection on what does it mean to be a people manager; building a personal development plan for oneself, Self-Stress Management: Causes for stress, work life Balance, Importance of Work life balance, Factors influencing Work life Balance.	

Skill Developments Activities:

1. Analyse two cases on any of the above content indicated above.
2. List out the modern tools to performance assessment and evaluation.
3. Conduct a survey of work life balance of working individuals
4. Draft a Career development of working individual in the middle level management.

Text Books:

1. McShane, Steven L. and Mary Ann Von Glinow, Organizational Behavior: Emerging Knowledge and Practice for the Real World. McGraw-Hill, latest edition, ISBN: 0-07-115113-3.
2. Bernardin, H. John and Joyce E. A. Russell. Human Resource Management: An Experiential Approach. McGraw-Hill, 6/e. ISBN: 0078029163
3. Argyris, C. (1974). Personality vs. Organization. Organizational Dynamics. Vol. 3. No. 2, Autumn.
4. Blume, B. Baldwin, T. and Ryan, K. (2013). Communication Apprehension. A barrier to students leadership, adaptability and multicultural appreciation. Academy of Management Learning & Education, Jun, Vol. 12 Issue 2, p158-172.
5. Colquitt, J.A., LePine, J.A., & Wesson, M.J. (2009) Organizational Behavior: Improving Performance and Commitment in the Workplace (International edition). New York: McGraw-Hill.
6. Goleman, D. (1998). Working with Emotional Intelligence. Bantam Books,

Note: Latest edition of text books may be used.

Name of the Program: Bachelor of Business Administration
Course Code: BBA 2.6 (OEC)
Name of the Course: Functional Areas of Management

Course Credits	No. of Hours per Week	Total No. of Teaching Hours
3 Credits	3 Hrs	45 Hrs

Pedagogy: Classroom's lecture, tutorials, Group discussion, Seminar, Case studies.

Course Outcomes: On successful completion Student will demonstrate ;

a) Understand the concepts and functions of marketing and analyzing the Marketing Mix.
b) Ability to describe Man power Planning and Implement Recruitment, Selection process and Evaluate Performance
c) Understanding various functions of Financial Management
d) Understanding the basics of production and operations management
e) Understanding the need for Information Systems in organization.

Syllabus:	Hours
Module No. 1: MARKETING MANAGEMENT	**10**
Meaning and Definitions-Evolution of marketing-Marketing Vs Selling-Marketing concepts-Nature and Scope of Marketing-Functions of Marketing, Elements of Marketing Mix (7Ps)	
Module No. 2: HUMAN RESOURCE MANAGEMENT	**10**
Meaning and Definitions-Functions of HR-Man power planning-Recruitment-Selection-Training and development- Placement-Compensation-Incentives-monetary and non monetary-Performance Appraisal	
Module No. 3: FINANCIAL MANAGEMENT	**10**
Meaning-Definitions-Objectives-Profit maximization vs. Wealth maximization-Scope of Financial management-Investment decisions- Financing decisions, Dividend decisions-Working capital decisions	
Module No. 4: PRODUCTION AND OPERATIONS MANAGEMENT	**08**
Meaning, Objectives and Functions -Plant Location -Plant Layout-Factors-Types- Production Planning and Control-Inventory Management-Total Quality Management-Concept of Supply Chain management	
Module No. 5: INFORMATION SYSTEM	**07**
Introduction, Data Vs Information, Information system in an Organisation, Importance of Information System in Decision making - Information system and sub systems	

Skill Developments Activities:

1. List the sources of recruitment and draw a Selection process chart of an organisation
2. Draw a chart showing a Plant layout operations
3. List out the current trends in Marketing and Human Resource Management
4. List out the Factors Influencing Financing and Investment Decisions

Books Recommended:

1. Richard Pettiger. Introduction to Management, Palgrave Macmillan, New York
2. M.J.Mathew,Functional Management, RBSA Publishers, Jaipur.
3. Meenakshy Gupta . Principles of Management, PHI, New Delhi.
4. Koonts and Heinz Weihrich. Essentials of Management, Tata McGraw-Hill Publishing Co.Ltd.
5. Modern Production Management Buffa Ekwood. S, and Rakesh K. Saren, John wiley and Sonss., 2003
6. Operations Management K.N. Krishnaswamy
7. Management Information System – C.S.V Murthy

JSS COLLEGE OF ARTS COMMERCE & SCIENCE

(Autonomous)

Ooty Road, Mysuru – 25

DEPARTMENT OF COMMERCE AND MANAGEMENT

Syllabus

CHOICE BASED CREDIT SYSYTEM

BBA Programme

(II & III Year)

2019-20 Scheme

CDC21001

III SEMESTER

MANAGEMENT INFORMATION SYSTEM – DSC -7

L: T: P - 2:0:2

Course Outcome:

On successful completion of this course the students are able to:

CO1: Understand in depth the evolution, significance and need of Management Information System
CO2: Learn in depth the structure of MIS based on management activity
CO3: Types of information systems - Operations support system - Transaction Processing Systems - Decision support System - Process Control Systems
CO4: Identify the Information required for various levels of management and Value of information in decision making
CO5: Understand in depth the details of Managing and Controlling information
CO6: Understand in depth the ERP Concepts, Evolution of ERP, and ERP packages,

Unit 1: Introduction to MIS:
Meaning, concept - Evolution - significance and need - Objectives and features - subsystems of MIS - MIS and other academic disciplines – operating elements of MIS - structure of MIS based on management activity - based on organizational functions.

Unit 2: Concepts of Information:
Nature of information - Definition and Types of management information - data Vs information - Information for various levels of management -Value of information in decision making - age of information.

Unit 3: Value and Cost of information:
Types of information systems - Operations support system - Transaction Processing Systems - Decision support System - Process Control Systems -Executive support system - Formal and Informal information system - Knowledge Work Systems- Expert system Artificial intelligence

Unit 4: Planning Information System:
Developing information system - System Analysis and design - Implementing Information System acquisition - Managing and Controlling information system resources - Information resources management.

Unit 5: Application Technologies:
Introduction, ERP Concepts, Evolution of ERP, ERP
packages, ERP Evaluation, ERP implementation Application Examples - Tally.ERP 9.

References:

1. Management Information System – CSV Murthy
2. Management Information System – Guptha
3. Management Information System – "Management Information Systems" by James A. O'Brien Tata McGrawHill Publication.
4. Management Information System – Kenneth C. Laudon

Note: Latest edition of the text books should be used.

CDC22001

III SEMESTER

FINANCIAL ACCOUNTING – III – DSC – 8

L: T: P - 4:1:0

Course Outcome:

On successful completion of this course the students can:
CO1: Learn in depth different sources of finance and become a corporate accountant
CO2: Understand the provision of Companies Act 2013
CO3: Identify the provisions for issue of debenture and bonds
CO4: Prepare the financial statement of companies as per the schedule of Companies Act 2013
CO5: Understand the details of liquidation of company and can become a liquidator

Unit 1: Accounting for Share Capital:
Issue, forfeiture and re-issue of forfeited shares - over subscription and under subscription of shares,

Unit 2: Accounting for Debentures and Bonds:
Issue of Debentures and Bonds, types of debentures and Bonds, differences betweenshares and debentures and Bonds and Debentures. Methods of redemption of Debentures conditions for issue of debentures. Simple problems on issue of debentures.

Unit 3: Final Accounts:
Financial statements of a company profit and loss account and balance sheet. (as per new regulations)

Unit 4: Liquidation:
Liquidation of company, Preparation of liquidator's final statement of account.

Unit 5: Redemption:
Redemption of preference shares (simple problems only)

Unit 6: Accounting for Bonus Shares:
Right shares, stock option, E-Trading BSE, NSE and SEBI. Bonus shares- problems on Bonus shares.

References:

1. Financial Accounting B S Raman
2. Advanced Accounting RL Guptha&Radhaswamy M
3. Advanced Accounting M C Shukla and T S Grewal
4. Financial Accounting S P Jain and Narang K L

Note: Latest edition of the text books should be used.

CDC23001

III SEMESTER

COST ACCOUNTING – DSC -9

L:T:P - 4:1:0

Course Outcome:

On successful completion of this course the students can:

CO 1: Identify and classify different elements of cost and able to prepare cost sheet, estimation, tender and quotation

CO 2: Learn in depth characteristics of a cost accountant and help the management in decision making

CO 3: Deliberate in depth cost minimization and profit maximization

CO 4: Deliberate the details of reconciliation of cost and financial statement

CO5: Write down the characteristics of inventory, labour and overhead control techniques and apply the same in manufacturing concern

Unit 1: Cost Accounting

Introduction, meaning, definitions of cost, Costing and CostAccounting, objectives, advantages and disadvantages of Cost Accounting. Comparison between Cost Accounting and Financial Accounting, Elements of Cost, classification of Cost, Cost unit,Cost centre, statement of Cost, preparation of Cost sheet including Estimations, Quotation and Tender.

Unit 2: Materials

Meaning, nature, classifications and codification. Purchase procedure,
functions of store keeper. Inventory control-meaning, techniques-problems on stock levels, pricing the issue of materials-methods, problems on FIFO AND LIFO only.

Unit 3: Labour

Meaning, methods of time keeping and time booking, methods of remunerations
to labour overtime and idle time and their treatment problems on time wage, piece wage, Halsey and Rowan plan.

Unit 4: Overheads

Meaning, Overhead accounting process-classifications, codifications, allocation, apportionment, re-apportionment and absorption of Overheads. Problems on primary and secondary distribution (Repeated Distribution method only). Machine Hour Rate- Meaning and problems.

Unit 5: Methods of Costing:

Introduction, different methods of costing and applications-Contract Costing-problems, Process Costing-problems on Process losses only.

Unit 6: Operating Costing:

Introduction, Format of operating Cost Sheet-problems on Operating Costing- Transport undertakings only.

References:

1. Cost Accounting- S P Jain and K L Narang
2. Cost Accounting R S.N. PillaiandVBagavathi
3. Cost Accounting M Ravi Kishore
4. Cost Accounting Shukla M.C. and Grewal T.S.

Note: Latest edition of the text books should be used.

CDD21001

IV SEMESTER

QUANTATIVE TECHNIQUES– DSC -10

L:T:P - 4:1:0

Course Outcome:

On successful completion of this course the students can:
CO1: Understand in depth the classification and operation of matrices and determinants
CO2: Learn the details of progression and their application to business
CO3: Understand in detail the concept of Ratio, proportion and variation
CO4: Learn in depth the Laws of indices and logarithms and its application
CO5: Understand the details of simple interest and compound interest

Unit1: Indices
Meaning - Law of Indices and their application for simplification. Logarithms – Laws of Logarithms – Common Logarithms – Application of Logarithms for simplification.

Unit 2: Progressions
Meaning of sequence and series – Types of Progression – Arithmetic Progression and Geometric Progression – General terms and sum of 'n' terms of Arithmetic Progression and Geometric Progression – Business applications – Problems on Arithmetic and Geometric Progression.

Unit3:Ratio Proportions and Percentages
Meaning and their application to business. Permutations – Factorial notations – Linear and circular Permutations. Combinations – Business applications – problems on Permutations and Combinations.

Unit 4: Commercial Arithmetic
Simple interest and Compound interest- Bills discounting concepts, Bankers discount, true discount, Bankers gain and present value of bill.

Unit 5: Matrices and determinants
Meaning, Definition and types of matrices – Matrix operations and properties.Determinants – Determinants of a square Matrix – Solutions of linear equations by usingCramer's Rule.

References:

1.Business Mathematics---D C Sancheti and V K Kapoor
2. Business Mathematics---K Madappa and M S Sridhar Rao
3. Business Mathematics---P R Vittal
4. Commercial Arithmetic---R H Dhareshwar

Note: Latest edition of the text books should be used.

CDD22001

IV SEMESTER

COMMERCIAL LAW– DSC -11

L:T:P - 4:1:0

Course Outcome:

On successful completion of this course the students can:

CO1: Understand in details various laws related to business and able to work as legal adviser of Business enterprises

CO2: Understand the characteristics of legal environment and practice business ethics

CO3: Learn in depth and apply the basic legal knowledge to business enterprises

CO4: Understand the characteristics of different intellectual properties and protect them

CO5: Deliberate the provisions of competition Protection Act 2002

CO6: Identify the provisions of special contracts

Unit 1: Contract

Definition – Essentials – Types – Offer – Acceptance - Rules –Consideration- Rules and Exceptions.

Unit 2: Contractual Capacity

Minor's Agreement – Free Consent – Essentials.Discharge ofContract – Modes – Remedies.

Unit 3: Special Contracts

Contract of Indemnity - Guarantee - Bailment and Pledge - Contract of Agency -Essentials - Rights and liabilities.

Unit 4: Intellectual Property Rights

Meaning – Provisions – Importance – Cyber Law –Meaning – Types of Crimes – Offence and Punishment.

Unit 5: Competition Protection Act, 2002

Objectives, Anti Competition Agreement, Prevention and Abuse of Dominant Position, Competition Commission of India.

References:

1. M.C. Kuchhal, and VivekKuchhal, *Business Law*, Vikas Publishing House, New Delhi.
2. Avtar Singh, *Business Law*, Eastern Book Company, Lucknow.
3. Ravinder Kumar, *Legal Aspects of Business*, Cengage Learning
4. SN Maheshwari and SK Maheshwari, *Business Law*, National Publishing House, New Delhi.

Note: Latest edition of the text books should be used.

CDD23001

IV SEMESTER

ORGANISATIONAL BEHAVIOUR– DSC -12

L:T:P - 3:1:0

Course Outcome:

On successful completion of this course the students can:

CO1: Understand in detail behaviour of employees and able to manage them efficiently

CO2: Identify in details employees performance and able to motivate for effective performance

CO3: Learn in depth and analyse the behaviour of employees

CO4: Understand in details key positions in an organisation and able to occupy them

CO5: Learn in details with examples frame policies and strategies in organisation

Unit 1:Introduction

Organisational Behaviour: Introduction, definition, historical development, fundamental principles of OB, contributing disciplines, approaches, challenges and opportunities.

Unit 2: Foundations of Individual Behaviour-Individual Behavior

Foundations of individual behavior. Ability**:** Intellectual abilities, Physical ability, the role of disabilities. Personality**:** Meaning, formation, determinants, traits of personality, personality attributes influencing OB .Attitude**:** Formation, components of attitudes, relation between attitude and Behavior.

Unit 3: Perception and Emotions-Perception

Process of perception, factors influencing perception, link between perception and individual decision making. Emotions**:** Affect, mood and emotion and their significance, basic emotions, emotional intelligence, self-awareness, self management, social awareness, relationship management.

Unit 4: Motivation and Leadership-Motivation

Meaning, theories of motivation-needs theory, two factor theory, Theory X and Y, application of motivational theories**.** Leadership**:** Meaning, styles of leadership, leadership theories, trait theory, behavioural theories, managerial grid, situational theories-Fiedler's model, SLT, transactional and transformation leadership.

Unit 5: Group Behaviour

Definition, types, formation of groups, building effective teams. Conflict**:** Meaning, nature, types, process of conflict, conflict resolution. Power and politic**s:** Basis of power, effectiveness of power tactics.

Unit 6: Emerging Challenges:

Emerging challenges, managing diversity, Behavior Action, technology transformation, e-business, promoting ethical Behavior.

References:

1. Organisational Behavior, Stephen P Robbins, Timothy A. Judge, NeharikaVohra, 14th Edition, Pearson
2. Organization Behaviour – Ashwathappa, Himalaya Publication House
3. Organisational Behaviour: A modern approach – Arun Kumar and Meenakshi, Vikas Publishing House
4. Organisational Behaviour – Fred Luthans, McGraw Hill International

Note: Latest edition of the text books should be used.

CDD24001

IV SEMESTER

MANAGEMENT ACCOUNTING – DSC -13

L:T:P - 4:1:0

Course Outcome:

On successful completion of this course the students can:

CO1: Learn in depth the characteristics to become a management accountant and able to work effectively

CO2: Understand in detail the required characteristics to become a good decision maker and able to make effective decisions

CO3: Understand in depth the accounting for management and able to occupy key position in an organisation

CO4: Learn in depth the financial analysis techniques and able to analyse and interpret the financial statements

CO5: Learn in depth the details of different types of budget and able to prepare them

CO6: Understand in depth standard costing and variance analysis

Unit 1: Management Accounting

Meaning and Definitions, Nature, Scope and Objectives of Management Accounting, Difference between Cost and Management Accounting and Management Accounting and Financial Accounting. Limitations of Management Accounting.

Unit 2: Marginal Costing

Basic concepts and Definitions, assumptions contribution, P/V ratio.BEP, margin of safety. Make or buy decisions, graphical analysis.

Unit 3: Relevant Costs

Meaning, Distinction between Incremental Cost and Opportunity Cost. Simple problems on relevant cost in decision making.

Unit 4: Analysis of Financial Statements

Meaning, tools of financial statements-(Common size, comparative, Trend analysis, Ratio analysis).Profitability Ratio- G/P, N/P, Operating Ratio, EPS, Turnover Ratio, Debtors Turnover ratio, Creditors Turnover ratio, Stocks Turnover ratio, working Capital Turnover ratio, Fixed Assets turnover ratio. Financial ratio- Current ratio, Liquid ratio, Debt-equity ratio, Proprietary ratio, (problems on above ratio only).

Unit 5: Budgetary Control

Definitions - Budget, Budgetary control, objectives, Basic concepts, key factors. Types of Budgets, problems on Flexible Budget, Cash Budget and Sales Budget.

Unit 6: Standard Costing

Meaning, Definition, Difference between standard costing and budgetary control, Advantages and limitations, Variance analysis. Simple problems on material and labour variances.

References

1. Maheshwari, S.N., and Mittal, S.N. Cost Accounting: Theory and Problems, Shree Mahavir Book Depot (Publishers), Delhi.
2. M.N.Arora, Management Accounting, Theory, Problems and Solutions, Himalaya Publishing House
3. Horngren, C.T., Foster, G, and Datar, S.M., Cost Accounting: A Managerial Emphasis, Prentice Hall of India Pvt. Ltd., New Delhi.
4. Henke, E.O., and Spoede, C.W., Cost Accounting: Managerial Use of Accounting Data,PWS-KENT Publishing Company, Boston.

Note: Latest edition of the text books should be used.

CDE21001

V SEMESTER

COMPANY LAW– DSC -14

L:T:P - 3:1:0

Course Outcome:

On successful completion of this course the students can:
CO1: Understand in depth Memorandum and Articles of Association and able to draft them
CO2: Learn in details the Formation of a Joint Stock Company
CO3: Write down the details of conducting the Board of Directors and Subcommittee meetings
CO4: Identify the provisions relating to Membership of a company
CO5: Learn in details Company frauds and their prevention
CO6: Understand in depth characteristics of different types of company and corporate veil

Unit 1: Company
Company – Definition – Features – Types - Corporate Veil and lifting of Corporate Veil (as per Companies Act of 2013).

Unit 2: Company Formation
Company Formation –Stages – CIN - Corporate Social Responsibility - Meaning Scope - Constitution of CSR Committee – CSR expenditure.

Unit 3: Company Documents
Memorandum of Association - Articles of Association – Meaning – Contacts –Prospectors – Meaning – Types - Liabilities towards misstatements in Prospects.

Unit 4: Membership
Membership – Modes - Rights Key Managerial Personnel as per Companies Act 2013- Secretary Directors - Rights and Duties Meeting – Types - Terms.

Unit 5: One Person Company
One Person Company - LLP Limited Liability Partnership - Ministry of Company Affairs – Setup – Scope – Objectives - Company Frauds and Scams –Types – Prevention – Credit Rating.

References:

1. M.C. Kuchhal, and VivekKuchhal, *Business Law*, Vikas Publishing House, New Delhi.
2. Avtar Singh, *Business Law*, Eastern Book Company, Lucknow.
3. Ravinder Kumar, *Legal Aspects of Business*, Cengage Learning
4. SN Maheshwari and SK Maheshwari, *Business Law*, National Publishing House, New Delhi.

Note: Latest edition of the text books should be used.

CDE22001

V SEMESTER

BUSINESS STATISTICS - I – DSC -15

L:T:P - 4:1:0

Course Outcome:

On successful completion of this course the students can:
CO1: Understand in depth the characteristics of statistics and data collection
CO2: Learn in details with examples Measures of Central tendency
CO3: Understand the classification and characteristics of Measures of dispersion
CO4: Learn in detail the correlation and determine the relation between two variables
CO5: Understand in depth regression and able to find unknown variable value based on known variable value

Unit 1: Statistics
Statistics – Meaning – Definition, characteristics, advantages and limitations-Collection of data-methods of collecting primary data and sources of secondary data-Classification and Tabulation of data. Bar diagram, Histogram and Pie chart

Unit 2: Measures of central tendency
Measures of central tendency-Arithmetic Mean, Median, quartiles and Mode. Geometric Mean and Harmonic Mean (Individual series only)

Unit 3: Measures of Dispersion
Measures of Dispersion – Quartile Deviation – Standard deviation – Co-efficient of variation. Skewness-Karl Pearson and Bowley's co-efficient of skewness

Unit 4: Correlation
Correlation-Meaning-types-Karl Pearson's co-efficient of correlation-Spearman's Rank correlation co-efficient. Probable error

Unit 5: Regression Analysis
Regression analysis-Construction of regression equations-Estimation

References:

1.Statistical Methods—S P Gupta
2. Fundamentals of Statistics—D N Elhance
3. Statistics—Sancheti and Kapoor
4. Statistics---R S N Pillai and Bhagavathi

Note: Latest edition of the text books should be used.

CDE23001

V SEMESTER

TAX MANAGEMENT– I – DSC -16

L:T:P - 4:1:0

Course Outcome:

On successful completion of this course the students can:

CO1: Learn in depth Income Tax Act of 1961 and able to practice as Tax Consultant and Tax Practitioner

CO2: Identify the different heads of income and able to compute assessable income

CO3: Identify in detail different sections of IT Act to reduce tax liability

CO4: Deliberate in details with examples and appear before IT tribunal on behalf of his clients

CO5: Understand in details with examples IT Authorities and able to work in different position of CBDT

Unit 1: Introduction to Income Tax

Introduction to Income Tax-Income Tax-Income-Person-Income-Person-Assessment year-Previous year- Assessee - Gross Total Income-Total Income-Exempted Income- Agricultural Income –Residential Status and Incidence of Tax (Individuals Only)

Unit2: Income from Salary

Income from Salary-Meaning of salary- Allowances- Perquisites-Valuations of perquisites-Provident fund-Deductions and U/S 24-Computation of Income from House Property.

Unit 3: Income from House Property

Income from House Property-Basis of Charge –Exempted Income from House Property– Annual Value-Determination of Annual Value- Deduction U/S 24- Computation of Income from House Property.

Unit 4: Profits and Gains of Business and Profession

Profits and Gains of Business and Profession-Meaning and Definition of Business and Profession, Expenses and Losses, Expressly allowed expenses and Losses Expressly Disallowed – Computation of Income from Business and Profession.

Unit 5: Deduction Under Chapter VI A

Deduction under Chapter VI A-Deductions from section 80C TO 80U (Applicable to Individual only)

Unit 6: Income Tax Authorities:

Income Tax Authorities - Structure-Functions and Powers of various Income Tax Authorities.

References:

1. Income Tax Law and Practice – S P Goyal and Meharotra
2. Problems and solutions in Income Tax -S P Goyal and Meharotra
3. Income Tax Law and Accounts – S P Goyal and Meharotra
4. Law and Practice of Income Tax - S P Goyal and Meharotra

Note: Latest edition of the text books should be used.

CDE24001

V SEMESTER

BUSINESS RESEARCH METHODS – SEC -1

L:T:P - 3:1:0

Course Outcome:

On successful completion of this course the students can:

CO1: Learn in depth different methods of research, methodology, data collection, analysis and interpretation of data to become a good business researcher

CO2: Understand and able to report about various issues of different organisations through research report

CO3: Understand the details of types of Business Research and Research design

CO4: Identify and contribute to the discipline of commerce and management through the research

CO5: Deliberate the details of Data analysis and methods of analysis

CO6: Specify in detail the sampling with examples

Unit 1: Business Research

Nature and Scope of Business Research, Types, Role of Business Research in decision making. Applications of Business Research; The Research process – Steps in the research process; the research proposal; Problem Formulation: Management decision problem vs. Business Research problem.

Unit 2: Research Design:

Research Design: Exploratory, Descriptive & Causal. Validity in experimentation internal validity and external validity. Secondary Data Research: Advantages & Disadvantages of Secondary Data, Criteria for evaluating secondary sources, secondary sources of data in Indian Context, Syndicated Research (in India) Primary Data Collection: Survey Vs Observations.

Unit 3:Measurement & Scaling:

Measurement & Scaling: Primary scales of Measurement-Nominal, Ordinal, and Interval &Ratio. Scaling techniques-paired comparison, rank order, constant sum, semantic differential, itemized ratings, Likert Scale; Questionnaire-form & design.

Unit 4: Sampling:

Sampling: Sampling techniques, determination of sample size using statistical techniques.

Unit 5: Methods of Analysis:

Methods of Analysis: Analysis of Variance (ANOVA) One-Way & Two-Way, Chisquare test (goodness of Fit). Multivariate Data Analysis: Factor Analysis (Principal Component Analysis), Discriminant Analysis (only theory)

References:

1. Chawla, D, &Sondhi,N. (2011) Research Methodology Concepts and Cases (1st ed.). Vikas Publishing House
2. Malhotra, N & Dash. S (2010) Marketing Research An Applied Orientation (6th ed.). Pearson, Prentice Hall of India.
3. Zikmund, W.G., Babin, B.J., Carr, J.C. & Griffin, M. (2013). Business Research Methods (9th ed.). Cengage Learning.
4. Johnson, R.A. &Wichern, D.W. (1997) Business Statistics-Decision Making with Data (1st ed.). John Wiley & Sons.

Note: Latest edition of the text books should be used.

CDE25001

V SEMESTER

PROJECT MANAGEMENT –SEC -1

L:T:P - 3:1:0

On successful completion of this course the students can:

CO1: Learn in depth the classification of projects, stages in project cycle, identification, formulation and implementation.

CO2: Understand and able to report about the role and responsibilities of project manager.

CO3: Understand the details of Project formulation, formulation stages and feasibility report

CO4: Identify the Administrative agencies for project approval, Ministry of Finance, Bureau of public enterprises planning commission Public Investment Board.

CO5: Understand and able to Estimate the Project Cost

CO6: Understand and able to prepare the project report.

Unit 1: Project

Project – meaning, definition, characteristics, importance, types, steps in identification ofprojects - features – classification of projects - stages in project cycle – identification, formulation and implementation.

Unit 2: Project Management

Meaning and scope, Technical appraisal, Environmental appraisal, Managerial appraisal Concepts of project management**:** concept of a project, categories of projects – tools and techniques for project management. The project manager - roles and responsibilities of project manager.

Unit 3: Appraisal of Projects

Market feasibility, technical feasibility, financial feasibility - different types of appraisal to determine feasibility – feasibility report. Project formulation: formulation stages -bottlenecks - feasibility report - financing arrangements - finalization of project implementation schedule.

Unit4: Financial Appraisal of a Project

Evaluation Techniques – traditional and modern (theoretical aspects only). Administrative agencies for project approval: Ministry of Finance - Bureau of public enterprises planning commission public investment board.

Unit 5: Estimation of Project Cost

Preliminary expenses – cost of acquisition of fixed assets, cost on technical knowhow, acquisition of patents and licenses – documentation charges – preparation of project report. Organizing systems and procedures: working of systems - design of systems - project worksystem' design - work break down structure - project execution plan - project procedure manual project control system - planning scheduling and monitoring - monitoring contracts and project diary. Project evaluation and its objectives, types and methods.

References:

1. Entrepreneurship – Tata MC Graw hill
2. Entrepreneurship and Small Business – New Jersey: Palgrave
3. Creativity and Entrepreneurship – Jhon Kao
4. Corporate Creativity Tata MC Graw hill

Note: Latest edition of the text books should be used.

CDE26001

V SEMESTER

Marketing Management – DSE -1

Elective I - Principles of Marketing

L:T:P - 4:1:0

Course Outcome:

On successful completion of the course students can:

CO1: Learn in depth characteristics of marketing

CO2: Write down the characteristics of a new product and able to launch a new product

CO3: Learn in depth and apply the strategies for pricing the product

CO4: Deliberate the factors influencing the consumer behavior

CO5: Understand the characteristics of online marketing and able to practice online marketing

CO6: Identify the future prospect and able to forecast demand for the products

Unit 1: Introduction

Marketing – meaning functions, importance. Marketing concepts, Marketing Mix, -Product, Price, Place and Promotion, Social Marketing.

Unit 2: Product Strategy

Product Strategy- Product Planning and Product development of New Product, Product Life cycle, Product Line and Mix, Product modification and elimination, Branding and Packing decisions.

Unit 3: Consumer Behaviour

Consumer Behaviour and the impact of behavioural science on marketing creations, Factors influencing the consumer Behaviour.

Unit 4: Pricing Policies and strategies

Pricing Policies and strategies, types of pricing, factors affecting pricing decisions Promotion, types of sales Promotion, Channels of distribution.

Unit 5: Social responsibility of Marketing

Social responsibility of Marketing, Marketing Ethics, Consumerism, Environmentalism.

References:

1. Kotler, Philip, Gary Armstrong, PrafullaAgnihotri and EhsanulHaque. *Principles of Marketing*.13th edition.Pearson Education.
2. Michael, J. Etzel, Bruce J. Walker, William J Stanton and Ajay Pandit. *Marketing: Concepts and Cases.* (Special Indian Edition)., McGraw Hill Education
3. William D. Perreault, and McCarthy, E. Jerome., *Basic Marketing*. Pearson Education.
4. Majaro, Simon. *The Essence of Marketing*. Pearson Education, New Delhi.

Note: Latest edition of text books may be used

CDE27001

V SEMESTER

HUMAN RESOURCE MANAGEMENT – DSE -1

Elective I - Human Resource Management

L:T:P - 4:1:0

Course Outcome:

On successful completion of this course the students can:

CO1: Learn in depth the Evolution and Development of HRM.

CO2: Understand the trade union movement era; social responsibility era; Human relations Era; behaviourial Science Era; systems approach era and contingency approach era.

CO3: Understand the details of need for and Importance of HRP- Human Resource Planning process; Human Resource information system and Barriers to HRP.

CO4: Identify the Recruitment practices in India

CO5: Understand the Selection process

CO6: Understand the ability tests, Aptitude tests, Achievement tests, Intelligence tests, Personality tests- interviews objectives.

Unit 1: Introduction

Meaning and Definition; Differences between Personnel Management and HRM; objectives; scope; functions; Evolution and Development of HRM- trade union movement era; social responsibility era; Human relations Era; Behaviourial Science Era; systems approach era contingency approach era.HRM in India- an overview.

Unit 2: Human Resource Planning

Definition, Man-power Planning vis-à-vis HR planning, objectives of HRP; Need for and Importance of HRP- Human Resource Planning process; Human Resource information system, Barriers to HRP.

Unit 3: Job-analysis and design; Job analysis- job description- job specification, job evlaution-uses of job analysis, process of Job Analysis- methods of data collection, concept of Job Design, factors affecting job design; Techniques of job Analysis-work simplification, job rotation, Job enrichment, Job Enlargement-ways to enrich job.

Unit 4: Recruitment

Meaning and definition; factors affecting recruitment-internal and external sources of recruitment-internal and external sources- evaluation of internal and external sources; recruitment process; Recruitment practices in India –an overview- Methods of Recruitment-direct, indirect and third party method.

Unit 5: Selection

Meaning and definition, differences between recruitment and Selection, Need for scientific selection, Selection process- preliminary interview, application blanks, Selection tests, Types oftests - ability tests, Aptitude tests, Achievement tests, Intelligence tests, Personality tests-interviews objectives, Types, Final selection, Induction, meaning objectives, Phases of induction.

References:

1. H.R.M – L.M Prasad
2. Fundamentals of Organisation & Management Y.K Bhushan
3 Fundamentals of Organisation & Management – M.C Shukla
4. Management of Human Resources – Rakesh K.Chopra

Note: Latest edition of the text books should be used.

CDE28001

V SEMESTER

FINANCIAL MANAGEMENT– DSE -1

Elective I - Financial Management

L:T:P - 4:1:0

Course Outcome:

On successful completion of this course the students can:

CO1: Learn in depth the concepts of Profit Maximization and Wealth Maximization.

CO2: Understand and able to identify the Sources of finance.

CO3: Understand the concepts of Cost of Debt, Cost of Preference Capital, Cost of Equity, Cost of Equity under CAPM, Cost of Retained Earnings, -Weighted Cost of Capital.

CO4: Understand the theories of Capital Structure-Net Income approach, Net operating Income theory, Traditional Approach, MM Hypothesis.

CO5: Understand and identify the Factors influencing Dividend decision

CO6: Understand the relevance of Dividend Policy.

Unit 1: Introduction to Financial Management

Nature, Scope, and objectives of Financial Management-Profit Maximization and Wealth Maximization, EVA- Risk and Return, Financial Engineering, Time value of Money.

Unit 2: Financing Decisions

Sources of long-term financing, Concept of Leverage- Operating Leverage, Financial Leverage, Combined Leverage, Computation of Cost of Capital- Cost of Debt, Cost of Preference Capital, Cost of Equity, Cost of Equity under CAPM, Cost of Retained Earnings, -Weighted Cost of Capital.

Unit 3: Capital Structure Theories

EBIT- EPS analysis, Financial Break-even point, Theories of Capital Structure-Net Income approach, Net operating Income theory, Traditional Approach, MM Hypothesis.

Unit 4: Capital budgeting Decisions

Meaning, Features, Significance, Problems of Capital budgeting-Techniques of Capital budgeting- Traditional Methods, ARR, Pay-back period-Discounted Cash flow techniques- NPV, IRR, Profitability Index.

Unit 5: Dividend Decisions

Concept and Significance, Factors influencing Dividend decision, Relevance of Dividend Policy-Walter's Model, Gordon's Model- Irrelevance of Dividend Policy-Residual theory, MM theory.

References:

1. Financial Management M Y Khan and P K Jain
2. Financial Management I M Pandey
3. Financial Management Prasanna Chandra
4. Financial Management Rustagi R P

Note: Latest edition of the text books should be used.

CDE29001

V SEMESTER

BANKING AND INSURANCE– DSE -1

Elective I - Indian Banking System

L:T:P - 4:1:0

Course Outcome:

On successful completion of this course the students can:
CO1: Learn in depth the structure of commercial banks in India.
CO2: Understand and identify the changing face of commercial banks,
CO3: Understand the cclassification of financial markets.
CO4: Understand and identify the obligations of a banker
CO5: Understand of types of accounts
CO6: Understand and identify theSpecial types of customers

Unit 1: Role and Function of banks
Definition of Banking, Services of banks, structure of commercial banks in India, public sector banks, New private sector banks, Local Area banks, status of scheduled banks, the changing face of commercial banks, Reserve bank of India constitution and management, functions Relationship between RBI and commercial banks.

Unit 2: Role and functions of Capital markets
Classification of financial markets, Regulatory role of SEBI, Mutual funds- benefits of mutual funds- types of schemes, Role of Insurance companies-IRDA-FUNCTIONS OF IRDA-BANCASSURANCE- meaning- Factoring companies-meaning- benefits- export factoring-forfeiting- Securitisation—meaning- advantages and disadvantages.

Unit 3: Banker and customer
Definition of Customer, General Relationship between customer and banker, obligations of a banker-obligation to honour the cheques- Garnishee order-meaning application to different accounts-Banker's Rights-Right of general lien,-exceptions to the right of general lien, Right of set-off, Right of appropriation, Right to charge interest, period of limitation.

Unit 4: Types of bank accounts
Types of deposit accounts- Fixed deposit-rate of interest on FD accounts, -opening and operation of fixed deposit account, payment of interest, renewal, change of name, loss of FD receipt, Savings bank Account- Minimum balance, Recurring Deposit, current accounts,- opening of current and savings account- proper introduction, KYC guidelines, Closing of a bank account.

Unit 5: Special types of customers
Minor- Married woman, pardanashin woman, illiterate persons, Lunatics, trustees, executors and administrators, customer's attorney, joint accounts, Partnership firm, precautions for opening account in the name of partner, borrowing power of a partner- Joint stock companies-examination of documents, copy of board's resolution, Borrowing powers of company-Clubs, Societies, and charitable institutions.

References:

1.Principles of banking P N Varshney S L Gupta, T D Malhotra
2.Principles and Practice of Banking Indian Institute of Banking and Finance
3.Principles of banking MooradChoudhary
4. Agarwal, O.P, Banking and Insurance, Himalaya Publishing House

Note: Latest edition of the text books should be used.

CDE30001

V SEMESTER

TOURISM MANAGEMENT– DSE -1

Elective I - Fundamentals of Tourism

L:T:P - 4:1:0

Course Outcome:

On successful completion of this course the students can:
CO1: Understand and identify the types of Tourism
CO2: Understand in depth the History of Tourism and Tourism in India
CO3: Able to identify the Infrastructure in Tourism
CO4: Learn in depth and identify the factors affecting tourism
CO5: Able to identify the trends in tourist statistics with respect to Karnataka and India
CO6: Understand the impact of tourism in India

Unit 1: Introduction to Travel and Tourism
Tourism: Meaning, Definition, Nature, Scope, Types: Leisure/ Holiday Tourism, Cultural Tourism, Adventure Tourism, Sports Tourism, Religious Tourism, Business Tourism, Health Tourism. Tourist, Traveller, Visitor, Tourist Visitor and Excursionist: Meaning, Definition and Differentiation.

Unit 2: History & Growth of Tourism
Developments in History of Tourism – Tourism in India: Post Independence Tourism and Modern Tourism – Tourism Industry – Recent Trends in Indian Tourism industry - Concept of Paid Holiday

Unit 3: Infrastructure in Tourism
Tourism infrastructure: Types, Forms and Significance-Accommodation: Forms and Types - Attractions, Telecommunications, Transport Sector, Modes and Relative Significance- Essential and Other Support Services -Hotel Industry- Major Hotel
Chains

Unit4: Tourism Demand and Supply
Concept of demand and supply in Tourism – Unique features of Tourist Demand – Factors affecting tourism supply – Creation of ideal destination for tourism: Significance and Constraints in creation of destination- Trends in tourist statistics with respect to Karnataka and India

Unit 5: Impact of Tourism
Economic impact- social impact – cultural impact – Environmental impact – Ecological impact – Negative impact of tourism – Impact of tourism in India: Positive and Negative

References:

1. Tourism Management and Principles - McIntosh
2. Tourism Management -Goeldner
3. Tourism Management and Principles- Rebecca Shepherd.
4 Tourism: Operations and Management -Stephen Wanhill and Alan Fyall

Note: Latest edition of the text books should be used.

CDE26201

V SEMESTER

MARKETING MANAGEMENT – DSE -2

Elective II - Rural Marketing and Consumer Behaviour

L: T: P - 4:1:0

Course Outcome:

On successful completion of this course the students can:
CO1: Understand and identify thefactors affecting rural consumer behaviour
CO2: Understand in depth the Product branding and promotion in rural market
CO3: Able to identify the importance of consumer behaviour in marketing decisions
CO4: Learn in depth and identify the influence of culture on consumer behaviour
CO5: Understand the concepts of Consumer reference groups and group dynamics
CO6: Able to identify the Consumer decision making process

Unit 1: Rural Marketing
Introduction, scope, evolution, classification of rural markets, rural vs. urban markets, need for rural marketing, types of rural customers, factors affecting rural consumer behaviour.

Unit 2: Product branding and promotion in rural market
Rural product categories – FMCGs –consumer durables-agriculture goods, services, branding in rural India: fake brands, look-alikes, spell-alikes, duplicates, product promotion through melas, haats, interactive games, folk media, puppet shows.

Unit 3: Consumer behaviour
Nature, scope, importance of consumer behaviour in marketing decisions, characteristics of consumer behaviour, models of consumer behaviour.

Unit 4: Consumer reference groups and group dynamics
Different types of reference groups, reference group influence on products & brands; determinants of social class, characteristics of social class; influence of culture on consumer behaviour, introduction to sub-cultural & cross-cultural influences; opinion leadership process.

Unit 5: Consumer decision making process
Problem recognition, pre-purchase search influences, information evaluation, purchase decision (compensatory decision rule, conjunctive decision, rule, lexicographic rule, affect referral, disjunctive rule), post-purchase evaluation; situational influences.

References:

1. Kotler, Philip, Gary Armstrong, PrafullaAgnihotri and EhsanulHaque. *Principles of Marketing*.13th edition.Pearson Education.
2. Michael, J. Etzel, Bruce J. Walker, William J Stanton and Ajay Pandit. *Marketing: Concepts and Cases.* (Special Indian Edition)., McGraw Hill Education
3. William D. Perreault, and McCarthy, E. Jerome., *Basic Marketing*. Pearson Education.
4. Majaro, Simon. *The Essence of Marketing*. Pearson Education, New Delhi.

Note: Latest edition of text books may be used.

CDE27201

V SEMESTER

HUMAN RESOURCE MANAGEMENT - DSE -2

Elective II - Human Resource Development

L:T:P - 4:1:0

Course Outcome:

On successful completion of this course the students can:

CO1:Understand in depth the techniques to manage Human Resources at work place and able to occupy a position of H R Manager

CO2:Specify the details of identifying causes and able to settle problems

CO3:Deliberate the methods and techniques of training to train the Human Resources and create assets for the organisation

CO4:Identify methods of wage payment and incentives and able to adopt different methods of wage payments and incentive plans

CO5:Understand the details of becoming a motivator and counsellor

Unit 1: Introduction to HRM

Concept, evolution and development of HRM, scope of HRM, function of HRM, role of HR executives – changing role of HR in India, emerging trends in HRM- competency mapping, business process outsourcing, right sizing of workforce, flexi time, talent management, employee engagement

Unit 2: Human Resource Development

Meaning and concept of HRD, training- objectives, methods, difference between training and development , advantages and limitations of training, evaluation of training, performance appraisal – concept, need, methods. Internal mobility and separations- promotion, transfer, demotion, separations. Employee misconduct and disciplinary procedure, grievances and grievances' redressal procedure.

Unit 3:Training and Development

Introduction, meaning and definition, objectives, need and importance, benefits of training to Individuals and organization, Steps in Systematic training plan, training methods—on the job training- Job instruction training, Coaching, Mentoring, position rotation, Apprenticeship,- Off the job training- vestibule training, Apprenticeship training, classroom training, internship training, conferences, role playing, computer based training.

Unit 4: Executive development

Introduction, meaning and definition, objectives, importance, process of executive development, methods of executive development- In basket exercise, management games, case study, interpersonal skills-Role playing, sensitivity training, behavioural training, transactional analysis, Multiple Management, Job Knowledge- on the job experience, coaching, understudy, organizational knowledge, Job rotation, General Knowledge.

Unit5: Career planning and development

Introduction, meaning, objectives, career planning v/smanpower planning, Individual career planning- factors to be considered – self awareness- elements ofcareer management programme- career Models- Pyramidal model, obsolescence model, Japanesemodel- benefits to individual and organizations, Steps in career Planning.- success in career –parametersof judging career success.

References:

1. H.R.M – L.M Prasad
2. Fundamentals of Organisation& Management Y.K Bhushan
3 Fundamentals of Organisation& Management – M.C Shukla
4. Management of Human Resources – RakeshK.Chopra

Note: Latest edition of the text books should be used.

CDE28201

V SEMESTER

FINANCIAL MANAGEMENT – DSE -2

Elective II – Working Capital Management

L: T: P - 4:1:0

Course Outcome:

On successful completion of this course the students can:
CO1: Understand and identify the nature and types of Working Capital
CO2: Understand in depth the approaches to Financing of Current assets and Working Capital Estimation
CO3: Able to identify the objectives of Cash Management
CO4: Learn in depth and identify Cost and Benefits of receivables
CO5: Able to identify the types of inventories
CO6: Understand the concept of Financing of Working Capital

Unit 1: Working Capital Planning and Management
Nature and types of Working Capital, Operating and Cash cycles, Factors influencing working capital, Types of working Capital- Permanent and temporary working capital, Approaches to Financing of Current assets- Working Capital Estimation.

Unit 2: Management of Cash
Introduction, motives for holding cash, Objectives of Cash Management, Cash budget, Optimum cash balance; Baumol's Model, Miller-orr model, Management of Marketable securities.

Unit 3: Receivables Management
Introduction- Cost and Benefits of receivables, Credit Policy, Credit evaluation, Evaluation of Credit Policies.

Unit 4: Inventory Management
Types of inventories, Motives for holding inventory, Techniques of inventory management- ABC analysis, E O Q, Levels of stock, JIT.

Unit 5: Financing of Working Capital
Sources - Trade credi t- Open account, Bills payable, Accrued expenses, Commercial Papers- Bank Credit for working capital- Types of bank credit- Overdraft, Cash credit, Bills purchased and Discounting, Letter of credit, Working capital term loan- Security for bank credit- Hypothecation, Pledge, Mortgage, Lien.

References:

1.Financial Management - M Y Khan and P K Jain
2.Financial Management - I M Pandey
3. Financial Management - Prasanna Chandra

Note: Latest edition of the text books should be used.

CDE29201

V SEMESTER

BANKING INSURANCE - DSE -2

ELECTIVE II - Banking Information Technology

L:T:P - 4:1:0

Course Outcome:

On successful completion of this course the students can:
CO1: Understand in depth the concept of bank mechanization

CO2: Understand in depth the concept of Electronic fund transfer system

CO3: Able to identify the objectives of Electronic Clearing System, procedure, cyber trading and mechanism

CO4: Learn in depth and identify Cyber crime and cyber laws, penalty for damage to computer and computer system, hacking with computer system

CO5: Able to identify the MICR based national clearing system and Code allotment under MICR,

CO6: Understand the concept of Security considerations

Unit 1: Bank Mechanization
Branch computerization- meaning, benefits, online systems with mini computer networking and with main frame computers, time sharing, duplication of data bases at various levels. Electronic payment system- ATM- advantages, disadvantages, safety measures in installing ATMs, electronic clearing service, credit clearing, process, benefits of the scheme, limitations of the scheme, debit clearing, process. Corporate and personalized banking, tele-banking.

Unit 2: Electronic fund transfer system
Transfer of funds- benefits of fund transfer system- society for worldwide internet bank financial tele-communications-SWIFT- facilities of SWIFT, bank net, RBInet, special features of RBINE, two level funds transfer, fedwire, bankwire, point of sale, chip card.

Unit 3:Document handling system
Magnetic ink character recognition (MICR)-features of MICR cheques, size quality of paper, MICR equipment, benefits of MICR technology, MICR based national clearing system. Code allotment under MICR, city codes, micro- filming, benefits of microfilming, microfiche, optical disk in documents handling, Documents transmission systems.

Unit 4: Banking technology
Electronic clearing service, objectives of ECS, procedure, cyber trading, mechanism, benefits-RTGS system, multimedia, application area of multimedia, voice mail, electronic mail, multimedia based FAX, digital signatures, Cyber crime and cyber laws, penalty for damage to computer and computer system, hacking with computer system.

Unit 5: Security Considerations

Computer security, power failure, accidental damage, human errors, malicious damage, measures to check damage to computers, security measures for computers, audit trails, computer audit system, computer virus- classification of viruses, types of viruses, safety from viruses, treatment of infection from virus.

References:

1. Agarwal, O.P, Banking and Insurance, Himalaya Publishing House.
2. Satyadevi. C, Financial Services Banking and Insurance, S Chand publications.
3. Suneja H.R, Practical and Law of Banking, Himalaya Publishing House.
4. Chabra T.N, Elements of Banking Law, Dhanpatrai& Sons.

Note: Latest edition of text books may be used.

CDE30201

V SEMESTER

TOURISM MANAGEMENT– DSE -2

ELECTIVE II – Tourism Planning and Organization

L:T:P - 4:1:0

Course Outcome:

On successful completion of this course the students can:

CO1: Understand in depth the concept of Planning approaches for different forms of Tourism

CO2: Understand the concept of Travel organization

CO3: Able to identify the Functions of a Travel Agency

CO4: Learn in depth and identify Evolution of Tour operation business – Functions of Tour Operators, Sources of Income of Travel Agency and Tour Operator

CO5: Able to identify the Duties and Responsibilities - Tour guiding - Tour escort - Tour managers –Tour guides

CO6: Understand the Procedure for setting up of Travel Agency and Tour Operating Enterprises

Unit 1: Planning

Planning: Its significance in Tourism – Planning approaches for different forms of Tourism: Eco tourism, Urban Tourism, Rural Tourism – Planning for Development of a tourist destination – Impact of unplanned tourism development on a tourist destination

Unit 2: Travel organization

Organization and Functions of UNWTO, TAAI, IATA and PATA. Govt organizations in India – ITDC – Dept of Tourism – With special reference to Karnataka - Computerized Reservation System - Introduction to Computerized Reservation System - change over from Manual booking to CRS - difference between CRS & GDS

UNIT 3: Understanding Travel Agency

Travel Agency and Tour Operation Business: Definition, types, forms of organizations. Genesis and Growth of travel agency– Functions of a Travel Agency: Travel information, Documentation, Tour Counselling, Ticketing, Reservation and Itinerary, Immigration related Services

Unit 4: Tour Operation business

Definition and Differentiation, Types and Forms of Organisations – Evolution of Tour operation business – Functions of Tour Operators, Sources of Income of Travel Agency and Tour Operator - Tour Packaging : Definition, Types and Designing a tour Package - Tourist Guide : Duties and Responsibilities - Tour guiding - Tour escort - Tour managers - Tour guides - Skills and Qualities of guides - Certification of guides - How to manage tourists – Tour analysis - Pre tour and Post tour analysis – Tourist retention programs.

Unit 5: Approval, Travel Formalities

Procedure for setting up of Travel Agency and Tour Operating Enterprises: Their Role in Development of Tourism Industry - Approval from Depat of Tourism – International Air Transport Association. Travel Formalities: Passport, Visa, Health Regulation along with Travel Documents required for visiting NE region of India: Restricted Area Permit and Inner Line Permit

References:

1. Tourism Management and Principles - McIntosh
2. Tourism Management -Goeldner
3. Tourism Management and Principles- Rebecca Shepherd.
4 Tourism: Operations and Management -Stephen Wanhill and Alan Fyall

Note: Latest edition of the text books should be used.

CDF21001

VI SEMESTER

ENTREPRENEURSHIP DEVELOPMENT – DSC -17

L: T: P - 3:1:0

Course Outcome:

On successful completion of this course the students can:

CO1: Learn in depth qualities of an entrepreneur and able to become an entrepreneur

CO2: Write down the details of financial schemes offered by banks and government agencies and able to access them easily

CO3: Learn the details of mobilization of resources

CO4: Learn in depth the characteristics of customer and able to identify the customer

Unit 1: Entrepreneurial Development Perspective

Concept of entrepreneurship development and their dynamics. importance of skill, knowledge and motivation in ED. Entrepreneurial Competition, generation of business, ideas and final selection of an activity. Market survey report and business plan preparation. Pooling of resources, forms enterprise ownership and their details.

Unit 2: Enterprise Management

Logistics and launching formalities, probable pitfalls, managing money, men, machinery, material and marketing. Support organization, entrepreneurial growth, following the law of the land and social obligation. Managing organization for innovation and creativity. Importance of leadership, business ethics and business skills on good team building

Unit 3: Running a Family Business

Concept, structure and kinds of family firms. Understanding its reputation and brand. Enhancing the knowledge and skill. Managing family and shareholders relationship. Managing leadership succession and understanding the group dynamics, encouraging family women into business. Identifying the changed customer needs and encouraging growth and change in the family business.

Unit 4: Social Entrepreneurship

Introduction, Role and Characteristics of Social Entrepreneurs, Starting of a Non-profits Organization innovatively through local resources in a social context, sustainability, Business Strategies and Scaling up.

Unit 5: Role of Government and Financial Institutions

Role of Central and State Government in promoting entrepreneurship. Types of schemes, loans, incentives, grants and subsidies. Different types of financial institutions, role of commercial banks, types of loans for MSMEs schemes, appraisal, sanctions, repayment.

References:

1. Entrepreneurship – Tata MC Graw hill
2. Entrepreneurship and Small Business – New Jersey: Palgrave
3. Creativity and Entrepreneurship – Jhon Kao
4. Corporate Creativity Tata MC Graw hill

Note: Latest edition of the text books should be used.

CDF22001

VI SEMESTER

BUSINESS STATISTICS - II – DSC -18

L:T:P - 3:1:0

Course Outcome:

On successful completion of this course the students can:

CO1: Understand in depth the components of time series analysis and measurement of trend

CO2: Learn in detail the features of linear programming and apply to solve business problem

CO3: Understand the statistical decision making process under certainty and uncertainty

CO4: Learn in detail the theories of probability

CO5: Understand in depth the properties of theoretical distributions and their application to business problem

Unit 1: Business forecasting

Time series analysis-components-measurement of trend by the method of least squares.

Unit 2: Linear programming

Meaning -features-applications-graphical method of finding solution to linear programming problem (two variables only).limitations.

Unit 3: Statistical decision theory

Decision making process-decision making under certainty and under uncertainty-mini-max, maxi-min, Laplace and Hurwicz's criterion-expected opportunity loss criterion.

Unit 4: Probability

Meaning-Uses-Random Experiment- Sample space- Event-Mutually exclusive events-Equally likely events-Independent and Dependent events. Addition and Multiplication theorem.

Unit 5: Theoretical distributions

Binomial, Poisson and Normal distribution. Properties of each distribution and their application

References:

1. Business Statistics – S.P. Gupta
2. Business Statistics – Sancheti&Kapoor
3. Business Statistics – M. Wilson
4. Business Statistics – C. B. Gupta

Note: Latest edition of the text books should be used.

CDF23001

VI SEMESTER

TAX MANAGEMENT – II – DSC -19

L:T:P - 3:1:0

Course Outcome:

On successful completion of this course the students are able to:
CO1:Understand the concept of Depreciation and rates of depreciation

CO2: Understand and identify the types of Capital Assets.

CO3: Understand in detail the concept of Income from other Sources

CO4: Learn in depth the computation of Total Income and Tax Liability

CO5: Learn in depth the concept of Tax deducted at Source
CO6: Understand in detail the concept of Goods and Service Tax

Unit 1: Depreciation
Meaning – Conditions – Block of Assets – Rates of Depreciation –Problems on computations of depreciation U/S 32.

Unit 2: Computation of Income from Capital Gains
Capital Gains – Types of Capital Assets –Transfer – Cost of Acquisition – Cost of Improvement – Types of Capital Gains – Exemption forIndividual Assessee – Computations.

Unit 3: Income from other Sources
Items of Income chargeable – Kinds of Securities – BondWashing Transaction – Deductions – Computations – Set of Losses and Carry forward and setoff of losses – Assessment of Individuals.

Unit 4: Assessment of Companies
Meaning-Types of Companies -Computations of Total Incomeand Tax Liability (Normal Computation Only)

Unit 5: Tax deducted at Source
Tax Deduction at Source-Advance Payment of Tax -Interest U/S234C- Assessment Procedure – Kinds of Assessment – E Filing of Returns.

Unit 6: Goods and Service Tax
Short title- Extent and Commencement –Features-Important definitions- Authority agrees – aggregate Turnover – Business Vertical Goods -Capital goods –CGST-SGST-Common portal-Input -Input Service-Input Tax-Input audit-Outward Supply-Output Tax, etc… Advantages and Disadvantages of GST.

References:

1. GST and Customs Duty – H.C. Mehotra and S.P Goyal
2. GST and Customs Duty– Dr. Manuel Tauro

Note: Latest edition of the text books should be used.

CDF24001

VI SEMESTER

BUSINESS POLICY –SEC – 2

L:T:P - 3:1:0

Course Outcome:

On successful completion of this course the students are able to:
CO1:Understand the concept of Business policy and Strategic Management
CO2: Understand and identify the Strategic planning in Organisation
CO3: Understand in detail the concept of Strategy Formulation. Strategic & Situational Analysis
CO4 :Learn in depth the concept of SWOT Analysis
CO5: Learn in depth the concept of Financial Strategy and Production Strategy
CO6: Understand in detail the Human Resource Strategy

Unit 1: Introduction
Meaning and Nature; Business policy and Strategic Management; Imperative, Vision, Mission, and Objectives, Strategic Levels in Organisation.

Unit 2: Strategic Planning
Meaning, Stages, Alternatives, Strategy Formulation. Strategic& Situational Analysis – SWOT Analysis, TOWS Matrix, Portfolio Analysis, BCG Matrix.

Unit 3: Marketing Strategy
Financial Strategy, Production Strategy, Logistics Strategy, Human Resource Strategy.

Unit 4: Organisational Structures
Establishing Strategic Business Units, Establishing Profit Centres by Business, Product or Service, Market Segment or Customer, Leadership and Behavioural Challenges.

Unit 5: Case studies
Case studies in business policy and strategic management.

References:

1. Kazmi A, Business Policy & Strategic Management, Tata McGraw hill, New Delhi.
2. Upendra K, Strategic Management Concepts & Cases, Excel Publications, New Delhi.
3. Glueck W.F., Strategic Management & Business Policy, McGraw Hill, Newyork.
4. Thompson & Strickland, Strategic management Concept & Cases, Tata McGraw Hill, New Delhi.

Note: Latest edition of the text books should be used.

CDF25001

VI SEMESTER

Project Report– SEC - 2

L: T: P–1:0:3

C1 – Proposal of Project Work - 15 Marks
C2 – Progress of Project Work - 15 Marks
Viva - 20 Marks
Valuation of Report – 50 Marks

Course Outcome:

On successful completion of the project work the students are able to:
CO1: Understand in depth the gap between theory and practical through internship
CO2: Understand in detail with examples the procedure and able to write a report on the various issues of an organisation
CO3: Specify the details in depth and able to communicate effectively
CO4: Learn in detail and able to absorb as an employee by the employer
CO5: Specify and analyse the components of project report and prepare the report effectively

CDF26401

VI SEMESTER

MARKETING MANAGEMENT– DSE -3

Elective III – Advertising

L:T:P - 4:1:0

Course Outcome:

On successful completion of this course the students are able to:
CO1: Understand the objectives, Scope and Growth of Modern Advertising

CO2: Understand and identify types of Advertising

CO3: Understand in detail the concept of Elements of Advertisement

CO4:Learn in depth the eessentials of good advertisement copy

CO5: Understand and identify the Factors influencing the choice of an Advertising agency – Types of agencies

CO6: Understand in detail the Advertising ethics

Unit1: Advertising:
Meaning, Definition, Objectives, Scope, Growth of Modern Advertising, Types of Advertising, Publicity v/s Advertising, AIDA.

Unit2: Advertising aids and Media
Trademark, Labelling and Package, Point of Purchase (POP), Display and below the line promotion, Advertising media, Types, Media Planning and Scheduling.

Unit3: Art and Layout of Advertising
Elements of Advertisement copy, visualisation, Types, Essentials of good advertisement copy, Layout- Balancing in layout, Technical aspect of layout Illustrations, advertise ability of a product and Slogan.

Unit4: Advertising Agency and Budget
Factors influencing the choice of Advertising agency – Types of agencies- Advertising Budget- Approaches to Advertising Budget.

Unit 5: Ethical and Legal Framework
Advertising ethics, Social responsibility and self regulation, Need for advertising laws, Types of advertising laws in India, Advertising Standards Council of India, Laws relating to advertising and article 19(1) & 2 of constitution, sections relating to advertising in IPO Code 1868 and Indian Contract Act 1872.

References:

1.Aaker, Myers &Batra : Advertising Management , Prentice Hall.
2.Aren&Bovee: Contemporary Advertising, Tata McGraw Hill.
3.Chunawala: Theory and Practice of Advertising Management .
4.Dawar S. R: Salesmanship and Advertisement.

Note: Latest edition of the text books should be used.

CDF27401

VI SEMESTER

HUMAN RESOURCE MANAGEMENT– DSE -3

Elective III –Performance Appraisal and Compensation Management

L:T:P - 4:1:0

Course Outcome:

On successful completion of this course the students are able to:

CO1: Understand and identify the objectives, principles, factors influencing wage and salary Administration

CO2: Understand the concept of wage policy in India

CO3: Learn in depth the objectives of fringe benefits.

CO4:Learn in depth the Methods of performance appraisal

CO5: Understand and identify the essentials of an effective appraisal system

CO6: Understand in detail the concept of m**otivation**

Unit 1: Wage and Salary Administration

introduction, meaning, objectives, principles, factors influencing wage and salary administration, wage and salary determination process, theories of wages, methods of wage payments, wage policy in India, concept of wages – minimum wage, fair wage, Living wage, Wage Differentials, significance of wage differentials.

Unit 2: Incentive Plans

Introduction, meaning, characteristics, benefits of incentive plans, Limitations, Essentials of a good incentive plan, types of wage incentive plans- Halsey plan- merits and demerits, Rowan Plan-merits and demerits, Emerson plan, Taylor's differential piece rate system, Gant's Task and Bonus Plan, types of Group incentive plans- priest man's plan, Scalon plan, Co-partnership plan, Profit sharing- meaning, merits and demerits. Fringe benefits- Definition, objectives.

Unit 3: Performance Appraisal

Meaning, definition, objectives, features, benefits, limitations, performance appraisal process-Methods of performance appraisal- traditional methods-confidential report, graphic sales method, straight ranking method, Paired comparisons method, grading system, Forced distribution method, check list method-critical incident method, free essay method, Group appraisals , Field Interview method.

Unit 4: Performance Appraisal Methods

Modern methods- Assessment centre, Human resource accounting, Behaviourally anchored rating scales. Management by objectives, 360 degree performance appraisal, computerized and web based performance appraisal, suggestions to improve performance appraisals, essentials of an effective appraisal system

Unit 5: Motivation

Meaning and Definition, types of motivation, importance of motivation, financial motivators, Non-financial Motivators, Theories of Motivation- Maslow's Need Hierarchy method, Herzberg's Theory, McGregor's theory X and Theory Y, theory Z, Alderfer's ERG Theory, Vroom's Expectancy theory.

References:

1. HRM – L.M. Prasad.
2. BOM Fundamentals – Y.K. Bhushan
3. Business Organisation – M.C. Shukla
4. HRM – M.V. Murthy.

Note: Latest edition of the text books should be used.

CDF28401

VI SEMESTER

FINANCIAL MANAGEMENT– DSE -3

Elective III – Financial Services

L:T:P - 4:1:0

Course Outcome:

On successful completion of this course the students are able to:

CO1: Understand and identify the features, importance, contribution of financial service in promoting industry and service

CO2: Understand the concept of money market and capital market.

CO3: Learn in depth the growth of merchant banking in India

CO4:Learn in depth the Scope of merchant banking services

CO5: Understand the concept of Mutual Funds

CO6: Understand in detail the concept of Factoring

Unit 1: Financial Services

Meaning-Features, Importance, Contribution of financial service in promoting industry and service sector-financial assets- types- financial markets-organized and unorganized- money market and capital market.

Unit 2: Merchant Banking

Meaning, Origin, and growth of merchant banking in India, Scope of merchant banking services-Merchant bankers and management of public issues- merchant banking practices in India, Weaknesses in the functioning of merchant bankers in India

Unit 3: Mutual Funds

Meaning, Evolution of mutual funds, types of mutual funds, differences between mutual funds and hedge funds-periodic plans for investors- Systematic investment Plan(SIP),Systematic Transfer Plan(STP),Systematic withdrawal plan(SWP),Mutual fund Myths.

Unit 4: Lease Financing

Meaning-types of leasing- Finance lease- direct lease, leveraged lease, sale and lease back-operating lease- factors influencing lease, Treatment of lease transactions –lease v/s buy-Evaluation of Lease-buy decision-Lease financing critical evaluation – problems on lease financing.

Unit 5: Factoring

Introduction need for factoring-types- factoring mechanism- securitization of debt- concept and mechanism.

References:

1.Fiancial Services	MY Khan
2.Financial Management	Dr R P Rustagi
3. Financial service in India	Rajesh Kothari
4.Financial services	Shashi K Gupta &NishaAgarwal

CDF29401

VI SEMESTER

BANKING AND INSURANCE– DSE -3

Elective III –Principles of Insurance

L:T:P - 4:1:0

Course Outcome:

On successful completion of this course the students are able to:

CO1: Understand and identify the nature of business risk, causes of business risk, types of business risk and methods of handling risk,

CO2: Understand and identify the characteristics, purpose, need and benefits of insurance

CO3: Learn in depth the principles of insurance

CO4: Understand the concept of Life insurance

CO5: Understand the concept ofStructure and operation of insurance business

CO6: Understand in detail the concept of Life Insurance Agency

Unit 1: Risk Management

Importance- concept of risk, meaning of business risk, nature of business risk, causes of business risk, types of business risk, methods of handling risk, enterprise risk management

Unit 2: Introduction to Insurance

characteristics, purpose, need, benefits of insurance, functions of insurance, importance of insurance, principles of insurance, nature of insurance contract, types of insurance contract, fundamentals of insurability, insurance v/s wagering, assurance vs insurance gambling vs insurance

Unit 3: Life insurance

meaning, features, advantages, types of life insurance plans-Term policies . Endowment Policies .Money back policies .with or without profit policies . Pension schemes Their features and purposes.

Unit 4: Insurance Business

Structure and operation. Life Insurance Corporation . LIC Act of 1956 .LIC of India .Structure and performance .LIC as a non-banking financial Intermediary.

Unit 5: Life Insurance Agency

Rules of agency .Types of agency .Qualities of Insurance salesman, Commission and benefits to agents.

References:

1.Elements of banking and insurance	-	JyothsnaSethi and Nishwan Bhatia PHI learning pvt ltd
2.Insurance theory and practice	-	Tripathy N P
3. Insurance Institute of India	-	Hand book on General Insurance
4. Insurance- principles and practice	-	M.N. Mishra and S B Mishra

Note: Latest edition of the text books should be used.

CDF30401

VI SEMESTER

TOURISM MANAGEMENT– DSE -3

Elective III –Tourism Management

L:T:P - 4:1:0

Course Outcome:

On successful completion of this course the students are able to:
CO1: Understand the concept of Managing of Services in tourism
CO2: Understand the concept of Front Office organization structure
CO3: Learn in depth the Role of State Tourism Development Corporation in the development of tourism in Karnataka.
CO4: Understand the concept of increasing competitiveness for globalization
CO5: Understand and identify the National Parks and Wildlife sanctuaries,
CO6: Understand and identify the types of Accommodation

Unit 1: Managing Tourism

Meaning of Tourism Management – Importance – Managing of Services in tourism -Customer Relationship Management in Tourism –Meaning and importance - Front Office and Other Departments - Front Office organization structure - Functions - Baggage handling upon arrivals & checkouts - Mails and Message Handling - luggage handling and arrival records - Methods of Communication - Importance – Methods - Managing risk involved in tourism management - Sustainable Tourism Management.

Unit 2: Hospitality industry

Introduction - Types of Accommodation – Hotels - Commercial &Non commercial hotels - Various departments in hotels: House Keeping Department - Engineering Department - HRD Department - Accounts Department . Hotel classification - supplementary accommodation - sector- Resorts - Guest House - Caravans, Lodges - Inns - Youth Hostels –Home stays - Serviced villas. Safety and Precautions - Importance - Fire Precautions - The accident book - Security & Safety Instruction.

Unit 3: Tourism Organisations

Inter -Governmental, National and International: Inter governmental organizations and tourism industry – coordination of the tourism industry with government departments : Tourism, Civil Aviation, Transport, Forest, Archaeology, Culture, Museum and Health – Role of State Tourism Development Corporation in the development of tourism in Karnataka – National Tourism organizations : NTD, IRDC, FHRAI, TAAI and their Role.

Unit 4: Destination Management

Tourist Destination, Management of the Destination: Measuring the infrastructure, Environmental Quality preservation of attractions through tourism–Future of the destination: increasing competitiveness for globalization and satisfying the tourist needs

Unit 5: Management of Natural Resources of India

Need for managing natural resources and their significance; National Parks and Wildlife sanctuaries , Bird Sanctuaries, Tiger and Crocodile Project sites of India – Major Hill stations, Islands, River & River Islands of India, Important Sea Beaches of India – Mumbai,Puri, Goa, Chennai, Trivandrum and Kerala. Adventure Sports: Existing trends and places of importance for Land based, Water based, and aero based adventure sports of India -

References:

1. Tourism Management and Principles - McIntosh
2. Tourism Management -Goeldner
3. Tourism Management and Principles- Rebecca Shepherd.
4 Tourism: Operations and Management -Stephen Wanhill and Alan Fyall

Note: Latest edition of the text books should be used.

CDF26601

VI SEMESTER

MARKETING MANAGEMENT– DSE -4

Elective VI –Retail and Supply Chain Management

L:T:P - 4:1:0

Course Outcome:

On successful completion of this course the students are able to:
CO1: Understand the concept of evolution of Retailing in India
CO2: Understand the concept of Emerging Trends in Retailing,
CO3: Learn in depth the Role of Design & Layout, Location Planning and its importance,
CO4: Understand the concept of Floor Space Management
CO5: Understand and identify the Elements/Components of Retail Store Operation
CO6: Understand the Concepts and importance of a Supply Chain

Unit 1: Introduction to Retailing
Definition, Characteristics, Evolution of Retailing in India, Emerging Trends in Retailing, Factors Behind the change of Indian Retail Industry, Retail Formats.

Unit 2: Store Planning
Design & Layout, Location Planning and its importance, retailing image mix, Effective Retail Space Management, Floor Space Management.

Unit 3: Retail Operation
Elements/Components of Retail Store Operation, Store Administration, Store Manager – Responsibilities, Inventory Management, Management of Receipts, Management of Retail Outlet/Store, Store Maintenance, Store Security.

Unit 4-Customer Relation Management(CRM)
Introduction, Benefits of RM, Principles, Strategies, Components, Customer Service in retailing.

Unit 5- Supply Chain Management
Concepts and importance of a Supply Chain (SC), Key issues of Supply Chain Management, SC strategies, Push-based, Pull-based and Push-Pull based supply chain, Demand Forecasting in a Supply Chain, Managing inventory in SC environment: Transportation in SC environment.

References:

1.Aaker, Myers &Batra : Advertising Management , Prentice Hall.
2.Aren&Bovee: Contemporary Advertising, Tata McGraw Hill.
3.Chunawala: Theory and Practice of Advertising Management .
4.Dawar S. R: Salesmanship and Advertisement.

Note: Latest edition of the text books should be used.

CDF27601

VI SEMESTER

Human Resource Management– DSE -4

Elective VI – Employee Empowerment and Industrial Relations

L:T:P - 4:1:0

Course Outcome:

On successful completion of this course the students are able to:
CO1: Understand and identify conditions necessary for employee empowerment
CO2: Understand the concept of Quality circles
CO3:Learn in depth the types of social Security
CO4: Understand the concept of trade unions and problems of Trade Union.
CO5: Understand and identify the measures to strengthen trade Union movement in India
CO6: Understand the concept of Strategic HRM

Unit 1: Employee Empowerment
Meaning, Conditions Necessary for Empowerment, Forms of Empowerment-Quality circles, features, Developing quality circles in organizations, problems of Quality circles-Empowered Teams, Workers' Participation in Management-, Definition and Objectives, Forms of Workers' Participation, Evaluation of WPM Scheme.

Unit 2: Employee Health and Safety
Meaning of Health, Importance, occupational Hazards and Diseases,-Types- protection Against hazards- preventive measures, Curative Measures, Accidents- types and Causes, Social Security, Meaning, objectives, Scope, Need for social security Types, Types of social Security

Unit 3: Industrial relations
Concept, objective, , Approach Industrial Relations,- causes of Poor Industrial Relations, Steps for Good Industrial Relations, Trade Union- Meaning, Reasons for joining trade unions, problems of Trade Union and Measures to strengthen trade Union movement in India.

Unit 4: Industrial Disputes
Definition, forms of Industrial disputes- primary strikes, secondary strikes, Lock-outs, Gherao, Picketing and Boycott- Causes of Disputes-Settlement of Industrial disputes- Conciliation, Arbitration, Labour court, Industrial Tribunal, National tribunal.

Unit 5: Strategic HRM
HRM effectiveness and business success- Michael Porter's theory of competitive strategy- types of strategies-corporate strategies- competitive strategies, functional strategies-strategic management process, Approaches to SHRM- Resource based Approach, Strategic Fit, Universalistic Approach, Configurational Approach, Contingency Approach.

References:

1.Human Resource Management - V S P Rao
2.Human Resource Management - K Ashwathappa
3.Human Resource Management - L M Prasad
4.Human Resource Management - Shashi K. Gupta &Rosy Joshi

Note: Latest edition of the text books should be used.

CDF28601

VI SEMESTER

FINANCIAL MANAGEMENT– DSE -4

Elective IV – Investment Analysis and Portfolio Management

L:T:P - 4:1:0

Course Outcome:

On successful completion of this course the students are able to:
CO1: Understand the concept of Investment
CO2: Understand the concept of Portfolio Management Process- Approaches to Investment Decision making Portfolio Management Process- Approaches to Investment Decision making
CO3:Learn in depth theCapital Market instruments
CO4: Understand the concept of Risk and Return
CO5: Understand the concept of Portfolio Return and Risk-Measurement
CO6: Understand the concept of Markowitz model.

Unit 1: Investment
Meaning, Alternatives, financial Markets, Portfolio Management Process- Approaches to Investment Decision making, Common errors in investment management- qualities for successful investing.

Unit 2: Investment Instruments
Capital Market instruments -shares, debentures, bonds, mutual funds- Money market instruments-Call Money, Treasury bills, Certificate of deposit, Commercial paper, Inter-corporate deposits- derivative instruments-futures, forwards, options and swaps.

Unit 3: Analysis of investments
fundamental analysis- Industry analysis-Equity analysis-problems on equity valuation, technical analysis-price chart- Dow theory, efficient market hypothesis-Elliot theory.

Unit 4: Risk and Return
meaning-current return and capital return-Risk- Sources of risk- interest rate risk, market risk, business risk, Measuring total return- average return- measuring risk-variance and standard deviation- Expected rate of return and risk.

Unit 5: Portfolio theory
diversification and portfolio risk- Portfolio Return and Risk-Measurement of co-variance, Co-efficient of correlation, calculation of Portfolio risk with two and three securities- Markowitz model.

References:

1.Investment analysis and Portfolio Management- Prasanna Chandra
2.Security Analysis and Portfolio Management-PuneethavathiPandian,
3. Security analysis and portfolio management-Sasidharan
4. Security analysis and Portfolio Management- Avadhani V A

Note: Latest edition of the text books should be used.

CDF29601

VI SEMESTER

BANKING AND INSURANCE– DSE -4

Elective IV – General Insurance

L:T:P - 4:1:0

Course Outcome:

On successful completion of this course the students are able to:
CO1: Understand the concept of General Insurance business in India
CO2: Understand the concept of GIC of India and its subsidiaries
CO3:Learn in depth the Classification of General Insurance
CO4: Understand the concept of Marine Insurance
CO5: Understand and identify the Types of marine insurance policies
CO6: Understand the concept of Health insurance

Unit 1: Introduction
History of general Insurance business in India . Scope and functions of general Insurance, GIC Act of 1972 ,GIC of India and its subsidiaries.

Unit 2: Classification of General Insurance
Cover note. Reinsurance contribution. Calculation of contribution.

Unit 3: Fire Insurance; Meaning and Scope, types of policies. Perils covered. Special perils and special policies. Excluded perils, property and losses fire policy rating and tariff declaration and floating policy. Problems.

Unit 4: Marine Insurance
Meaning and Scope of marine insurance, fundamental principles of marine insurance, types of marine insurance losses, Types of marine insurance policies.

Unit 5: Health **insurance**
importance of health - concept of health - determinants of health - levels of healthcare - legal provisions - healthcare – stakeholders in India - – health insurance products: classification of health insurance products - health insurance products - fixed benefit insurance plans - clauses in health policies.

References:

1.Elements of banking and insurance- JyothsnaSethi and Nishwan Bhatia PHI learning pvt ltd
2.Insurance theory and practice- Tripathy N P
3. Insurance Institute of India- Hand book on General Insurance
4. Insurance- principles and practice - M.N. Mishra and S B Mishra

Note: Latest edition of the text books should be used.

CDF30601

VI SEMESTER

TOURISM MANAGEMENT– DSE -4

Elective IV – TOURISM MARKETING

L:T:P - 4:1:0

Course Outcome:

On successful completion of this course the students are able to:
CO1: Understand the concept of Tourism Marketing
CO2: Understand the concept of State tourism offices and Local Bodies, Private Organizations, Non-Governmental Organizations in Tourism
CO3:Learn in depth the Tourism Marketing Environment
CO4: Understand the concept of Tourism Pricing and Promotion
CO5: Understand and identify the factors influencing Tourism Pricing, Methods of Price fixation, Pricing Strategies
CO6: Understand and identify the Promotional Tools in Tourism

Unit 1: Introduction to Tourism Marketing
Tourism Marketing: Nature, Process and Growth. Services and their Marketing, Tourism Marketing and Development: Socially Responsible Marketing, Social Marketing, Participants in Socially Responsible Marketing and their Roles. Government Bodies- National Tourism-offices, State tourism offices and Local Bodies, Private Organizations, Non-Governmental Organizations in Tourism.

Unit 2: Challenges of Tourism Marketing
Nature and Characteristics of Tourism Offers: Tangibility and Intangibility, Non-perishability and Perish ability, Homogeneity and Heterogeneity, Separability and Inseparability, Ownership and Non-ownership. Issues and Challenges in Tourism Marketing, Marketing strategies to overcome limitations of Tourism

Unit 3: Tourism Marketing Environment
Concept of Marketing Mix, Developing Marketing Mix, Tourism Markets, Types of Tourism Markets, Tourist behavior, Tourist Buying Process, Factors Influencing Tourists' Buying Process, Tourism Product and Distribution- Concept of Tourism Product, Tourism as a packaged Product, Destination as a Product, Managing Products, New Product Development, Product Life Cycle.

Unit 4:Tourism Pricing and Promotion
Concept, Importance and Process of Pricing, Factors influencing Tourism Pricing, Methods of Price Fixation, Pricing Strategies, Price Fixation. Tourism Promotion and Communication: Objectives of Promotion, Promotion Mix, Factors affecting Promotion Mix, Components of Promotion Mix, Important Promotional Tools in Tourism- Brochures, Events, Movies and Cinema.

Unit 5: Catalyst of Tourism Development in India

Tourism promotional festivals of India, Museum and art galleries of India, Tourist Trains in India, Important tourism Circuits, Important hotel chains in India .

References:

1. Tourism Management and Principles - McIntosh
2. Tourism Management -Goeldner
3. Tourism Management and Principles- Rebecca Shepherd.
4 Tourism: Operations and Management -Stephen Wanhill and Alan Fyall

Note: Latest edition of the text books should be used.

BBA

Question Paper Pattern

(For all courses except Quantitative Techniques and Management Information system)

PART-A

Answer the following. Each question carries 15 marks. 2X15=30

1. …… ……

OR

2. ……..…….

3. ……..……..

OR

4. ……..…….……

PART-B

Answer the following. Each question carries 10 marks. 2X10=20

5. …….…….

OR

5. …….……..……

7. …….…….

OR

8. …….…….

PART-C

Answer any four of the following. Each question carries 5 marks. 4X5=20

9. …….……

10. …….…….…….

11. …….…….…….

12. …….…….…….

13. …….……..

14 ……..

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BBA

Question Paper Pattern
Quantitative Techniques

Time: 3 hrs **Max. Marks: 70**

Part-A

Answer the following. Each question carries two marks 10X2=20

1. a. …….
   b. …….
   c.……...
   d. ……......
   e.……..
   f.…….
   g.…….
   h. …….
   i. ……..
   j. ……..

Part-B

Answer any four of the following. Each question carries five marks 4X5=20

2. ……...

3. ……..……..

4. ……..……..

5. ……

6. ……...……

Part-C

Answer any three of the following. Each question carries ten marks 3X10=30

7. ….……

8. …….

9. ……

10. ……..…….

BBA
Question Paper Pattern
Management Information System

Time: 3 hrs **Max. Marks: 70**

Part-A

Answer the following. Each question carries two marks. 10X2=20

1. a. ……..……..
b. ……..……..
c. ……..……..
d. ……..……..
e. ……..……..
f. ……..……..
g. ……..……..
h. ……..……..
i. ……..……..
j. ……..……..

Part-B

Answer any four of the following. Each question carries five marks. 4X5=20

2. ……..……..
3. ……..……..
4. ……..……..
5. ……
6. ……

Part-C

Answer any three of the following. Each question carries ten marks 3X10=30

5. ……
6. ……
7. ……
8. ……

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE

(Autonomous)

Ooty Road, Mysuru-570025

Model Curriculum Structure for Bachelor of Computer Applications (BCA)Programme (Basic and Honours degree), Model Syllabus for I and II Semesters and Open Elective Courses in Computer Applications

As per

NATIONAL EDUCATION POLICY - 2020 (NEP-2020)

2021-22

DEPARTMENT OF COMPUTER SCIENCE

The objectives of the BCA Program

1. The primary objective of this program is to provide a foundation of computing principles and business practices for effectively using/managing information systems and enterprise software
2. It helps students analyze the requirements for system development and exposes students to business software and information systems
3. This course provides students with options to specialize in legacy application software, system software or mobile applications
4. To produce outstanding IT professionals who can apply the theoretical knowledge into practice in the real world and develop standalone live projects themselves
5. To provide opportunity for the study of modern methods of information processing and its applications.
6. To develop among students the programming techniques and the problem- solving skills through programming
7. To prepare students who wish to go on to further studies in computer science and related subjects.
8. To acquaint students to Work effectively with a range of current, standard, Office Productivity software applications

Program Outcomes: BCA (3 Years) Degree

1. **Discipline knowledge:** Acquiring knowledge on basics of Computer Science and ability to apply to design principles in the development of solutions for problems of varying complexity
2. **Problem Solving:** Improved reasoning with strong mathematical ability to Identify, formulate and analyze problems related to computer science and exhibiting a sound knowledge on data structures and algorithms.
3. **Design and Development of Solutions:** Ability to design and development of algorithmic solutions to real world problems and acquiring a minimum knowledge on statistics and optimization problems. Establishing excellent skills in applying various design strategies for solving complex problems.
4. **Programming a computer:** Exhibiting strong skills required to program a computer for various issues and problems of day-to-day applications with thorough knowledge on programming languages of various levels.
5. **Application Systems Knowledge**: Possessing a sound knowledge on computer application software and ability to design and develop app for applicative problems.
6. **Modern Tool Usage:** Identify, select and use a modern scientific and IT tool or technique for modeling, prediction, data analysis and solving problems in the area of Computer Science and making them mobile based application software.
7. **Communication:** Must have a reasonably good communication knowledge both in oral and writing.
8. **Project Management:** Practicing of existing projects and becoming independent to launch own project by identifying a gap in solutions.
9. **Ethics on Profession, Environment and Society:** Exhibiting professional ethics to maintain the integrality in a working environment and also have concern on societal impacts due to computer-based solutions for problems.
10. **Lifelong Learning:** Should become an independent learner. So, learn to learn ability.
11. **Motivation to take up Higher Studies:** Inspiration to continue educations towards advanced studies on Computer Science.

Additional Program Outcomes: BCA Degree (Hons)

The Bachelor of Computer Application (BCA (Hons)) program enables students to attain following additional attributes besides the afore-mentioned attributes, by the time of graduation:

1. Apply standard Software Engineering practices and strategies in real -time software project development
2. Design and develop computer programs/computer -based systems in the areas related to AI, algorithms, networking, web design, cloud computing, IoT and data analytics.
3. Acquaint with the contemporary trends in industrial/research settings and thereby innovate novel solutions to existing problems
4. The ability to apply the knowledge and understanding noted above to the analysis of a given information handling problem.
5. The ability to work independently on a substantial software project and as an effective team member.

I-C. Model Program Structures for the Under-Graduate Programs in Universities and Colleges in Karnataka

Bachelor of Computer Applications (Basic/Hons.) with Computer Applications as core subject

Sem.	Discipline Core (DSC) (Credits) (L+T+P)	Discipline Elective (DSE) / Open Elective (OE) (Credits) (L+T+P)	Ability Enhancement Compulsory Courses (AECC),		Skill Enhancement Courses (SEC)			Total Credits
					Skill based credits (L+T+P)	Value based (Credits) (L+T+P)		
I	CA C-1 (3+2) CA C-2 (3+2) CA C-3 (3)	OE-1 (3)	L1-1(3), L2-1(3) (4 hrs. each)	Environmental Studies (3)		Physical Education for fitness (1) (0+0+2)	Health & Wellness (1) (0+0+2)	26
II	CA C-4 (3+2) CA C-5 (3+2) CA C-6 (3)	OE-2 (3)	L1-2(3), L2-2(3) (4 hrs. each)		SEC-1: Alternative SEC in place of digital Fluency (2) (1+0+2)	Physical Education – Yoga (1) (0+0+2)	NCC/NSS/R&R(S&G) / Cultural (1) (0+0+2)	26
Exit option with Certificate in Computer Applications (50 credits)								
III	CA C-7 (3+2) CA C-8 (3+2) CA C-9 (3)	OE-3 (3)	L1-3(3), L2-3(3) (4 hrs each)	Constitution of India (3)		Physical Education-Sports (1)(0+0+2)	NCC/NSS/R&R(S&G)/Cultural (1) (0+0+2)	26
IV	CA C-10 (3+2) CA C-11 (3+2) CA C-12 (3)	OE-4 (3)	L1-4(3), L2-4(3) (4 hrs each)		SEC-2: Alternative SEC in place of AI (2) (1+0+2)	Physical Education - Games (1) (0+0+2)	NCC/NSS/R&R(S&G)/Cultural (1) (0+0+2)	26
Exit option with Diploma in Computer Applications (100 credits)								
V	CA C-13 (3+2) CA C-14 (3+2) CA C-15 (3)	CA E-1 (3) Vocational-1 (3)			SEC-4: Professional Communication (3)			23
VI	CA C-16 (3+2) CA C-17 (3+2) CA C-18 (3)	CA E-2 (3) Vocational-2 (3)			SEC-3: Alternative SEC in place of Cyber(2) (1+0+2)			23
Exit Option with Bachelor of Computer Applications Degree, BCA Degree (142 credits)								
VII	CA C-19(3+2) CA C-20(3+2) Internship (2)	CA E-3 (3) Vocational-3 (3) Res. Methodology (3)						21
VIII	CA C-21 (3+2) CA C-22 (3)	CA E-4 (3) Vocational-4 (3) Research Project(6)*						20
Award of Bachelor of Computer Applications Honours Degree, BCA (Hons.) Degree (183 credits)								

NEP 2020 Syllabus - BCA. for 2021-22 onwards

Year	Sem	Corse Code	Title	Hours / Week			Credits			Maximum Marks						Exam Duration	Total Marks
										Th. IA		Pr. IA		Exam			
				L	T	P	L	T	P	C1	C2	C1	C2	Th.	Pr.		
I	I	**FAA410** [CAC 01]	Fundamentals of Computers	3	0	0	3	0	0	20	20	-	-	60	-	3 Hours	100
		FAA410 [CAC 01P]	LAB: Information Technology	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		FAA420 [CAC 02]	Programming in C	3	0	0	3	0	0	20	20	-	-	60	-	3 Hours	100
		FAA420 [CAC 02P]	LAB: C Programming	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		FAA430 [CAC 03 A /B]	Mathematical Foundation/ Accountancy	3	0	0	3	0	0	20	20	-	-	60	-	3 Hours	100
	II	**FAB410** [CAC 04]	Data Structures using C	3	0	0	3	0	0	20	20	-	-	60	-	3 Hours	100
		FAB410 [CAC 04P]	LAB: Data Structure	3	0	0	3	0	0	-	-	10	15*	60	25	3 Hours	50
		FAB420 [CAC 05]	Object Oriented Concepts using JAVA	0	0	4	0	0	2	20	20	-	-	60	-	3 Hours	100
		FAB420 [CAC 05P]	LAB: JAVA Lab	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		FAB430 [CAC 06]	Discrete Mathematical Structures	3	0	0	3	0	0	20	20	-	-	60	-	3 Hours	100

Exit option with Certificate in Computer Applications (50 credits)																	
II	**III**	CAC 07	Data Base Management Systems	**3**	**0**	**0**	**3**	**0**	**0**	**20**	**20**	**-**	**-**	**60**	**-**	**3 Hours**	**100**
		CAC 07P	DBMS LAB	**0**	**0**	**4**	**0**	**0**	**2**	**-**	**-**	**10**	**15***	**-**	**25**	**3 Hours**	**50**
		CAC 08	C# and DOT NET Framework	**3**	**0**	**0**	**3**	**0**	**0**	**20**	**20**	**-**	**-**	**60**	**-**	**3 Hours**	**100**
		CAC 08P	C# and DOT NET Framework LAB	**0**	**0**	**4**	**0**	**0**	**2**	**-**	**-**	**10**	**15***	**-**	**25**	**3 Hours**	**50**
		CAC 09	Computer Communication and Networks	**3**	**0**	**0**	**3**	**0**	**0**	**20**	**20**	**-**	**-**	**60**	**-**	**3 Hours**	**100**
		OE – 3	**OPEN ELECTIVE – 3**	**3**	**0**	**0**	**3**	**0**	**0**								
			Constitution of India	**3**	**0**	**0**	**3**	**0**	**0**								

Year	Sem	Corse Code	Title	Hours / Week			Credits			Maximum Marks						Exam Duration	Total Marks
										Th. IA		Pr. IA		Exam			
				L	T	P	L	T	P	C1	C2	C1	C2	Th.	Pr.		
II	IV	CAC10	Python Programming	3	0	0	3	0	0	20	20	-	-	60	-	3 Hours	100
		CAC10P	Python programming LAB	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		CAC11	Computer Multimedia and Animation	3	0	0	3	0	0	20	20	-	-	60	-	3 Hours	100
		CAC11P	Multimedia and Animation LAB	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		CAC12	Operating System Concepts	3	0	0	3	0	0	20	20	-	-	60	-	3 Hours	100
		OE – 4	**OPEN ELECTIVE – 4**	3	0	0	3	0	0								
		SEC – 2	**Artificial Intelligence or some other**	1	0	1	1	0	2								
Exit option with Diploma in Computer Applications (100 credits)																	
III	V	CAC13	Internet Technologies	3	0	0	3	0	0	20	20	-	-	60	-	3 Hours	100
		CAC13P	JAVA Script, HTML and CSS LAB	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		CAC14	Statistical Computing and R Programming	3	0	0	3	0	0	20	20	-	-	60	-	3 Hours	100
		CAC14P	R Programming LAB	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		CAC15	Software Engineering	3	0	0	3	0	0	20	20	-	-	60	-	3 Hours	100
		CAE-1A	**DISCIPLINE SPECIFIC ELECTIVE - 1**	3	0	0	3	0	0	20	20	-	-	60	-	3 Hours	100
		VOC-1	**VOCATIONAL 1 (Anyone from table -IA)**	3	0	0	3	0	0	20	20	-	-	60	-	3 Hours	100
		SEC – 4	**Professional Communication**	2	0	0	2	0	0								
	VI	CAC 16	PHP and MySQL	3	0	0	3	0	0	20	20	-	-	60	-	3 Hours	100
		CAC 16P	LAB: PHP and MySQL	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		CAC 17	Artificial Intelligence and Applications	3	0	0	3	0	0	20	20	-	-	60	-	3 Hours	100
		CA -P1	PROJECT Work	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		CAE 2A	**DISCIPLINE SPECIFIC ELECTIVE - 2**	3	0	0	3	0	0	20	20	-	-	60	-	3 Hours	100
		VOC-2	**VOCATIONAL 2 (Anyone from table -IA)**	3	0	0	3	0	0	20	20	-	-	60	-	3 Hours	100
		SEC – 2	**Cyber Security or some other SEC**	1	0	1	1	0	2								
Exit Option with Bachelor of Computer Applications Degree, BCA Degree (142 credits)																	

Year	Sem	Corse Code	Title	Hours / Week			Credits			Maximum Marks						Exam Duration	Total Marks
										Th. IA		Pr. IA		Exam			
				L	T	P	L	T	P	C1	C2	C1	C2	Th.	Pr.		
IV	VII	CAC 18	Analysis and Design of Algorithms	3	0	0	3	0	0	20	20	-	-	60	-	3 Hours	100
		CAC 18P	Algorithms LAB	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		CAC 19	Data Mining and KnowledgeManagement	3	0	0	3	0	0	20	20	-	-	60	-	3 Hours	100
		CAC 19P	Data Mining and KnowledgeManagement LAB	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		CAI 01	Internship	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		CAE 2A	**DISCIPLINE SPECIFIC ELECTIVE - 3**	3	0	0	3	0	0	20	20	-	-	60	-	3 Hours	100
			Research Methodology	3	0	0	3	0	0	20	20	-	-	60	-	3 Hours	100
	VIII	CAC 20	Automata Theory and CompilerDesign	3	0	0	3	0	0	20	20	-	-	60	-	3 Hours	100
		CAC 20P	Compiler Lab	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		CAC 21	Cryptography and Network Security	3	0	0	3	0	0	20	20	-	-	60	-	3 Hours	100
		CA-P2	**Research Project**	0	0	12	0	0	6	-	-	20	20	-	60	3 Hours	100
		CAE 4A	**DISCIPLINE SPECIFIC ELECTIVE - 4**	3	0	0	3	0	0	20	20	-	-	60	-	3 Hours	100
Award of Bachelor of Computer Applications Honours Degree, BCA (Hons.) Degree (183 credits)																	

Note: 15* is spilt 10 marks for Practical's C2 + 5 marks for practical Record/Report

Table - IA

Course-Type	Course Code	Compulsory/ Elective	Listof option of elective courses. (A suggestive list)	
DISCIPLINE SPECIFIC ELECTIVE COURSES	**DSE 1A**	**Elective**	Cyber Law and CyberSecurity	
			Cloud Computing	
			Business Intelligence	
	DSE 2A	**Elective**	Fundamentals of DataScience	
			Mobile ApplicationDevelopment	
			Embedded Systems	
	DSE 3A	**Elective**	Data Compression	
			IoT	
			Data Analytics	
	CAE 4A	**Elective**	Open-Source Programming	
			Storage Area Networks	
			Pattern Recognition	
			Machine Learning	
VOCATIONAL	**VOC 1** **VOC 2** **VOC 3** **VOC 4**	**Elective**	DTP, CAD and Multimedia	
			Hardware and Server Maintenance	
			Web Content Management Systems	
			Computer Networking	
			Health Care Technologies	
			Digital Marketing	
			Office Automation	
OPEN ELECTIVE OFFER TO OTHER PROGRAMME STUDENTS (L: T: P) = (3: 0:0)				
OPEN ELECTIVE (For BA, BSc, BCom, BSW, BBA, BBM students studying Core Courses other than Computer Science/ Computer Applications)	**OE – 1** **OE – 2** **OE – 3** **OE – 4**	**Elective**	Business Intelligent	
			Big Data Analytics	

Model Course Content for BCA, Semesters I and II

Semester: I

Course Code: CAC01	**Course Title:** Fundamentals of Computers
Course Credits: 03	Hours/Week: 03
Total Contact Hours: 42	Formative Assessment Marks: 40
Exam Marks:60	Exam Duration: 03

Course Outcomes (COs):

• Introduction to computers, classification of computers, anatomy of computer, constituents and architecture, microcontrollers

• Operating systems, functions of operating systems, classification of operating systems, kernel, shell, basics of Unix, shell programming, booting

• Databases, why databases are used, users, SQL, data types in SQL, introduction of queries - select, alter, update, delete, truncate, using where, and or in not in

• Internet basics, features, applications, services, internet service providers, domain name system, browsing, email, searching

• Web Programming basics, introduction of HTML and CSS programming

• Introduction of computers, classification of computers, anatomy of computer, constituents and architecture, microcontrollers.

Course Content

Content	Hours
Unit - 1	
Fundamentals of Computers: Introduction to Computers - Computer Definition, Characteristics of Computers, Evolution and History of Computers, Types of Computers, Basic Organisation of a Digital Computer; Number Systems – different types, conversion from one number system to another; Computer Codes – BCD, Gray Code, ASCII and Unicode; Boolean Algebra – Boolean Operators with Truth Tables; Types of Software – System Software and Utility Software; Computer Languages - Machine Level, Assembly Level & High Level Languages, Translator Programs – Assembler, Interpreter and Compiler; Planning a Computer Program - Algorithm, Flowchart and Pseudo code with Examples. **Introduction to computers:** Characteristics of computers, Classification of Digital Computer Systems: Microcomputers, Minicomputers, Mainframes, Super computers.	14
Unit-2	
Anatomy of Computer: Introduction, Functions & Components of a Computer, Central Processing Unit, Microprocessor, Storage units, Input and output Devices. How CPU and memory works. Program execution with illustrative examples. Introduction to microcontrollers. **Operating System Fundamentals :** Operating Systems: Introduction, Functions of an operating System, Classification of Operating Systems, System programs, Application programs, Utilities, The Unix Operating System, Basic Unix commands, Microkernel	14

Based Operating System, Booting.	
Unit-3	
Introduction to Database Management Systems: Database, DBMS, Why Database - File system vs DBMS, Database applications, Database users, Introduction to SQL, Data types, Classification of SQL-DDL with constraints, DML, DCL, TCL **Internet Basics:** Introduction, Features of Internet, Internet application, Services of Internet, Logical and physical addresses, Internet Service Providers, Domain Name System. **Web Basics:** Introduction to web, web browsers, http/https, URL, HTML5, CSS	14

Text Books:

1. Pradeep K. Sinha and Priti Sinha: Computer Fundamentals (Sixth Edition), BPB Publication

2. David Riley and Kenny Hunt, Computational thinking for modern solver, Chapman & Hall/CRC,

Reference:

1. J. Glenn Brook shear," Computer Science: An Overview", Addision-Wesley, Twelfth Edition,

2. R.G. Dromey, "How to solve it by Computer", PHI,

Course Code: **CAC01P**	**Course Title: Information Technology Lab**
Course Credits: 02	Hours/Week: 04
Total Contact Hours: 52	Formative Assessment Marks: 10
Exam Marks: 40	Exam Duration: 04

Part A: Hardware

1. Identification of the peripherals of a computer, components in a CPU and their functions.

2. Assembling and disassembling the system hardware components of personal computer.

3. Basic Computer Hardware Trouble shooting.

4. LAN and WiFi Basics.

5. Operating System Installation – Windows OS, UNIX/LINUX, Dual Booting.

6. Installation and Uninstallation of Software – Office Tools, Utility Software (like Anti-Virus, System Maintenance tools); Application Software - Like Photo/Image Editors, Audio Recorders/Editors, Video Editors …); Freeware, Shareware, Payware and Trialware; Internet Browsers, Programming IDEs,

7. System Configuration – BIOS Settings, Registry Editor, MS Config, Task Manager, System Maintenance, Third-party System Maintenance Tools (Similar to CCleaner and Jv16 PowerTools …)

Part B: Software

1. Activities using Word Processor Software

2. Activities using Spreadsheets Software

3. Activities using Presentation Software

4. Activities involving Multimedia Editing (Images, Video, Audio …)

5. Tasks involving Internet Browsing

6. Flow charts: Installation and using of flowgarithms software for different arithmetic tasks like sum, average, product, difference, quotient and remainder of given numbers, calculate area of Shapes (Square, Rectangle, Circle and Triangle), arrays and recursion.

NOTE: In addition to the ones listed above, universities can include other activities so as for the student to become proficient in using personal computers for multiple purposes for which modern computers can be put to use.

Reference:

1. Computational Thinking for the Modern Problem Solver, By Riley DD, Hunt K.A CRC press, 2014

2. Ferragina P, Luccio F. Computational Thinking: First Algorithms, Then Code. Springer

Web References:

http://www.flowgorithm.org/documentation/

Evaluation Scheme for Lab Examination

Assessment Criteria		**Marks**
Activity – 1 from Part A	Write up on the activity/ task	5
	Demonstration of the activity/ task	5
Activity-2 from Part B	Write up on the activity/ task	5
	Demonstration of the activity/ task	5
Viva Voice based on Lab Activities		05
Total		**25**

Course Code: CAC02	**Course Title: Programming in C**
Course Credits: 03	Hours/Week: 03
Total Contact Hours: 42	Formative Assessment Marks: 40
Exam Marks: 60	Exam Duration: 03

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

- Confidently operate Desktop Computers to carry out computational tasks
- Understand working of Hardware and Software and the importance of operating systems
- Understand programming languages, number systems, peripheral devices, networking, multimedia and internet concepts
- Read, understand and trace the execution of programs written in C language
- Write the C code for a given problem
- Perform input and output operations using programs in C
- Write programs that perform operations on arrays

Course Content

Content	**Hours**
Unit - 1	
Introduction to C Programming: Overview of C; History and Features of C; Structure of a C Program with Examples; Creating and Executing a C Program; Compilation process in C. **C Programming Basic Concepts:** C Character Set; C tokens - keywords, identifiers, constants, and variables; Data types; Declaration & initialization of variables; Symbolic constants. **Input and output with C:** Formatted I/O functions - *printf* and *scanf,* control stings and escape sequences, output specifications with *printf* functions; Unformatted I/O functions to read and display single character and a string - *getchar, putchar, gets* and *puts* functions. **C Operators & Expressions:** Arithmetic operators; Relational operators; Logical operators; Assignment operators; Increment & Decrement operators; Bitwise operators; Conditional operator; Special operators; Operator Precedence and Associatively; Evaluation of arithmetic expressions; Type conversion.	14
Unit - 2	
Control Structures: Decision making Statements - S*imple if, if_else*, *nested if_else, else_if ladder, Switch Case*, *goto, break* & *continue* statements; Looping Statements - Entry controlled and exit controlled statements, *while, do-while, for* loops, Nested loops. **Derived data types in C:** Arrays: One Dimensional arrays - Declaration, Initialization and Memory representation; Two Dimensional arrays - Declaration, Initialization and Memory representation.	14

Strings: Declaring & Initializing string variables; String handling functions - *strlen, strcmp, strcpy and strcat;* Character handling functions - *toascii, toupper, tolower, isalpha, isnumeric* etc.	

Unit - 3	
Pointers in C: Understanding pointers - Declaring and initializing pointers, accessing address and value of variables using pointers; Pointers and Arrays; Pointer Arithmetic; Advantages and disadvantages of using pointers; **User Defined Functions:** Need for user defined functions; Format of C user defined functions; Components of user defined functions - return type, name, parameter list, function body, return statement and function call; Categories of user defined functions - With and without parameters and return type. **User defined data types:** Structures - Structure Definition, Advantages of Structure, declaring structure variables, accessing structure members, Structure members initialization, comparing structure variables, Array of Structures; Unions - Union definition; difference between Structures and Unions.	14

Text Books:

1. C: The Complete Reference, By Herbert Schildt.
2. C Programming Language, By Brain W. Kernighan
3. Kernighan & Ritchie: The C Programming Language (PHI)

Reference Books:

1. P. K. Sinha & Priti Sinha: Computer Fundamentals (BPB)
2. E. Balaguruswamy: Programming in ANSI C (TMH)
3. Kamthane: Programming with ANSI and TURBO C (Pearson Education)
4. V. Rajaraman: Programming in C (PHI – EEE)
5. S. Byron Gottfried: Programming with C (TMH)
6. Yashwant Kanitkar: Let us C
7. P.B. Kottur: Programming in C (Sapna Book House)

Course Code: CAC02P	**Course Title: C Programming Lab**
Course Credits: 02	Hours/Week: 04
Total Contact Hours: 52	Formative Assessment Marks:25
Exam Marks: 25	Exam Duration: 03

Programming Lab

Part A:

1. Program to read radius of a circle and to find area and circumference
2. Program to read three numbers and find the biggest of three
3. Program to demonstrate library functions in math.h
4. Program to check for prime
5. Program to generate n primes
6. Program to read a number, find the sum of the digits, reverse the number and check it for palindrome
7. Program to read numbers from keyboard continuously till the user presses 999 and to find the sum of only positive numbers
8. Program to read percentage of marks and to display appropriate message (Demonstration of else-if ladder)
9. Program to find the roots of quadratic equation (demonstration of switch Case statement)

10. Program to read marks scored by n students and find the average of marks (Demonstration of single dimensional array)
11. Program to remove Duplicate Element in a single dimensional Array
12. Program to perform addition and subtraction of Matrices

Part B:

1. Program to find the length of a string without using built in function
2. Program to demonstrate string functions.
3. Program to demonstrate pointers in C
4. Program to check a number for prime by defining isprime( ) function
5. Program to read, display and to find the trace of a square matrix
6. Program to read, display and add two m x n matrices using functions
7. Program to read, display and multiply two m x n matrices using functions
8. Program to read a string and to find the number of alphabets, digits, vowels, consonants, spaces and special characters.
9. Program to Reverse a String using Pointer
10. Program to Swap Two Numbers using Pointers
11. Program to demonstrate student structure to read & display records of n students.
12. Program to demonstrate the difference between structure & union.

Note: Student has to execute a minimum of 10 programs in each part to complete the Lab course

Evaluation Scheme for Lab Examination

Assessment Criteria		**Marks**
Program – 1 from Part A	Flowchart / Algorithm	02
	Writing the Program	05
	Execution and Formatting	03
Program -2 from Part B	Flowchart/Algorithm	02
	Writing the Program	05
	Execution and Formatting	03
Viva Voice based on Lab Activities		05
Total		**25**

Course Code: CAC03(a)	**Course Title:** Mathematical Foundation
Course Credits: 03	Hours/Week: 03
Total Contact Hours: 42	Formative Assessment Marks: 40
Exam Marks: 60	Exam Duration: 03

Course Outcomes (COs):

- Study and solve problems related to connectives, predicates and quantifiers under different situations.
- Develop basic knowledge of matrices and to solve equations using Cramer's rule.
- Know the concept of Eigen values.
- To develop the knowledge about derivatives and know various applications of differentiation.
- Understand the basic concepts of Mathematical reasoning, set and functions

Content	**Hours**
Unit - 1	
Basic concepts of set theory: Mathematical logic introduction-statements Connectives-negation, conjunction, disjunction- statement formulas and truth tables- conditional and bi Conditional statements- tautology contradiction-equivalence of formulas-duality law-Predicates and Quantifiers, Arguments.	14
Unit - 2	
Operations on sets: power set- Venn diagram Cartesian product-relations -functions-types of functions - composition of functions. **Matrix algebra:** Introduction-Types of matrices-matrix operations- transpose of a matrix -determinant of matrix - inverse of a matrix- Cramer's rule	14
Unit - 3	
Matrix: finding rank of a matrix - normal form-echelon form cayley Hamilton theorem-Eigen values **Differential calculus:** Functions and limits - Simple Differentiation of Algebraic Functions – Evaluation of First and Second Order Derivatives – Maxima and Minima	14

Text Books:

P. R. Vittal-Business Mathematics and Statistics, Margham Publications, Chennai,

Reference Books:

B. S. Vatsa-Discrete Mathematics –New Age International Limited Publishers, New Delhi

Course Code: CAC03(b)	**Course Title:** Accountancy
Course Credits: 03	Hours/Week: 03
Total Contact Hours: 42	Formative Assessment Marks: 40
Exam Marks: 60	Exam Duration: 03

Course Outcomes (COs):

- Study and understand Accounting, systems of Book, Branches of accounting advantage and limitations
- Know the concept of accounting, financial accounting process and Journalization
- Maintenance different account book and reconciliations
- Preparations of different bills, and trial balance.
- Understand the basic concepts of Mathematical reasoning, set and functions

Content	**Hours**
Unit - 1	
Introduction: History and Development of Accounting, Meaning, Objectives and functions of Accounting, Book keeping V/s Accounting, Users of accounting data, systems of book keeping and accounting, branches of accounting, advantages and limitations of accounting **Accounting Concepts and Convention:** Meaning, need and classification, accounting standards meaning, need and classification of Indian accounting standards. Accounting principles V/s accounting standard	14
Unit - 2	
Financial Accounting Process: Classification of accounting transactions and accounts, rules of debit and credit as per Double Entry System. Journalization and Ledger posting. **Preparation of Different Subsidiary Books:** Purchase Day book Sales Day Book, Purchase Returns Day Book, Sales Returns Day Book, Cash Book. Bank Reconciliation Statement: Meaning, Causes of Difference, Advantages, Preparation of Bank Reconciliation Statements.	14
Unit - 3	
Account Procedure: Honor of the Bill, Dishonor of the Dill, Endorsement, Discounting, Renewal, Bill for collection, Retirement of the Bill, Accommodation Bills, Bill Receivable Book and Payable Book. Preparation of Trial Balance: Rectification of errors and Journal Proper **Preparation of Final Accounts:** Meaning, need and classification, Preparation of Manufacturing, Trading, Profit and loss account and Balance – Sheet of sale-traders and partnership firms.	14

Text Books:

1. S. Ramesh, B.S. Chandrashekar, A Text Book of Accountancy.
2. V.A. Patil and J.S. Korihalli, Book – keeping and accounting, (R. Chand and Co. Delhi).
3. R. S. Singhal, Principles of Accountancy, (Nageen Prakash pvt. Lit. Meerut).
4. M. B. Kadkol, Book – Keeping and Accountancy, (Renuka Prakashan, Hubil)
5. Vithal, Sharma:Accounting for Management, Macmillan Publishers, Mumbai.

Reference Books:

1. B.S. Raman, Accountancy, (United Publishers, Mangalore).
2. Tulsian, Accouning and Finacial Management – I: Financial Accounting – Person Education.

Semester: II

Course Code: CAC04	**Course Title: Data Structures using C**
Course Credits: 03	Hours/Week: 03
Total Contact Hours: 42	Formative Assessment Marks: 40
Exam Marks: 60	Exam Duration: 03 Hours

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

• Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithms

• Describe common applications for arrays, records, linked structures, stacks, queues, trees, and graphs

• Write programs that use arrays, records, linked structures, stacks, queues, trees, and graphs

• Demonstrate different methods for traversing trees

• Compare alternative implementations of data structures with respect to performance

• Describe the concept of recursion, give examples of its use

• Discuss the computational efficiency of the principal algorithms for sorting, searching, and hashing

Course Content

Content	**Hours**
Unit - 1	
Introduction to data structures: Definition; Types of data structures - Primitive & Non-primitive, Linear and Non-linear; Operations on data structures. Dynamic memory allocation: Static & Dynamic memory allocation; Memory allocation and de-allocation functions - *malloc*, *calloc*, *realloc* and *free.* Algorithm Specification, Performance Analysis, Performance Measurement Recursion: Definition; Types of recursions; Recursion Technique Examples - GCD, Binomial coefficient ${}_nC_r$, Towers of Hanoi; Comparison between iterative and recursive functions. **Arrays:** Basic Concepts – Definition, Declaration, Initialisation, Operations on arrays; Types of arrays; Arrays as abstract data types (ADT); Representation of Linear Arrays in memory;	14
Unit - 2	
Traversing linear arrays; Inserting and deleting elements; Sorting – Selection sort, Bubble sort, Quick sort, Selection sort, Insertion sort; Searching - Sequential Search, Binary search; Iterative and Recursive searching; Multidimensional arrays; Representation of multidimensional arrays; Sparse matrices. **Linked list**: Basic Concepts – Definition and Representation of linked list, Types of linked lists - Singly linked list, Doubly liked list, Header liked list, Circular linked list; Representation of Linked list in Memory; Operations on Singly linked lists – Traversing, Searching, Insertion, Deletion; Memory allocation; Garbage collection,	14

Unit - 3	
Stacks: Basic Concepts – Definition and Representation of stacks; Operations on stacks; Applications of stacks; Infix, postfix and prefix notations; Conversion from infix to postfix using stack; Evaluation of postfix expression using stack; Application of stack in function calls. **Queues**: Basic Concepts – Definition and Representation of queues; Types of queues - Simple queues, Circular queues, Double ended queues, Priority queues; Operations on Simple queues; **Trees:** Definition; Tree terminologies –node, root node, parent node, ancestors of a node, siblings, terminal & non-terminal nodes, degree of a node, level, edge, path, depth; **Binary tree:** Type of binary trees - strict binary tree, complete binary tree, binary search tree and heap tree; Array representation of binary tree. Traversal of binary tree; preorder, inorder and postorder traversal;	14

Text Books

1. Ellis Horowitz and Sartaj Sahni: Fundamentals of Data Structures

References

1. Tanenbaum: Data structures using C (Pearson Education)
2. Kamathane: Introduction to Data structures (Pearson Education)
3. Y. Kanitkar: Data Structures Using C (BPB)
4. Kottur: Data Structure Using C
5. Padma Reddy: Data Structure Using C
6. Sudipa Mukherjee: Data Structures using C – 1000 Problems and Solutions (McGraw Hill Education, 2007))

Course Code: CAC04P	**Course Title: Data Structures Lab**
Course Credits: 02	Hours/Week: 04
Total Contact Hours: 52	Formative Assessment Marks: 25
Exam Marks: 25	Exam Duration: 03 Hours

Programming Lab

Part A:

1. Program to find GCD using recursive function
2. Program to display Pascal Triangle using binomial function
3. Program to generate n Fibonacci numbers using recursive function.
4. Program to implement Towers of Hanoi.
5. Program to implement dynamic array, find smallest and largest element of the array.
6. Program to create two files to store even and odd numbers.
7. Program to create a file to store student records.
8. Program to read the names of cities and arrange them alphabetically.
9. Program to sort the given list using selection sort technique.

10. Program to sort the given list using bubble sort technique.

Part B:

1. Program to sort the given list using insertion sort technique.
2. Program to sort the given list using quick sort technique.
3. Program to sort the given list using merge sort technique.
4. Program to search an element using linear search technique.
5. Program to search an element using recursive binary search technique.
6. Program to implement Stack.
7. Program to convert an infix expression to postfix.
8. Program to implement simple queue.
9. Program to implement linear linked list.
10. Program to display traversal of a tree.

Evaluation Scheme for Lab Examination

Assessment Criteria		**Marks**
Program – 1 from Part A	Flowchart / Algorithm	02
	Writing the Program	05
	Execution and Formatting	03
Program -2 from Part B	Flowchart/Algorithm	02
	Writing the Program	05
	Execution and Formatting	03
Viva Voice based on C Programming		05
Total		**25**

Course Code: CAC05	**Course Title: Object Oriented Programming with JAVA**
Course Credits: 03	Hours/Week: 03
Total Contact Hours: 42	Formative Assessment Marks: 40
Exam Marks: 60	Exam Duration: 03 Hours

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

• Understand the features of Java and the architecture of JVM

• Write, compile, and execute Java programs that may include basic data types and control flow constructs and how type casting is done

• Identify classes, objects, members of a class and relationships among them needed for a specific problem and demonstrate the concepts of polymorphism and inheritance

• The students will be able to demonstrate programs based on interfaces and threads and explain the benefits of JAVA's Exceptional handling mechanism compared to other Programming Language

• Write, compile, execute Java programs that include GUIs and event driven programming and also programs based on files

Course Content

Content	**Hours**
Unit - 1	
Introduction to Java: Basics of Java programming, Data types, Variables, Operators, Control structures including selection, Looping, Java methods, Overloading, Math class, Arrays in java. **Objects and Classes:** Basics of objects and classes in java, Constructors, Finalizer, Visibility modifiers, Methods and objects, Inbuilt classes like String, Character, String Buffer, File, this reference.	14
Unit - 2	
Inheritance and Polymorphism: Inheritance in java, Super and sub class, Overriding, Object class, Polymorphism, Dynamic binding, Generic programming, Casting objects, Instance of operator, Abstract class, Interface in java, Package in java, UTIL package. **Event and GUI programming:** Event handling in java, Event types, Mouse and key events, GUI Basics, Panels, Frames, Layout Managers: Flow Layout, Border Layout, Grid Layout, GUI components like Buttons, Check Boxes, Radio Buttons, Labels, Text Fields, Text Areas, Combo Boxes, Lists, Scroll Bars, Sliders, Windows, Menus, Dialog Box, Applet and its life cycle, Introduction to swing, Exceptional handling mechanism.	14
Unit - 3	
I/O programming: Text and Binary I/O, Binary I/O classes, Object I/O, Random Access Files. **Multithreading in java:** Thread life cycle and methods, Runnable interface, Thread synchronization, Exception handling with try catch-finally, Collections in java, Introduction to JavaBeans and Network Programming.	14

Text Books

1. Programming with Java, By E Balagurusamy – A Primer, Fourth Edition, Tata McGraw Hill Education Private Limited.
2. Core Java Volume I – Fundamentals, By Cay S. Horstmann, Prentice Hall
3. Object Oriented Programming with Java : Somashekara, M.T., Guru, D.S., Manjunatha, K.S

Reference Books:

1. Java 2 - The Complete Reference – McGraw Hill publication.
2. Java - The Complete Reference, 7th Edition, By Herbert Schildt– McGraw Hill publication.

Course Code: CAC05P	**Course Title:** JAVA Lab
Course Credits: 02	Hours/Week: 04
Total Contact Hours: 52	Formative Assessment Marks: 25
Exam Marks: 25	Exam Duration: 03 Hours

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

- Implement Object Oriented programming concept using basic syntaxes of control Structures
- Identify classes, objects, members of a class and the relationships among them needed for a finding the solution to specific problem
- Demonstrates how to achieve reusability using inheritance
- Demonstrate understanding and use of interfaces, packages, different exception handling mechanisms and concept of multithreading for robust faster and efficient application development.
- Identify and describe common user interface components to design GUI in Java using Applet & AWT along with response to events

Practice Lab

1. Program to print the following triangle of numbers

1
1 2
1 2 3
1 2 3 4
1 2 3 4 5

2. Program to simple java application, to print the message, “Welcome to java”
3. Program to display the month of a year. Months of the year should be held in an array.
4. Program to find the area of rectangle.
5. program to demonstrate a division by zero exception
6. Program to create a user defined exception say Pay Out of Bounds.

Programming Lab

PART A: Java Fundamentals OOPs in Java

1. Program to assign two integer values to X and Y. Using the ‘if’ statement the output of the program should display a message whether X is greater than Y.
2. Program to list the factorial of the numbers 1 to 10. To calculate the factorial value, use while loop. (Hint Fact of 4 = 4*3*2*1)

3. Program to add two integers and two float numbers. When no arguments are supplied, give a default value to calculate the sum. Use function overloading.

4. Program to perform mathematical operations. Create a class called AddSub with methods to add and subtract. Create another class called MulDiv that extends from AddSub class to use the member data of the super class. MulDiv should have methods to multiply and divide A main function should access the methods and perform the mathematical operations.

5. Program with class variable that is available for all instances of a class. Use static variable declaration. Observe the changes that occur in the object's member variable values.

6. Program

a. To find the area and circumference of the circle by accepting the radius from the user.

b. To accept a number and find whether the number is Prime or not

7. Program to create a student class with following attributes;

Enrollment No: Name, Mark of sub1, Mark of sub2, mark of sub3, Total Marks. Total of the three marks must be calculated only when the student passes in all three subjects. The pass mark for each subject is 50. If a candidate fails in any one of the subjects his total mark must be declared as zero. Using this condition write a constructor for this class. Write separate functions for accepting and displaying student details. In the main method create an array of three student objects and display the details.

8. In a college first year class are having the following attributes Name of the class (BCA, BCom, BSc), Name of the staff No of the students in the class, Array of students in the class

9. Define a class called first year with above attributes and define a suitable constructor. Also write a method called best Student () which process a first-year object and return the student with the highest total mark. In the main method define a first-year object and find the best student of this class

10. Program to define a class called employee with the name and date of appointment. Create ten employee objects as an array and sort them as per their date of appointment. ie, print them as per their seniority.

11. Create a package 'student. Fulltime. BCA 'in your current working directory

a. Create a default class student in the above package with the following attributes: Name, age, sex.

b. Have methods for storing as well as displaying

PART B: Exception Handling & GUI Programming

1. Program to catch Negative Array Size Exception. This exception is caused when the array is initialized to negative values.

2. Program to handle Null Pointer Exception and use the "finally" method to display a message to the user.

3. Program which create and displays a message on the window

4. Program to draw several shapes in the created window

5. Program to create an applet and draw grid lines

6. Program which creates a frame with two buttons father and mother. When we click the father button the name of the father, his age and designation must appear. When we click mother similar details of mother also appear.

7. Create a frame which displays your personal details with respect to a button click

8. Create a simple applet which reveals the personal information of yours.

9. Program to move different shapes according to the arrow key pressed.

10. Program to create a window when we press M or m the window displays Good Morning, A or a the window displays Good After Noon E or e the window displays Good Evening, N or n the window displays Good Night

11. Demonstrate the various mouse handling events using suitable example.

12. Program to create menu bar and pull-down menus.

Note: Student has to execute a minimum of 10 programs in each part to complete the Lab course

Evaluation Scheme for Lab Examination

Assessment Criteria		**Marks**
Program – 1 from Part A	Flowchart / Algorithm	02
	Writing the Program	05
	Execution and Formatting	03
Program -2 from Part B	Flowchart/Algorithm	02
	Writing the Program	05
	Execution and Formatting	03
Viva Voice based on **Object Oriented Programming with JAVA**		05
Total		**25**

Course Code: CAC06	Course Title: Discrete Mathematical Structures
Course Credits: 03	Hours/Week: 03
Total Contact Hours: 42	Formative Assessment Marks: 40
Exam Marks: 60	Exam Duration: 03 Hours

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

- To understand the basic concepts of Mathematical reasoning, set and functions.
- To understand various counting techniques and principle of inclusion and exclusions.
- Understand the concepts of various types of relations, partial ordering and
- equivalence relations.
- Apply the concepts of generating functions to solve the recurrence relations.
- Familiarize the fundamental concepts of graph theory and shortest path algorithm

Course Content

Content	Hours
Unit - 1	
The Foundations: Logic and proofs: Propositional Logic, Applications of Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference, Introduction to Proofs, Proof Methods and Strategy. **Basic Structures**: Sets, Functions, Sequences, Sums, and Matrices: Sets, set operations, Functions, Sequences and Summations, matrices.	14
Unit - 2	
Counting: Basics of counting, Pigeonhole principle, Permutation and combination, Binomial Coefficient and Combination, Generating Permutation and Combination**.** **Advanced Counting Techniques**: Applications of Recurrence Relations, Solving Linear Recurrence, Relations, Divide and Conquer Algorithms and Recurrence Relations, Generating functions, Inclusion-Exclusion, Applications of Inclusion-exclusion. **Induction and Recursion**: Mathematical Induction, Strong Induction and Well-Ordering, Recursive Definitions and Structural Induction, Recursive Algorithms, Program Corrections.	14
Unit - 3	
Relation: Properties of relation, Composition of relation, Closer operation on relation, Equivalence relation and partition. Operation on relation, Representing relation. **Graphs**: Graphs and Graph models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path Problems, Planar Graphs, Graph Coloring.	14

Text Book:

1. Discrete Mathematics and Its Applications, Kenneth H. Rosen: Seventh Edition, 2012.

References:

2. Discrete Mathematical Structure, Bernard Kolman, Robert C, Busby, Sharon Ross, 2003.
3. Graph Theory with Applications to Engg and Comp. Sci: Narsingh Deo-PHI 1986.
4. Discrete and Combinatorial Mathematics Ralph P. Grimaldi, B. V. Ramatta, Pearson, Education, 5 Edition.
5. Discrete Mathematical Structures, Trembley and Manobar.

Course Code: OE-1	**Course Title:** Business Intelligence
Course Credits: 3 (3: 0:0) / (2: 1: 0)	Hours/Week: 03
Total Contact Hours: 42	Formative Assessment Marks: 40
Exam Marks: 60	Exam Duration: 03

Course outcomes:

- gain knowledge of Business Intelligence
- build business projects
- generate and manage BI reports
- do BI Deployment, Administration & Security.

Course Content

Content	Hours
Unit - 1	
Introduction to Business Intelligence: Understanding the scope of today's BI solutions and how they fit into existing infrastructure Assessing new options such as SaaS and cloud-based technology. Describe BI, its components & architecture, previewing the future of BI Crafting a better experience for all business users, End User Assumptions, setting up Data for BI, The Functional Area of BI Tools, Query Tools and Reporting, OLAP and Advanced Analytics, Supporting the requirements of senior executives, including performance management.	14
Unit - 2	
Elements of Business Intelligence Solutions: Reports & ad hoc queries; Analyze OLAP data; Dashboards & Scorecards development, Metadata Models; Automated tasks & events; Mobile & disconnected BI; Collaboration capabilities; Real time monitoring capabilities; Software development kit; Consume BI through portals, web applications, Desktop applications. **Building the BI Project:** Planning the BI project, Project Resources; Project Tasks, Risk Management and Mitigation, Cost-justifying BI solutions and measuring success, Collecting User Requirements, Requirements-Gathering Techniques; Prioritizing & Validating BI Requirements, Changing Requirements; BI Design and Development, Best Practices for BI Design; Post-Implementation Evaluations, Maintaining Your BI Environment.	14
Unit - 3	
Reporting authoring: Building reports with relational vs Multidimensional data models; Types of Reports Data Grouping & Sorting, Filtering Reports, Adding Calculations to Reports, Conditional formatting, Adding Summary Lines to Reports. Drill up, drill- down, drill-through capabilities. Run or schedule report, different output forms. **BI Deployment, Administration & Security:** Centralized Versus Decentralized Architecture, BI Architecture Alternatives, phased & incremental BI roadmap, System Sizing, Measurements and Dependencies, System Sizing, Measurements, and Dependencies. Setting Early Expectations and Measuring the Results. End-User Provisos. OLAP Implementations. Expanding BI Authentication Authorization, Access Permissions, Groups and Roles, Single-sign on Server Administration, Manage Status & Monitoring, Audit, Mail server & Portal integration, Back Up and Restore.	14

TEXT BOOKS

1. Business Intelligence (IBM ICE Publication).

REFERENCE BOOKS

1. http://en.wikipedia.org/wiki/Business_intelligence.
2. http://www.webopedia.com/TERM/B/Business_Intelligence.html.
3. Http://www.cio.com/article/40296/Business_Intelligence_Definition_and_Solutions.

Course Code: OE-2	**Course Title:** Big Data Analytics
Course Credits: 3 (3: 0:0) / (2: 1: 0)	Hours/Week: 03
Total Contact Hours: 42	Formative Assessment Marks: 40
Exam Marks: 60	Exam Duration: 03

Course outcomes:

- Explain the importance of data and data analysis.
- Interpret the probabilistic models for data.
- Illustrate hypothesis, uncertainty principle.
- Demonstrate the regression analysis

Course Content

Content	Hours
Unit - 1	
Overview Of Big Data: History of big data, its elements, career related knowledge, advantages, disadvantages. Using Big Data in Businesses: Focus on the application perspective of Big Data covering, using big data in marketing, analytics, retail, hospitality, consumer good, defense etc. Technologies for Handling Big Data: Introduction to Hadoop, functioning of Hadoop, Cloud computing (features, advantages, applications) etc	14
Unit - 2	
Understanding Hadoop Ecosystem: Hadoop and its ecosystem which includes HDFS, Map Reduce, YARN, HBase, Hive, Pig, Sqoop, Zookeeper, Flume, Oozie etc. Dig Deep to understand the fundamental of Map Reduce and HBase: framework of Map Reduce and uses of map reduce. Understanding Big Data Technology Foundations: big data stack i.e. data source layer, ingestion layer, source layer, security layer, visualization layer, visualization approaches etc.	14
Unit - 3	
Databases And Data Warehouses: Databases, polygot persistence and their related introductory knowledge. Using Hadoop to store data: Module of HDFS, HBase and ways to store and manage data along with their commands. Learn to Process Data using Map Reduce: Emphasizes on developing simple map reduce framework and the concept applied.	14

Text Books:

1. Big Data Now: 2014 Edition by "Raymond I Morrison"
2. Analytics in a Big Data World: The essential guide to data science and its application

References:

1. Hadoop For Dummies, Dirk deRoos, For Dummies, 2014
2. Big Data Analytics, Introduction to Hadoop, Spark, and Machine-Learning by Raj Kamal Preeti Saxena.
3. Big Data Analytics: A Hands-On Approach Paperback – 7 Sep 2018, by Arshdeep Bahga, Vijay Madisetti.

ECC21101

III SEMESTER

DSC 7A: Programming in JAVA Lab
Credit (L: T: P = 0: 0: 2)

Software Lab based on Java

PART A

1. Write a java program to find whether given number is positive, negative or zero
2. Write a java program to find the largest of three number using ternary operator
3. Write a java program to find out roots of the quadratic Equation
4. Write a java program to check whether given date is valid or not
5. Write a java program to implement ATM Transaction Using Switch statement
6. Write a java program to generate the following pattern

```
        A
      A B A
    A B C B A
  A B C D C B A..
```

7. Write a java program to find sum of all digits of a given number until given number become a single digit
8. Write a program to create an array of 10 integers. Accept values from the user in that array. Input another number from the user and find out how many numbers are equal to the number passed, how many are greater and how many are less than the number passed.
9. Write a java program to sort the given element using selection sort
10. Write a java program to find the trace and norm of the given square matrices

PART B

1. Write a java program to Generate Employee Salary slip Using Class and Object
2. Write a java program to check whether entered character is a vowel or consonant using Constructor
3. Write a java program to Demonstrate Method Overloading
4. Write java program to generate Student marks card Using Inheritance
5. Write a java program to calculate bonus for different departments using abstract class
6. Write a java program to Demonstrate Method Overriding
7. Write a java program to that reads two integer numbers for the variables a and b. If any other character except number (0-9) is entered then the error is caught by Number Format Exception object. After that ex. getMessage () prints the information about the error occurring causes
8. Write a java program to Demonstrate multiple Inheritance using Interface
9. Write a java program to Demonstrate multithreading
10. Write a applet program to generate the following pattern

ECC22001

III SEMESTER
DSC 8A: Database Management Systems
Credit (L: T: P = 4: 0: 0)

Course Outcome

After successful completion of the course, the student is able to
CO 1. Understand the characteristics of DBMS with examples
CO 2. Deliberate the details of types of database languages with examples
CO 3. Learn the details of ER- Diagrams and Relationship
CO 4. Understand in depth Basic concepts of Relational Model
CO 5. Learn in details with examples MYSQL Commands
CO 6. Learn in details with examples in PL-SQL

Unit - 1 **15 Hours**

Introduction to Database Management Systems: Definition of Data, Information, DBMS, Data base system application, Purpose of database systems, Characteristics of DB – Self describing nature, Insulation between programs, data and data Abstraction (data Independence), support of multiple views of the data, sharing of data and multiples transaction processing, Storage management, Database language – DDL, DML,DCL. File processing system v/s DBMS, Data models, Levels of Abstraction in a DBMS, Three Schema architecture, Characteristics of database approach,, data models, DBMS architecture and data independence.

Unit - 2 **15 Hours**

Entity Relationship and Enhanced ER Modelling: Entity types, Entity Sets, Attributes, and Keys, Relationships, Relationship Types, Roles, and Structural Constraints, Weak Entity Types, ER Diagrams, Naming Conventions, SQL99: Schema Definition, constraints, and object modelling

Unit - 3 **15 Hours**

Relational Data Model: Basic concepts, Relational Constraints and Relational Database Schemas, Update Operations and Dealing with Constraint Violations, Basic Relational Algebra Operations.
Database design: ER and EER to relational mapping, functional dependencies, normal forms-first normal form, second normal forms. Third normal form BCNF

Unit - 4 **15 Hours**

MYSQL (SQL/PL-SQL): sql vs. Sql * plus: sql commands and data types, operators and expressions, introduction to sql * plus.
Managing tables and data: Creating and altering tables (including constraints)
Data manipulation command like insert, update, delete
Select statement with where, group by and having, order by, distinct, special operator like - in, any, all between, exists, like SQL Wildcards
joins, built in functions other database objects
Views

Synonyms, index transaction control statements
Commit, rollback, save point
Introduction to pl/sql: sql v/s pl/sql, pl/sql block structure
Language construct of pl/sql (variables, basic and composite data type, conditions, looping ...
% type and % row type using cursor (implicit, explicit)
Trigger and its types

Reference Books:

1. R. Elmasri, S.B. Navathe, Fundamentals of Database Systems 6th Edition, Pearson Education, 2010.
2. R. Ramakrishanan, J. Gehrke, Database Management Systems 3rd Edition, McGraw-Hill, 2002.
3. A. Silberschatz, H.F. Korth, S. Sudarshan, Database System Concepts 6th Edition, McGraw Hill, 2010.
4. R. Elmasri, S.B. Navathe Database Systems Models, Languages, Design and application Programming, 6th Edition, Pearson Education,2013.

ECC22101

III SEMESTER
DSC 8A: Database Management Systems Lab
Credit (L: T: P = 0: 0: 2)

Software Lab based on Database Management Systems

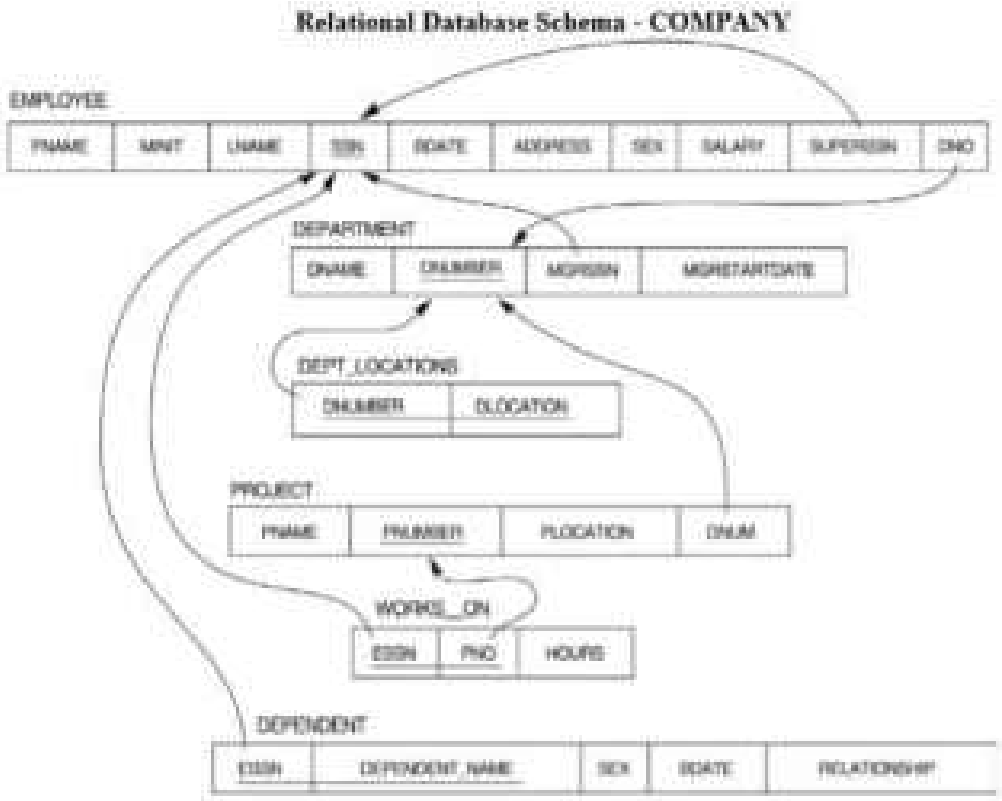
The following concepts must be introduced to the students: **Note:** MS Access / MySQL may be used.

DDL Commands

- Create table, alter table, drop table

DML Commands

- Select, update, delete and insert statements
- Condition specification using Boolean and comparison operators (and, or, not,=,<>,>,<,>=,<=)
- Arithmetic operators and aggregate functions (Count, sum, avg, Min, Max)
- Multiple table queries (join on different and same tables) • Nested select statements
- Set manipulation using (any, in, contains, all, not in, not contains, exists, not exists, union, intersect, minus, etc.)
- Categorization using group by.....having
- Arranging using order by



1. Create tables with relevant foreign key constraints
2. Populate the tables with data
3. Perform the following queries on the database:
   a. Display all the details of all employees working in the company.
   b. Display ssn, lname, fname, address of employees who work in department no 7.
   c. Retrieve the birthdate and address of the employee whose name is ‘Franklin T. Wong'
4. Retrieve the name and salary of every employee
5. Retrieve all distinct salary values
6. Retrieve all employee names whose address is in ‘Bellaire’
7. Retrieve all employees who were born during the 1950s
8. Retrieve all employees in department 5 whose salary is between 50,000 and 60,000(inclusive)
9. Retrieve the names of all employees who do not have supervisors
10. Retrieve SSN and department name for all employees
11. Retrieve the name and address of all employees who work for the ‘Research’ department 12. For every project located in 'Stafford', list the project number, the controlling department number, and the department manager's last name, address, and birth date.
13. For each employee, retrieve the employee's name, and the name of his or her immediate supervisor.
14. Retrieve all combinations of Employee Name and Department Name

15. Make a list of all project numbers for projects that involve an employee whose last name is 'Narayan' either as a worker or as a manager of the department that controls the project. 16. Increase the salary of all employees working on the 'ProductX' project by 15%. Retrieve employee name and increased salary of these employees.
17. Retrieve a list of employees and the project name each works in, ordered by the employee's department, and within each department ordered alphabetically by employee first name.
18. Select the names of employees whose salary does not match with salary of any employee in department 10.
19. Retrieve the name of each employee who has a dependent with the same first name and same sex as the employee.
20. Retrieve the employee numbers of all employees who work on project located in Bellaire, Houston, or Stafford.
21. Find the sum of the salaries of all employees, the maximum salary, the minimum salary, and the average salary. Display with proper headings.
22. Find the sum of the salaries and number of employees of all employees of the 'Marketing' department, as well as the maximum salary, the minimum salary, and the average salary in this department
23. Select the names of employees whose salary is greater than the average salary of all employees in department 10.
24. For each department, retrieve the department number, the number of employees in the department, and their average salary.
25. For each project, retrieve the project number, the project name, and the number of employees who work on that project.
26. Change the location and controlling department number for all projects having more than 5 employees to 'Bellaire' and 6 respectively. 27. For each department having more than 10 employees, retrieve the department no, no of employees drawing more than 40,000 as salary.
28. Insert a record in Project table which violates referential integrity constraint with respect to Department number. Now remove the violation by making necessary insertion in the Department table.
29. Delete all dependents of employee whose ssn is '123456789'.
30. Delete an employee from Employee table with ssn = '12345' (make sure that this employee has some dependents, is working on some project, is a manager of some department and is supervising some employees). Check and display the cascading effect on Dependent and Works on table. In Department table MGRSSN should be set to default value and in Employee table SUPERSSN should be set to NULL 31. Perform a query using alter command to drop/add field and a constraint in Employee table.

ECC23001

III SEMESTER

DSC 9A: Web Technologies
Credit (L: T: P = 4: 0: 0)

Course Outcome:

After successful completion of the course, the student is able to
CO 1. Learn the details of HTML tags
CO 2. Understand in details with examples Document object Model
CO 3. Understand the details of Basic CSS and implements
CO 4. Understand the details of Basic Concepts of Java Scripts
CO 5. Write down in details with application and Usage of Java scripts
CO 6. Deliberate in depth JQuery& Bootstrap with Examples

Unit - 1 15 Hours

Introduction to Web Design: Introduction to HyperText Markup Language (HTML), header, footer, formatting tags, graphical elements, inserting images, lists, hyperlinks, tables. **Frames-** Introduction, frameset. Forms- attributes of forms. Creating web pages
DOM: Basics of DOM, DOM methods, functions Forms collection, table collections Inner HTML.

Unit - 2 15 Hours

Cascading Style Sheets: Introduction, Understanding the Basic CSS syntax, Types of style sheets, multiple sheets, and Background properties, Text properties, Font properties, and Border properties, Margin properties padding list & table properties. DIV, SPAN, CSS Layout - The position Property, float and clear, the display-inline-block Property, Overflow
CSS Advanced - Rounded Corners, Border Images, Backgrounds, Colors, Gradients, Shadows, Text Effects, Web Fonts, 2D & 3D Transforms, Transitions, Animations

Unit - 3 15 Hours

JavaScript: Introduction, Java script in HTML, Java script statement, comments, Expressions, Data types, operators, Conditional statements, Loop statements, functions, Popup boxes ,Array & Boolean Objects Math & Date Objects String & Number Objects, events and event handling & form document object.

Unit - 4 15 Hours

JQuery: Introduction, Syntax, Selectors, Events, Effects, Hide/Show, Fade, Slide, Animate, stop (), Callback, Chaining
JQuery HTML Interface: Get, Set, Add, Remove, CSS Classes, css (), Dimensions
JQuery Traversing: Ancestors, Descendants, Siblings & Filtering
Bootstrap 4: Introduction, Grid Basic, Typography, Colors, Tables, Images, Jumbotron, Alerts, Buttons, Badges, List Groups, Cards, Dropdowns, Collapse, Navs, Navbar, Forms, Inputs, Input Groups, Custom Forms, Carousel, Modal, Tooltip, Popover, Toast, Scrollspy, Utilities, Flex, Icons, Media Objects, Filters

Reference Books:

1. M.Deitel, P.J.Deitel, A.B.Goldberg: Internet & World Wide Web How to program, 3rd Edition, Pearson Education / PHI, 2004.
2. Chris Bates: Web Programming Building Internet Applications, 3rd Edition, Wiley India, 2006.
3. 3. XueBai et al: The Web Warrior Guide to Web Programming, Thomson, 2003.
4. Learning jQuery Fourth Edition-Jonathan Chaffer.
5. Web Development with jQuery -Richard York
6. Bootstrap-Jake Spurlock
7. Mastering Bootstrap4- Benjamin Jakobus, Jason Marah

ECC23101

III SEMESTER

DSC 9A: Web Technologies Lab
Credit (L: T: P = 0: 0: 2)

1. Program for formatting tags.
2. Creating a Webpage having Hyperlink.
3. Creating Types of Lists (Ordered, Unordered, Definition).
4. Creating a Nested List.
5. Creating a Time Table.
6. Creating a HTML document having vertical frames.
7. Creating Student Application Form.
8. Program to insert audio & video files
9. Creating Internal & External Style Sheets.
10. Program to Margin & Padding.
11. Program to create a Greeting card
12. Program to Image Transparency
13. Program to generate Fibonacci series in JavaScript.
14. Program to display Rainbow Colors in JavaScript.
15. Program to create Pop-Up Boxes.
16. Program to generate multiplication table.
17. Program to find even and odd numbers.
18. Program to add 2 numbers.
19. Program to find factorial of a numbers.
20. Program to generate 2 different patterns.
21. Program to change background color after 5 sec of page load.
22. Display reverse of a given number.
23. Display Time Using Jquery
24. Design Simple Department web Site Using Bootstrap
25. Design Web page using Bootstrap and Jquery

ECD21001

IV SEMESTER
DSC 10A: Numerical Analysis and Statistics
Credit (L: T: P = 4: 0: 0)

Course Outcome:

After successful completion of the course, the student is able to

CO1. Understand the details of Computer Numerical data and arithmetic
CO2. Understand the classification and characteristics of Iterative Methods in numerical analysis
CO3. Deliberate in details with examples Matrices and linear system of Equations
CO4. Specify in details with examples Interpolation
CO5. Understand in depth Numerical integration and differentiation
CO6. Learn the details of Importance and limitations of statistics

Unit - 1 **15 Hours**

Computer Arithmetic: Fixed and Floating point representation, Normalization of numbers. Errors in numbers.

Iterative methods: Bisection method, Regula-Falsi method, Secant method, Newton-Raphson method

Unit - 2 **15 Hours**

Matrices and Linear System of Equations: LU decomposition method, Gauss elimination, Gauss serial and Gauss Jordan for solving system of equations

Interpolation: Polynomial interpolation, Newton-Gregory forward and backward interpolation, Newton's divided differences interpolation formulae.

Unit - 3 **15 Hours**

Numerical Integration: Trapezoidal rule, Simpson's 1/3rd and 3/8th rule,

Numerical Differentiation: Euler's, modified Euler's and Runge-Kutta (RK) 2nd order and 4th order.

Unit - 4 **15 Hours**

Statistics: Definition, Importance, Functions and Limitations of statistics.

Graphic presentation: Frequency distribution, Histogram, Frequency polygon, frequency curve and O gives Measures of central tendency: (Mean, Median, Mode) Dispersion, Correlation, Regression.

Reference Books:

1. K.E. Atkinson, W. Han, Elementary Numerical Analysis, 3rd Ed., Wiley, 2003.
2. C. Xavier, S.S. Iyengar, Introduction to Parallel Algorithms, Wiley-Interscience, 1998.
3. A. Kharab, R.B. Guenther, An Introduction to Numerical Methods: A MATLAB Approach,1st Ed. Chapman and Hall/CRC, 2001.
4. B. Bradie, A Friendly Introduction to Numerical Analysis, Pearson Education, 2007.
5. S.R. Otto and J.P. Denier, An Introduction to Programming and Numerical Methods in MATLAB, Springer, 2005.
6. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, 7th Ed., New Age International Publishers, 2007.
7. Computer oriented numerical methods by V Rajaraman
8. Statistics Theory and Practice by R S N Pillai, Bagavathi
9. Practical statistics by S P Gupta

ECD21101

IV SEMESTER
DSC 10A: Numerical Analysis and Statistics Lab
Credit (L: T: P = 0: 0: 2)

Software lab based on numerical techniques and statistics

1. Brute force method
2. Bisection method
3. regula –falsi method
4. NewtonRaphson
5. Secant
6. LU decomposition
7. Gauss elimination
8. GaussJordan
9. Gauss seidal
10. Euler's
11. modified Euler's
12. Runge Kutta ii order
13. Runge Kutta iv order
14. Trapezoidal
15. Simpson's 1/3 rd Rule
16. Simpson's 3/8 th Rule
17. Finding the mean, median and mode of a set of data
18. Finding the range of a set of data
19. Finding the standard deviation of a set of data
20. Newton's forward and backward interpolation
21. Newton's divided difference

ECD22001

II SEMESTER
DSC 11A: J2EE
Credit (L: T: P = 4: 0: 0)

Course Outcome:

After successful completion of the course, the student is able to

CO 1. Learn the details of Basic elements of J2EE
CO 2. Deliberate the details of Concepts of Multi-Tier Architectures
CO 3. Understand the characteristics of Enterprise Application Strategy
CO 4. Write down in depth Basic Concepts of JDBC
CO 5. Identify in details with examples implementation of SQL Commands Using JDBC objects
CO 6. Learn in details with examples Basic Concepts of Servlets
CO 7. Learn in details with examples Basic Concepts of JSP

Unit - 1 15 Hours

Introduction: The ABC of Programming Languages, taking programming languages up a notch, the beginning of java, java byte-code, the advantages of Java, J2EE and J2SE.

J2EE Multi-Tier Architecture: Distributive systems, the Tier, J2EE Multi-Tier Architecture, Client Tier Implementation, Web Tier Implementation, Enterprise JavaBeans Tier Implementation, Enterprise Information Systems Tier Implementation, Challenges.

J2EE Nest Practices: Enterprise Application Strategy, The enterprise application, clients, Sessions Management, Web Tier and Java Server pages, Enterprise Java Beans Tier, The Myth of using inheritance, Maintainable classes, Performance Enhancements, The power of Interfaces, The power of threads, The power of Notification.

Unit - 2 15 Hours

J2EE Database Concepts: Data, Database, Database Schema, the Art of Indexing.

JDBC Objects: The concept of JDBC, JDBC Driver Types, JDBC packages, A Brief overview of the JDBC Process, Database Connection, Associating the JDBC / ODBC Bridge with the database, Statement Objects, Result Set, Transaction Processing, and Metadata.

Unit - 3 15 Hours

JDBC and Embedded SQL: Model Programs: Model A Program, Model B Program, Tables: Creating a Table, Dropping a Table, Indexing: Creating an Index, Dropping an Index, Inserting Data into tables: Inserting a Row, Inserting the systems date into a column, Inserting the system Time into a column, Inserting a Timestamp into a column, Selecting Data from a Table: Selecting all data from a Table, Requesting one column, Requesting Multiple column, Requesting rows, Requesting rows and columns, AND, OR, and NOT clauses, Joining multiple compound expressions, equal & not equal operators, Less than & greater than operators, Less than equal to & greater than equal to, BETWEEN, LIKE, IS NULL Operator, DISTINCT Modifier, IN modifier,

Unit - 4 **15 Hours**

Metadata: Number of columns in result set, Data type of a column, Name of a column, Column Size, updating Tables: Updating a row and column, updating multiple rows, Deleting Data from a table: Deleting a Row from a table, Joining tables, Calculating Data, Grouping and ordering data, sub queries, view.

Java Servlets: Java Servlets and common gateway interface programming: Benefits of using a Java servlet, A simple Java Servlets, Anatomy of a java Servlets: Development Descriptor, Reading Data from a client, Reading HTTP request Headers, Sending Data to a Client & writing the HTTP response Header, Working with cookies, Tracking Sessions, Quick reference guide.

JAVA Server Pages: JSP installation, JSP Tags: Variables & objects, Methods, Control Statements, Loops, Tomcat, Request string: Parsing other information, User sessions, cookies, Session objects, Quick reference guide.

Reference Books:

1. The complete reference J2EE seventh edition - Java 2 Enterprise edition overview
2. J2EE: The complete Reference - McGraw-Hill Education

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IV SEMESTER
DSC 11A: J2EE Lab
Credit (L: T: P = 0: 0: 2)

1. Program to Create Jdbc Connection
2. Application to access the database using the Java Database Connectivity (JDBC).
3. Perform a Database Query and View Results.
4. Write a program to display a day of a given date
5. Write a program to Display request header information.
6. Write a program to calculate income tax of a customer using database
7. Write a program to display cookie value, cookie age and cookie path.
8. Write a program in JSP file to set and then display the cookie.
9. Write a program for Java script validation.
10. Write a JAVA Servlets Program to implement a dynamic HTML using Servlets(user name and password should be accepted using HTML and displayed using a Servlets).
11. Write a JAVA Servlets Program to Download a file and display it on the screen(A link has to be provided in HTML, when the link is clicked corresponding file has to be displayed on Screen)
12. Write a JAVA Servlets Program to implement Request Dispatcher object (use include () and forward () methods)
13. Write a JAVA Servlets Program to implement and demonstrate get() and Post methods(Using HTTP Servlets Class).
14. Write a JAVA Servlets Program to implement send Redirect () method (using HTTP Servlets Class).
15. Write a JAVA Servlets Program to implement sessions (Using HTTP Session Interface).
16. Write a JAVA JSP Program to print 10 even and 10 odd numbers.
17. Write a JAVA JSP Program to implement verification of a particular user login and display a welcome page.
18. Write a JAVA JSP Program to get student information through a HTML and create a JAVA Bean Class, populate Bean and display the same information through another JSP.
19. Write a JAVA JSP Program which uses <jsp:plugin> tag to run a applet
20. Write a JAVA JSP Program which implements nested tags and also use TagSupport Class.

ECD23001

IV SEMESTER

DSC 12A: Software Engineering and Software Testing
Credit (L: T: P = 4: 0: 0)

Course Outcome:

After successful completion of the course, the student is able to
CO 1. Understand in details with examples Concepts of Software process
CO 2. Specify the details of Software requirements and analysis
CO 3. Learn in depth Design concepts and principles of software engineering
CO 4. Understand in depth software Configuration Management and Project Management
CO 5. Learn in details with examples Software Tastings
CO 6. Specify in depth trends in software engineering

Unit - 1 15 Hours

Software Process: Introduction, S/W Engineering Paradigm, life cycle models (water fall, incremental, spiral, evolutionary, prototyping, object oriented), System engineering, computer based system, verification, validation, life cycle process, development process, system engineering hierarchy.

Software requirements: Functional and non-functional, user, system, requirement engineering process, feasibility studies, requirements, elicitation, validation and management, software prototyping, prototyping in the software process, rapid prototyping techniques, user interface prototyping, S/W document.

Unit - 2 15 Hours

Software Analysis: Analysis and modeling, data, functional and behavioral models, structured analysis and data dictionary.

Design Concepts and Principles: Design process and concepts, modular design, design heuristic, design model and document, Architectural design, software architecture, data design, architectural design, transform and transaction mapping, user interface design, user interface design principles. Real time systems, Real time software design, system design, real time executives, data acquisition system, monitoring and control system.

Unit - 3 15 Hours

Software Configuration Management: The SCM process, Version control, Change control, Configuration audit, SCM standards.

Software Project Management: Measures and measurements, S/W complexity and science measure, size measure, data and logic structure measure, information flow measure. Estimations for Software Projects, Empirical Estimation Models, Project Scheduling.

Unit - 4 15 Hours

Testing: Taxonomy of software testing, levels, test activities, types of s/w test, black box testing, and testing boundary conditions, structural testing, test coverage criteria based on data flow, mechanisms, regression testing, testing in the large. S/W testing strategies, strategic approach and issues, unit testing, integration testing, validation testing, system testing and debugging.

Trends in Software Engineering: Reverse Engineering and Re-engineering – wrappers – Case Study of CASE tools.

Reference Books:

1. Roger S. Pressman, Software engineering- A practitioner's Approach, McGraw-Hill
2. Ian Sommerville, Software engineering, Pearson education Asia, 6th edition, 2000.
3. PankajJalote- An Integrated Approach to Software Engineering, Springer Verlag, 1997.
4. James F Peters and WitoldPedryez, "Software Engineering – An Engineering Approach", John Wiley and Sons, New Delhi, 2000.
5. Ali Behforooz and Frederick J Hudson, "Software Engineering Fundamentals", Oxfor University Press, New Delhi, 1996.
6. Pfleeger, "Software Engineering", Pearson Education India, New Delhi, 1999.
7. Carlo Ghezzi, Mehdi Jazayari and Dino Mandrioli, "Fundamentals of Software Engineering", Prentice Hall of India, New Delhi, 1991.

ECD23101

IV SEMESTER

DSC 12A: Software Engineering and Software Testing Lab

Credit (L: T: P = 0: 0: 2)

Lab based on Software Engineering

1. Practical Title
   - Problem Statement,
   - Process Model
2. Requirement Analysis
   - Creating a Data Flow
   - Data Dictionary,
   - Use Cases
3. Project Management
   - Computing FP
   - Effort
   - Schedule, Risk Table, Timeline chart
4. Design Engineering
   - Architectural Design
   - Data Design, Component Level Design
5. Testing
   - Basis Path Testing

Sample Projects like

- DTC Route Information: Online information about the bus routes and their frequency and fares
- Car Pooling: To maintain a web based intranet application that enables the corporate
- Employees within an organization to avail the facility of carpooling effectively.
- Patient Appointment and Prescription Management System
- Organized Retail Shopping Management Software
- Parking Allocation System
- Wholesale Management System

ECE21001

III SEMESTER
DSE 1A: Elective: Data Communication and Computer Networks
Credit (L: T: P = 4: 0: 0)

Course Outcome:

After successful completion of the course, the student is able to

CO1. Learn in depth Elements of Data Communications and network Systems
CO2. Learn in depth Transmission Media
CO3. Understanding the various classifications and characteristics of Signals
CO4. Understand in details with examples Network Models
CO5. Learn in depth Error Detection and Corrections Algorithms
CO6. Deliberate in details with examples Switching Concepts
CO7. Deliberate the classification and characteristics of networking and internetworking Devices

Unit - 1 15 Hours

Data Communications: Components, Data Representation, Dataflow
Networks: Network criteria, Physical Structures, Topology (Mesh, Star, Tree, Bus, Ring, Hybrid)
Categories of Network: LAN, MAN, WAN
History of Network: Protocols and Standards: Protocols (Standards organization),
Addressing: Physical, Logical, Port Specific.

Unit - 2 15 Hours

Transmission Media: Guided Media – Twisted pair cable, co-axial cable, optical fibre, Unguided Media – Radio waves, microwaves, Infrared.
Signals: Analog and Digital Data, Analog and Digital Signals, periodic and non periodic signals. Analog Signals – Sine wave, Peak Amplitude, Period and frequency, Phase, wave length, composite signals. Digital Signals – Band width, Bit length, Bit rate, base band transmission, Digital v/s Analog. Transmission Impairment, Data rate limits (Noisy and noiseless channel)

Unit - 3 15 Hours

Network Models: Layered tasks, OSI model (peer – to – peer), Layered Architecture. Functions of Layers (OSI), TCP / IP Protocol suite
Multiplexing: FDM (MUX and DEMUX process, Application of FDM), WDM, TDM (Interleaving, synchronizing, bit padding)
Switching Concept: Working principle of circuit switching and packet switching. Circuit switched networks, three phases' efficiency, delay. Data grams network, routing table, delay efficiency, virtual.
Error Detection and Correction: Types of Errors, Redundancy, Error detection virus Error Correction.
Error Detection: Parity check, Cyclic Redundancy Check (CRC), Check Sum. Error Correction - Retransmission, Forward Error Correction, Burst error Correction.

Unit - 4 15 Hours

Networking And Internetworking Devices: Connecting Devices - Hubs, Repeaters, Amplifiers, Bridges – LAN bridges, transparent bridges, Source-route bridges, Routers, Gateways, 2 layer and 3 layers switches.
Routing Concepts: Types, Shortest path, flooding.
Wireless Lan's: Blue tooth - Architecture, Blue tooth layers.
Network Layer: IPV4, IPV6 addresses
Transport Layer: UDP – user datagram, operations, Application. TCP - Services, TCP segment, SCTP - Services, packet format.
Application Layer: - SMTP, SNMP, HTTP, FTP

Reference Books:

1. Data Communication and Networking – Forouzan
2. Computer Network – Tanenbaurn – 3rd Editions
3. Computer Network – Larry L. Peterson & Bruce S. Davie

ECE21101

V SEMESTER
DSE 1A: Elective: Data Communication and Computer Networks Lab
Credit (L: T: P = 0: 0: 2)

1. Program for Identifying well known Ports
2. Program for Data Retrieval from Remote Database.
3. Program for Simulating SMTP Client.
4. Program for Simulating Telnet Client
5. Program for Simple file transfer between two systems, (without using Protocols)
6. Program for implementing HTTP.
7. Program for Downloading Image files.
8. Simulate Checksum Algorithm.
9. Simulate Stop & Wait Protocol.
10. Simulate Go-Back-N Protocol.
11. Simulate Selective Repeat Protocol.
12. Take an example subnet of hosts. Obtain broaECAst tree for it.
13. Network address with automatic subnet address generation:

ECE21201

V SEMESTER

DSE 1B: Elective: Computer Graphics
Credit (L: T: P = 4: 0: 0)

Course Outcome:

After successful completion of the course, the student is able to
CO1. Learn the classification and characteristics of Elements of Graphics Systems
CO2. Learn in depth Graphics Algorithms
CO3. Deliberate the classification and characteristics of 2D Graphics
CO4. Understand the characteristics of 3D Graphics
CO5. Deliberate the details of Transformation and Viewing Techniques
CO6. Learn the details of Illumination and Color Models

Unit - 1 15 Hours

INTRODUCTION: Survey of computer graphics, Overview of graphics systems – Video display devices, Raster scan systems, Random scan systems, Graphics monitors and Workstations, Input devices, Hard copy Devices, Graphics Software; Output primitives – points and lines, line drawing algorithms, loading the frame buffer, line function; circle and ellipse generating algorithms; Pixel addressing and object geometry, filled area primitives.

Unit - 2 15 Hours

TWO DIMENSIONAL GRAPHICS: Two dimensional geometric transformations – Matrix representations and homogeneous coordinates, composite transformations; Two dimensional viewing – viewing pipeline, viewing coordinate reference frame; widow-to-viewport coordinate transformation, Two dimensional viewing functions; clipping operations – point, line, and polygon clipping algorithms.

Unit - 3 15 Hours

THREE DIMENSIONAL GRAPHICS: Three dimensional concepts; Three dimensional object representations – Polygon surfaces Polygon tables- Plane equations – Polygon meshes; Curved Lines and surfaces, Quadratic surfaces; Blobby objects; Spline representations – Bezier curves and surfaces -B-Spline curves and surfaces.

TRANSFORMATION AND VIEWING: Three dimensional geometric and modeling transformations – Translation, Rotation, Scaling, composite transformations; three dimensional viewing – viewing pipeline, viewing coordinates, Projections, Clipping; Visible surface detection methods.

Unit - 4 15 Hours

ILLUMINATION AND COLOUR MODELS: Light sources – basic illumination models – halftone patterns and dithering techniques; Properties of light – Standard primaries and chromaticity diagram; Intuitive color concepts – RGB color model – YIQ color model – CMY colour model – HSV color model – HLS color model; Color selection.

Reference Books:

1. Computer Graphics C Version by Donald Hearn & M. Pauline Baker Pearson Education, New Delhi, 2004
2. Procedural Elements for Computer Graphics by David F. Rogers, Tata McGraw Hill Book Company, New Delhi, 2003
3. Computer Graphics: Principles & Practice in C by J. D. Foley, S. K Feiner, A Van Dam F. H John, Pearson Education, 2004
4. Computer Graphics using Open GL by Franscis S Hill Jr Pearson Education, 2004.

ECE21301

V SEMESTER
DSE 1B: Elective: Computer Graphics Lab
Credit (L: T: P = 0: 0: 2)

1. Implementation of Bresenham's Algorithm – Line, Circle, Ellipse.
2. Implementation of Line, Circle and ellipse attributes
3. Two Dimensional transformations - Translation, Rotation, Scaling, Reflection, Shear.
4. Composite 2D Transformations
5. Cohen Sutherland 2D line clipping and Windowing
6. Sutherland – Hodgeman Polygon clipping Algorithm
7. Three dimensional transformations - Translation, Rotation, Scaling
8. Composite 3D transformations
9. Drawing three dimensional objects and Scenes
10. Generating Fractal images

ECE21**01**

V SEMESTER

DSE 1C: Elective: Multimedia Systems and Applications
Credit (L: T: P = 4: 0:0)

Course Outcome:

After successful completion of the course, the student is able to

CO1. Understand the details of Components of Multimedia with applications

CO2. Identify in details with examples Text, Images, Sound and Videos

CO3. Learn in depth Animation Techniques

CO4. Understand the details of Multimedia in internet

CO5. Deliberate the characteristics of Making Multimedia

CO6. Deliberate in depth Multimedia Making Tools

Unit - 1 15 Hours

Multimedia: Introduction to multimedia, components, uses of multimedia, multimedia applications, virtual reality.

Text: Fonts & Faces, Using Text in Multimedia, Font Editing & Design Tools, Hypermedia & Hypertext.

Images: Still Images – bitmaps, vector drawing, 3D drawing & rendering, natural light &colours, computerized colours, colour palettes, image file formats.

Unit - 2 15 Hours

Sound: Digital Audio, MIDI Audio, MIDI vs Digital Audio, Audio File Formats.

Video: How video works, analog video, digital video, video file formats, video shooting and editing.

Unit - 3 15 Hours

Animation: Principle of animations, animation techniques, animation file formats.

Internet and Multimedia: www and HTML, multimedia on the web – web servers, web browsers, web page makers and site builders.

Unit - 4 15 Hours

Making Multimedia: Stages of a multimedia project, Requirements to make good multimedia, Multimedia Hardware - Macintosh and Windows production Platforms, Hardware peripherals - Connections, Memory and storage devices, Multimedia software and Authoring tools.

Reference Books:

1. Tay Vaughan, “Multimedia: Making it work”, TMH, Eighth edition.
2. Ralf Steinmetz and KlaraNaharstedt, “Multimedia: Computing, Communications Applications”, Pearson.
3. Keyes, “Multimedia Handbook”, TMH.
4. K. Andleigh and K. Thakkar, “Multimedia System Design”, PHI.

ECE22**01**

V SEMESTER
DSE 1C: Elective: Multimedia Systems and Applications Lab
Credit (L: T: P = 0: 0: 2)

Practical exercises based on concepts listed in theory using Presentation tools in office automation tool/ GIMP/Blender / Audacity/ Animation Tools/ Image Editors/ Video Editors.

Implement the followings using Blender -

1. Create an animation using the tools panel and the properties panel to draw the following – Line, pie, oval, circle, rectangle, square, pencil, brush and lasso tool
2. Create an animation using text tool to set the font, size, colour etc.
3. Create an animation using free transform tool that should use followings-
   - Move Objects
   - Skew Objects
   - Stretch Objects
   - Rotate Objects
   - Stretch Objects while maintaining proportion
   - Rotate Objects after relocating the centre dot
4. Create an animation using layers having following features- Insert layer, Delete layer, guide layer, Mask layer.
5. Modify the document (changing background color etc.)using the following tools
   - Eraser tool
   - Hand tool
   - Ink bottle tool
   - Zoom tool
   - Paint Bucket tool
   - Eyedropper tool
6. Create an animation for bus car race in which both starts from the same point and car wins the race.
7. Create an animation in which text Hello gets converted into Good Bye (using motion/shape tweening).
8. Create an animation having five images having fade-in fade-out effect.
9. Create an scene to show the sunrise (using multiple layers and motion tweening)
10. Create an animation to show the ripple effect.
11. Create an animation (using Shape tweening and shape hints) for transforming one shape into another.
12. Create an animation for bouncing ball (you may use motion guide layer).

OR

Project:

Design a minimum 10 page interactive website using Joomla or WordPress.

ECE23 01

V SEMESTER

DSE 2A: Elective: ASP.Net

Credit (L: T: P = 4: 0: 0)

Course Outcome:

After successful completion of the course, the student is able to
CO 1. Learn the details of ASP.NET Framework
CO 2. Learn the details of ASP.NET working Environment
CO 3. Deliberate in details with examples Standard Control of ASP.NET
CO 4. Understand the details of Developing Simple Websites Using ASP.NET Controls
CO 5. Deliberate in depth Developing Simple Web Application Using ASP.NET Controls
CO 6. Learn the details of Database Access Controls
CO 7. Identify in details with examples Database Access Controls

Unit - 1 15 Hours

Overview of the ASP.NET: Introduction of different Web Technology, What is Asp.Net, How Asp.Net Works, Use of visual studio, Different Languages used in ASP.Net. Summary.
Framework: Common Language Runtime (CLR), .NET Framework Class Library, Summary

Unit - 2 15 Hours

Setting up and Installing ASP.NET: Installing Internet Information Server, Installation of Asp.Net, virtual directory, Application Setting in IIS, Summary.

Unit - 3 15 Hours

Asp.Net Standard Controls, Displaying information, Label Controls, Literal Controls, Bulleted List, Accepting User Input, Textbox controls, Radio Button and Radio Button List Controls, Checkbox and Checkbox List Controls, Button controls, Link Button Control, Image Button Control, Using Hyperlink Control, Dropdown List, List Box, Displaying Images, Image Control, Image Map Control, Using Panel Control, Using Hyperlink Control, Asp.Net, Page & State Management, Overview of events in page, Summary.

Unit - 4 15 Hours

Designing Websites with master pages, creating master pages, Creating default contents, nesting master pages, registering master pages in web configuration, Summary.
ASP.Net Theme: ASP.NET Website Theme, Named Skin and Default Skin in ASP.NET Theme, Style Sheet Theme and Theme Attributes of a Page Directive
Using the Rich Controls: Accepting File Uploads, Saving files to file system, Calendar Control, Displaying advertisements, Displaying Different Page view, Displaying a Tabbed Page View, Wizard Control, Summary.

Reference Books:

1. Mathew Mac Donald, ASP. Net The Complete Reference, McGraw –Hill, 2002.

ECE2401

V SEMESTER
DSE 2A: Elective: ASP.Net Lab
Credit (L: T: P = 0: 0: 2)

LAB MANUAL:

1. Write a Program to generate the factorial operation.
2. Write a Program to perform Money Conversion.
3. Write a Program to generate the Quadratic Equation.
4. Write a Program to generate the Login control.
5. Write a Program to perform Asp.Net state.
6. Write a Program to perform validation operation.
7. Write a Program to perform Tree view operation.
8. Write a Program to display the phone no of an author using database.
9. Write a Program to insert the data in to database using Execute-Non Query.
10. Write a Program to bind data using template in data list.
11. Write a Program to bind data using Hyperlink column in data grid.

ECE22201

V SEMESTER
DSE 2B: Elective: Visual Programming
Credit (L: T: P = 4: 0:0)

{Note: Use any open source alternative such as Tkinter with Python /SharpDevelop/GAMBAS/OPENXAVA with JAVA}

Course Outcome:

After successful completion of the course, the student is able to
CO 1. Learn in details with examples Basic concept Of GUI Environment
CO 2. Deliberate the details of GUI Controls
CO 3. Learn in details with examples Data types and Operations in Visual Programming
CO 4. Learn in details with examples Control statements in Visual Programming
CO 5. Write down in details with examples Modular Programming
CO 6. Learn the details of Forms Handling in Visual Programming
CO 7. Understand in depth Database Connectivity in Visual Programming

Unit - 1 15 Hours

GUI Environment: Introduction to graphical user interface (GUI), programming language (procedural, object oriented, event driven), the GUI environment, compiling, debugging, and running the programs.

Controls: Introduction to controls textboxes, frames, check boxes, option buttons, images, setting borders and styles, the shape control, the line control, working with multiple controls and their properties, designing the user interface, keyboard access, tab controls, default & cancel property, coding for controls.

Operations: Data types, constants, named & intrinsic, declaring variables, scope of variables, val function, arithmetic operations, formatting data.

Unit - 2 15 Hours

Decision Making: If statement, comparing strings, compound conditions (and, or, not), nested if statements, case structure, using if statements with option buttons & check boxes, displaying message in message box, testing whether input is valid or not.

Modular programming: Menus, sub-procedures and sub-functions defining / creating and modifying a menu, using common dialog box, creating a new sub-procedure, passing variables to procedures, passing argument by value or by reference, writing a function/ procedure.

Unit - 3 15 Hours

Forms Handling: Multiple forms creating, adding, removing forms in project, hide, show method, load, unload statement, me keyword, referring to objects on a different forms

Iteration Handling: Do/loops, for/next loops, using msg box function, using string function

Arrays and Grouped Data Control: Arrays - 1-dimension arrays, initializing an array using for each, user-defined data types, accessing information with user-defined data types, using list boxes with array, two dimensional arrays.

Unit - 4 **15 Hours**

lists, loops and printing list boxes & combo boxes, filling the list using property window / add item method, clear method, list box properties, removing an item from a list, list box/ combo box operations.

Database Connectivity: Database connectivity of forms with back end tool like mysql, populating the data in text boxes, list boxes etc. searching of data in database using forms. Updating/ editing of data based on a criterion.

Reference Books:

1. Reference: Programming in Visual Basic 6.0 by Julia Case Bradley, Anita C. Millispangh (Tata Mcgraw Hill Edition 2000 (Fourteenth Reprint 2004))

ECE22301

V SEMESTER
DSE 2B: Elective: Visual Programming Lab
Credit (L: T: P = 0: 0: 2)

1. Print a table of numbers from 5 to 15 and their squares and Cubes.
2. Print the largest of three numbers.
3. Find the factional of a number n.
4. Enter a list of positive numbers terminated by zero. Find the sum and average of these numbers.
5. A person deposits Rs. 1000 in a fixed account yielding 5% interest. Complete the amount in the account at the end of each year for n years.
6. Read n numbers. Count the number of negative numbers, positive numbers and zeros in the list.
7. Read n numbers. Count the number of negative numbers, positive numbers and zeroes in the list. Use of arrays.
8. Read a single dimension array. Find the sum and average of these numbers.
9. Read a two dimension array. Find the sum of two 2D Array.
10. Create a database Employee and Make a form to allow data entry to Employee Form with the following command buttons:

ECE22401

V SEMESTER

DSE2C: PHP Programming with MySQL
Credit (L: T: P = 4: 0: 0)

Course Outcome:

After successful completion of the course, the student is able to
CO1. Learn in depth Elements of PHP
CO2. Learn in depth Interaction Methods Between HTML and PHP
CO3. Understand in depth PHP function
CO4. Understand in depth String Manipulation
CO5. Learn the characteristics of Regular Expression
CO6. Learn the details of Developing PHP Web Application

Unit - 1 15 Hours

Introduction Basic PHP Development Control Structure: Introduction to www, History, Understanding client/server roles Apache, PHP, MySQL, XAMPP Installation PHP Basic syntax, PHP data Types, PHP Variables PHP Constants, PHP Expressions, PHP Operators Control Structures & Loop

Unit - 2 15 Hours

Working With the File System Working With Regular Expressions, Opening a File, Reading from a File, Writing to a File, File Locking, Uploading Files via an HTML Form, Getting File Information, Directory Functions, Getting a Directory Listing, The basic regular expressions, Matching patterns, Finding matches, Replace patterns

WORKING WITH FORMS: PHP Form handling, PHP GET/POST, PHP Form Validation, Accessing user input, Combine HTML and PHP code using hidden fields, Redirecting the user, File upload

Unit - 3 15 Hours

CLASSES AND OBJECTS: Object oriented concepts, Define a class, attributes, Object, Object properties, methods, constructors and destructors, Class constants, Static method, Class inheritance, Abstract classes, Final keyword, Implementing Interface, Object serialization

Using Cookies: What are Cookies? – Setting Cookies – Using Cookie variables – Session Basics: What's a session? – Understanding Session variables – Managing User preferences with Sessions – Graphics: Drawing functions.

Unit - 4 15 Hours

INTRODUCTION TO DATABASE: What is RDBMS technology?, Introduction to SQL, Connecting to the MYSQL, Selecting a database, Adding data to a table, Displaying returned data on Web pages ,Finding the number of row, Inserting, Deleting , Entering and updating data, Executing multiple queries, Understanding Primary and Foreign Key, Understanding Database Normalization, Dealing with Dates and Times

Reference Books:

1. Complete Beginner's Guide to PHP: Programming & Web Development by Cedric Palmer (22 February 2014)
2. PHP and MySQL Web Development by Laura Thomson and Luke Welling
3. PHP Reference: Beginner to Intermediate PHP5 by Mario Lurig
4. PHP 4: A Beginner's Guide by William Mccarty
5. Julie Meloni and Matt Telles, PHP 6, Course Technology, CENGAGE Learning, India Edition, 2008.
6. Kevin Tatroe, Peter MacIntyre and RasmusLerdorf, Programming PHP, O'REILLY media, 3rd edition, 2013.

ECE22501

V SEMESTER

DSE2C: PHP Programming with MySQL Lab
Credit (L: T: P = 0: 0: 2)

1. Write a PHP program to find the factorial of a number.
2. Write a PHP program using Conditional Statements.
3. Write a PHP program to find the maximum value in a given multi-dimensional array.
4. Write a PHP program to find the GCD of two numbers using user-defined functions.
5. Design a simple web page to generate multiplication table for a given number using PHP.
6. Design a web page that should compute one's age on a given date using PHP.
7. Write a PHP program to download a file from the server.
8. Write a PHP program to store the current date and time in a COOKIE and display the 'Last Visited' date and time on the web page.
9. Write a PHP program to store page views count in SESSION, to increment the count on each refresh and to show the count on web page.
10. Write a PHP program to draw the human face.
11. Write a PHP program to design a simple calculator.
12. Design an authentication web page in PHP with MySQL to check username and password.

ECE23001

V SEMESTER

DSE 3A: Elective: Analysis and Design of Algorithms

(Credit L: T: P = 4: 0: 0)

Course Outcome:

After successful completion of the course, the student is able to
CO1. Learn the details of Types of notion of Algorithm
CO2. Learn in details with examples Algorithm Design Techniques
CO3. Deliberate in depth Sorting Techniques
CO4. Deliberate in depth of Searching Techniques
CO5. Identify in details with examples Analysis of Graph Algorithms
CO6. Learn the details of Dynamic Programming Methods

Unit - 1 15 Hours

Introduction: Notion of Algorithm, Review of Asymptotic Notations, Mathematical Analysis of Non-Recursive and Recursive Algorithms Correctness of Algorithm
Algorithm Design Techniques: Iterative techniques Divide and conquer greedy algorithms.
Sorting Techniques: Selection sort, bubble sort, insertion sort, more sorting techniques-quick sort, merge sort. Radix sort,

Unit - 2 15 Hours

The Greedy Method: General Method - Container Loading - Knapsack Problem - Tree
Searching Techniques: Linear and Binary search, Complexity Analysis.
Graphs: Analysis of Graph algorithms -Depth-First Search Breadth-First Search and its applications, minimum Spanning Trees and Shortest Paths -PRIM 'S, KRUSKAL, Dijkstra's algorithm. Branching-Hamiltonian Circuit problem.

Unit - 3 15 Hours

Dynamic Programming: The General Method, Warshall's Algorithm, Floyd's Algorithm for the All-Pairs Shortest Paths, Single-Source Shortest Paths: The Travelling Salesperson problem.

Unit - 4 15 Hours

Vertex Splitting – Job Sequencing With Deadlines - Minimum Cost Spanning Trees - Optimal
Storage on Tapes – Optimal Merge Patterns - #Single Source Shortest Paths#.
Backtracking: The General Method – The 8-Queens Problem – Sum of Subsets – Graph Coloring – Hamiltonian Cycles – Knapsack Problem Branch and Bound: The Method - 0/1 Knapsack Problem.

Reference Books:

1. Analysis & design of Algorithm-Padma Reddy
2. A.V. Levitin, Introduction to the Design and Analysis of Algorithms, Pearson Education, 2006.
3. J. Kleinberg and E. Tardos, Algorithms Design, Pearson Education, 2006.
4. Ellis Horowitz, SatrajSahni and SanguthevarRajasekaran, Fundamentals of Computer Algorithms,Universities Press, Second Edition, Reprint 2009.
5. A.A.Puntambekar, Analysis and Design Of Algorithms, Technical Publications, 2008

ECE23101

V SEMESTER

DSE 3A: Elective: Analysis and Design of Algorithms Lab

(Credit L: T: P = 0: 0: 2)

1. Implement Insertion Sort.
2. Implement Merge Sort.
3. Implement recursive algorithm
4. Implement Randomized Quick sort.
5. Implement Radix Sort.
6. Implement Searching Techniques (linear & Binary)
7. Implement selection sort
8. Implement Bubble sort
9. Implement Prim's Algorithm
10. Implement Dijkstra's Algorithm
11. Implement Krushkal's Algorithm
12. Implement Travelling Salesperson problem
13. Implement Floyd's Algorithm
14. Implement Depth First Search
15. Implement Binary Search tree.

ECE23201

V SEMESTER

DSE 3B: Elective: Mobile Applications

Credit (L: T: P = 4: 0: 0)

Course Outcome:

After successful completion of the course, the student is able to

CO1. Deliberate the details of Concepts of Event Driven Programming
CO2. Learn in details with examples issues of Mobile applications
CO3. Specify the details of Mobile applications Development tools and Frameworks
CO4. Deliberate in details with examples common Mobile device UI's
CO5. Write down in depth Data persistence Remote data storage and communication
CO6. Learn in details with examples Code signing

Unit - 1 15 Hours

Event Driven Programming: UI event loop, Threading for background tasks, Outlets / actions, delegation, notification, Model View Controller (MVC) design pattern.
Mobile application issues: limited resources (memory, display, network, file system), input / output (multi-touch and gestures), sensors (camera, compass, accelerometer, GPS)

Unit - 2 15 Hours

Development tools: Apple iOS toolchain: Objective-C, Xcode IDE, Interface Builder, Device simulator.
Frameworks: Objective-C and Foundation Frameworks, Cocoa Touch, UI Kit, Others: Core Graphics, Core Animation, Core Location and Maps, Basic Interaction.

Unit - 3 15 Hours

Common UI's for mobile devices: Navigation Controllers, Tab Bars, Table Views, Modal views, UI Layout.
Data Persistence: Maintaining state between application invocations, File system, Property Lists, SQLite, Core Data.

Unit - 4 15 Hours

Remote Data-Storage and Communication: "Back End" / server side of application, RESTful programming, HTTP get, post, put, delete, database design, server side JavaScript / JSON.
Code signing: security, Keychain, Developers and App Store License Agreement

Reference:

1. Rajiv Ramnath, Roger Crawfis, and Paolo Sivilotti, Android SDK 3 for Dummies, Wiley, 2011.
2. Valentino Lee, Heather Schneider, and Robbie Schell, Mobile Applications: Architecture, Design, and Development, Prentice Hall, 2004.
3. Brian Fling, Mobile Design and Development, O'Reilly Media, 2009. Maximiliano
4. Firtman, Programming the Mobile Web, O'Reilly Media, 2010.
5. Christian Crumlish and Erin Malone, Designing Social Interfaces, O'Reilly Media, 2009.
6. James E Smith, Ravi Nair, "Virtual Machines", Morgan Kaufmann Publishers, 2006.

ECE23301

V SEMESTER

DSE 3B: Elective: Mobile Applications Lab

Credit (L: T: P = 0: 0: 2)

Software Lab based on Mobile Applications:

1. Installing Android Environment
2. Create Hello World Application
3. Sample Application about Android Resources
4. Sample Application about Layouts
5. Sample Application about Intents
6. Sample Application I about user interfaces
7. Sample Application about Animations
8. Make a Project based on above labs
9. Sample Application about Android Data
10. Sample Application about SQLite I
11. Sample Application about SQLite II
12. Project Presentation

ECE33301

V SEMESTER

DSE 3C: Elective: Machine Learning

Credit (L: T: P = 4: 0: 0)

Course Outcome:

After successful completion of the course, the student is able to

CO1. Deliberate the details of Concepts of Machine Learning
CO2. Learn in details with examples for Machine Learning Software
CO3. Specify the details of Linear Algebra
CO4. Deliberate in details with examples Linear & Logistic Regression
CO5. Write down in depth Regularization and its utility
CO6. Learn in details with methods of Neural Networks

Unit - 1 15 Hours

Introduction: Concept of Machine Learning, Applications of Machine Learning, Key elements of Machine Learning, Supervised vs. Unsupervised Learning, Statistical Learning: Bayesian Method, The Naive Bayes Classifier

Unit - 2 15 Hours

Softwares for Machine Learning and Linear Algebra Overview: Plotting of Data, Vectorization, Matrices and Vectors: Addition, Multiplication, Transpose and Inverse using available tool such as MATLAB.

Unit - 3 15 Hours

Linear Regression: Prediction using Linear Regression, Gradient Descent, Linear Regression with one variable, Linear Regression with multiple variables, Polynomial Regression, Feature Scaling/Selection.

Logistic Regression: Classification using Logistic Regression, Logistic Regression vs. Linear Regression, Logistic Regression with one variable and with multiple variables.

Unit - 4 15 Hours

Regularization: Regularization and its utility: The problem of Overfitting, Application of Regularization in Linear and Logistic Regression, Regularization and Bias/Variance.

Neural Networks: Introduction, Model Representation, Gradient Descent vs. Perceptron Training, Stochastic Gradient Descent, Multilayer Perceptrons, Multiclass Representation, Backpropagation Algorithm.

Readings

1. Ethem Alpaydin, "Introduction to Machine Learning" 2nd Edition, The MIT Press, 2009.
2. Tom M. Mitchell, "Machine Learning", First Edition by Tata McGraw-Hill Education, 2013.
3. Christopher M. Bishop, "Pattern Recognition and Machine Learning" by Springer, 2007.
4. Mevin P. Murphy, "Machine Learning: A Probabilistic Perspective" by The MIT Press, 2012.

ECE34**01**

V SEMESTER

DSE 3C: Elective: Machine Learning Lab

Credit (L: T: P = 0: 0: 2)

For practical Labs for Machine Learning, students may use software like MABLAB/Octave or Python. For later exercises, students can create/use their own datasets or utilize datasets from online repositories like UCI Machine Learning Repository (http://archive.ics.uci.edu/ml/).

1. Perform elementary mathematical operations in Octave/MATLAB like addition, multiplication, division and exponentiation.
2. Perform elementary logical operations in Octave/MATLAB (like OR, AND, Checking for Equality, NOT, XOR).
3. Create, initialize and display simple variables and simple strings and use simple formatting for variable.
4. Create/Define single dimension / multi-dimension arrays, and arrays with specific values like array of all ones, all zeros, array with random values within a range, or a diagonal matrix.
5. Use command to compute the size of a matrix, size/length of a particular row/column, load data from a text file, store matrix data to a text file, finding out variables and their features in the current scope.
6. Perform basic operations on matrices (like addition, subtraction, multiplication) and display specific rows or columns of the matrix.
7. Perform other matrix operations like converting matrix data to absolute values, taking the negative of matrix values, additing/removing rows/columns from a matrix, finding the maximum or minimum values in a matrix or in a row/column, and finding the sum of some/all elements in a matrix.
8. Create various type of plots/charts like histograms, plot based on sine/cosine function based on data from a matrix. Further label different axes in a plot and data in a plot.
9. Generate different subplots from a given plot and color plot data.
10. Use conditional statements and different type of loops based on simple example/s.
11. Perform vectorized implementation of simple matrix operation like finding the transpose of a matrix, adding, subtracting or multiplying two matrices.
12. Implement Linear Regression problem. For example, based on a dataset comprising of existing set of prices and area/size of the houses, predict the estimated price of a given house.
13. Based on multiple features/variables perform Linear Regression. For example, based on a number of additional features like number of bedrooms, servant room, number of balconies, number of houses of years a house has been built – predict the price of a house.
14. Implement a classification/ logistic regression problem. For example based on different features of students' data, classify, whether a student is suitable for a particular activity. Based on the available dataset, a student can also implement another classification problem like checking whether an email is spam or not.
15. Use some function for regularization of dataset based on problem 14.
16. Use some function for neural networks, like Stochastic Gradient Descent or backpropagation - algorithm to predict the value of a variable based on the dataset of problem 14.

ECE24101

V SEMESTER

SEC 2A: Elective: Object Oriented Modelling& Design with UML
Credit (L: T: P = 0: 0: 2)

Course Outcome:

After successful completion of the course, the student is able to
CO1. Deliberate in details with examples Object Oriented Development
CO2. Write down the details of OO Modeling Concepts
CO3. Learn the details of OO process Overview
CO4. Identify in depth Design of System Using OO Model
CO5. Specify the details of Steps for Implementation of OO Modeling
CO6. Learn the details of Design a System Using UML Tool

Object Oriented Modeling& Design with UML Lab

Term Work / Assignment

Each candidate will submit an approximately10-page written report on a case study or mini project. Students have todo OO analysis & design for the project problem, and develop use case model, analysis model and design model for it, using UML.

Practical assignment

Nine assignments, one on each of the diagrams learnt in UML.

Reference Books:

1. Object –oriented modeling and design- Michael R Blaha and James R Rumbaugh
2. Object Technology- David A.Taylor
3. Designing Flexible Object Oriented systems with UML – Charles Ritcher
4. Object Oriented Analysis & Design, Sat/.inger. Jackson, BurdThomson
5. Object Oriented Modeling and Design - James Rumbaugh
6. Teach Yourself UML in 24 Hours - Joseph Schmuilers

ECE24301

V SEMESTER

SEC 2B: Elective: JQuery
Credit (L: T: P = 0: 0: 2)

Course Outcome:

After successful completion of the course, the student is able to
CO1. Deliberate in details with examples JQuery
CO2. Learn the details of JQuery Overview
CO3. Specify the details of Steps for Implementation of JQuery
CO4. Learn the details of Design and use of JQuery

JQuery Lab

1. Test if jQuery is loaded.
2. Scroll to the top of the page with jQuery.
3. Disable right click menu in html page using jquery.
4. Blink text using jQuery.
5. Create a Zebra Stripes table effect.
6. Print a page using jQuery.
7. Limit character input in the text area including count.
8. Create a div using jQuery with style tag.
9. Move one DIV element inside another using jQuery.
10. Add a list element within an unordered list element.
11. Remove all the options of a select box and then add one option and select it.
12. How to get the value of a textbox using jQuery?
13. Remove style added with .css() function using jQuery.
14. Distinguish between left and right mouse click with jQuery.
15. Check if an object is a jQuery object.
16. How to detect whether the user has pressed 'Enter Key' using jQuery.
17. How to get textarea text using jQuery.
18. Access form input fields using jQuery.
19. Convert a jQuery object into a string.
20. How to detect a textbox's content has changed using jQuery?
21. Remove a specific value from an array using jQuery.
22. Add options to a drop-down list using jQuery.
23. Delete all table rows except first one using jQuery.
24. Count Child elements using jQuery.
25. Restrict "number"-only input for textboxes including decimal points.
26. Set value in input text using jQuery.
27. Set a value in a span using jQuery.
28. Find the class of the clicked element.
29. Set href attribute at runtime using jquery.
30. Find the total width of an element (including width, padding, and border) in jQuery.
31. Change options of select using jQuery.
32. Access HTML form data using jQuery.

ECE24501

V SEMESTER

SEC 2B: Elective: MongoDB
Credit (L: T: P = 0: 0: 2)

Course Outcome:

After successful completion of the course, the student is able to

CO1. Deliberate in details with examples MongoDB

CO2. Learn the details of MongoDB Overview

CO3. Specify the details of Steps for Implementation of MongoDB

CO4. Learn the details of Design and use of MongoDB

MongoDB Lab

1. Write a MongoDB query to display all the documents in the collection restaurants.
2. Write a MongoDB query to display the fields restaurant_id, name, borough and cuisine for all the documents in the collection restaurant.
3. Write a MongoDB query to display the fields restaurant_id, name, borough and cuisine, but exclude the field _id for all the documents in the collection restaurant.
4. Write a MongoDB query to display the fields restaurant_id, name, borough and zip code, but exclude the field _id for all the documents in the collection restaurant.
5. Write a MongoDB query to display all the restaurant which is in the borough Bronx.
6. Write a MongoDB query to display the first 5 restaurant which is in the borough Bronx.
7. Write a MongoDB query to display the next 5 restaurants after skipping first 5 which are in the borough Bronx.
8. Write a MongoDB query to find the restaurants who achieved a score more than 90.
9. Write a MongoDB query to find the restaurants that achieved a score, more than 80 but less than 100.
10. Write a MongoDB query to find the restaurants which locate in latitude value less than -95.754168.
11. Write a MongoDB query to find the restaurants that do not prepare any cuisine of 'American' and their grade score more than 70 and latitude less than -65.754168.
12. Write a MongoDB query to find the restaurants which do not prepare any cuisine of 'American' and achieved a score more than 70 and located in the longitude less than -65.754168.
    Note : Do this query without using $ and operator.
13. Write a MongoDB query to find the restaurants which do not prepare any cuisine of 'American ' and achieved a grade point 'A' not belongs to the borough Brooklyn. The document must be displayed according to the cuisine in descending order.
14. Write a MongoDB query to find the restaurant Id, name, borough and cuisine for those restaurants which contain 'Wil' as first three letters for its name.
15. Write a MongoDB query to find the restaurant Id, name, borough and cuisine for those restaurants which contain 'ces' as last three letters for its name.

16. Write a MongoDB query to find the restaurant Id, name, borough and cuisine for those restaurants which contain 'Reg' as three letters somewhere in its name.
17. Write a MongoDB query to find the restaurants which belong to the borough Bronx and prepared either American or Chinese dish.
18. Write a MongoDB query to find the restaurant Id, name, borough and cuisine for those restaurants which belong to the borough Staten Island or Queens or Bronxor Brooklyn.
19. Write a MongoDB query to find the restaurant Id, name, borough and cuisine for those restaurants which are not belonging to the borough Staten Island or Queens or Bronxor Brooklyn.
20. Write a MongoDB query to find the restaurant Id, name, borough and cuisine for those restaurants which achieved a score which is not more than 10.
21. Write a MongoDB query to find the restaurant Id, name, borough and cuisine for those restaurants which prepared dish except 'American' and 'Chinees' or restaurant's name begins with letter 'Wil'.
22. Write a MongoDB query to find the restaurant Id, name, and grades for those restaurants which achieved a grade of "A" and scored 11 on an ISODate "2014-08-11T00:00:00Z" among many of survey dates..
23. Write a MongoDB query to find the restaurant Id, name and grades for those restaurants where the 2nd element of grades array contains a grade of "A" and score 9 on an ISODate "2014-08-11T00:00:00Z".
24. Write a MongoDB query to find the restaurant Id, name, address and geographical location for those restaurants where 2nd element of coord array contains a value which is more than 42 and upto 52..
25. Write a MongoDB query to arrange the name of the restaurants in ascending order along with all the columns.
26. Write a MongoDB query to arrange the name of the restaurants in descending along with all the columns.
27. Write a MongoDB query to arrange the name of the cuisine in ascending order and for that same cuisine borough should be in descending order.
28. Write a MongoDB query to know whether all the addresses contains the street or not.
29. Write a MongoDB query which will select all documents in the restaurants collection where the coord field value is Double
30. Write a MongoDB query which will select the restaurant Id, name and grades for those restaurants which returns 0 as a remainder after dividing the score by 7
31. Write a MongoDB query to find the restaurant name, borough, longitude and attitude and cuisine for those restaurants which contains 'mon' as three letters somewhere in its name.
32. Write a MongoDB query to find the restaurant name, borough, longitude and latitude and cuisine for those restaurants which contain 'Mad' as first three letters of its name.

ECF3901

VI SEMESTER

DSE 4A: Elective: Operation Research
Credit (L: T: P = 4: 0: 0)

Course Outcome

After successful completion of the course, the student is able to
CO1. Write down the details of Origin and Development of Operation Research
CO2. Understand the characteristics of Linear Programming Problems and Methods
CO3. Deliberate in depth Transportation Problems
CO4. Deliberate in depth Assignment Problem
CO5. Identify in details with examples Network Analysis
CO6. Learn in depth Application of Operation Research

Unit - 1 15 Hours

Linear Programming Problems: Origin and development of operations research, formulation of Linear Programming problem, Graphical solution.

Theory of simplex method, Use of artificial variables and their solution.

Unit - 2 15 Hours

Transportation Problem: Mathematical formulation of transportation problem, Initial basic Feasible solution, North West corner rule, Matrix minima method, Vogel's approximation method, MODI method to find optimal solution.

Unit - 3 15 Hours

Assignment Problem: Mathematical formulation of an Assignment problem, Assignment algorithm, Hungarian Method to solve Assignment Problem.

Unit - 4 15 Hours

Network Analysis: Basic components of Network, Rules for drawing Network diagram Time calculation in Networks. Critical Path Method and PROJECT Evaluation and Review Techniques. Algorithm and flow chart for CPM and PERT.

Reference Books:

1. Taha, "Operations Research", 7th edition, Pearson Education, 2007.
2. Billey E. Gillett, "Introduction to Operations Research", Himalaya Publishing House, Delhi,1979.
3. HamadyA.Taha "Operations Research" , Collin Mac Millan, 1982

ECF21101

VI SEMESTER

DSE 4A: Elective: Operation Research Lab
Credit (L: T: P = 0: 0:2)

Lab based on Operation Research

1. LPP
2. Simplex
3. Dual Simplex
4. Big – M
5. Vogel's
6. Maxima and Minima
7. North West corner
8. Sequencing Problems
9. Modi Method
10. Hugarian Method
11. Assignment Problem

ECE4101

VI SEMESTER
DSE 4B: Elective: Enterprise Resource Planning
Credit (L: T: P = 4: 0: 0)

Course Outcome:

After successful completion of the course, the student is able to

CO1. Deliberate the details of ERP

CO2. Learn in depth Models of ERP

CO3. Write down in depth Business Process Mapping for ERP

CO4. Understand in details with applications of ERP and Related Technologies

CO5. Deliberate the details of ERP Modules

CO6. Specify in details with examples SAP

Unit - 1 15 Hours

Introduction to ERP, Evolution of ERP, What is ERP? Reasons for the growth of ERP, Scenario and Justification of ERP in India, Evaluation of ERP, Various Modules of ERP, Advantage of ERP and Disadvantage of ERP.

Unit - 2 15 Hours

An overview of Enterprise, Integrated Management Information, Business Modeling, ERP for Small Business, ERP for make to order companies, Business Process Mapping for ERP Module Design, Hardware Environment and its Selection for ERP Implementation.

Unit - 3 15 Hours

ERP and Related Technologies, Business Process Reengineering (BPR), Management Information System (MIS), Executive Information System (EIS), Decision support System (DSS), Supply Chain Management (SCM) (With Example)

Unit - 4 15 Hours

ERP Modules, Introduction to Finance, Plant Maintenance, Quality Management, Materials Management, ERP Market, Introduction, SAP AG, Baan Company, Oracle Corporation, People Soft, JD Edwards World Solutions Company, System Software Associates.

Reference Books:

1. C.S. V Murthy Enterprise Resource Planning
2. R.G. Saha – Enterprise Resource Planning - HPH
3. Alexis Leon, Leon Publishers: Enterprise Resource Planning
4. Ravi Anupindi, Sunil Chopra, Pearson Education". "Managing Business Process Flows
5. Altekar, PHI. Enterprise Resource Planning
6. Srivatsava, I.K. International Publishers, Enterprise Resource Planning
7. P. DiwanVinod Kumar Garg and N.K. Venkitakrishnan, PHI. Enterprise Resource Planning
8. Introduction to SAP, an Overview of SD: MM, PP, FI/CO Modules of SAP. 10. ZaveriJyotindra Enterprise Resource Planning

ECE21301

VI SEMESTER
DSE 4B: Elective: Enterprise Resource Planning Lab
Credit (L: T: P = 0: 0: 2)

Students should be Prepare ERP Solution Report for his / her Case Study under the supervision of Teacher/ Lecturer

ECF21401

VI SEMESTER

DSE 4C: Elective: E-Commerce Technologies

Credit (L: T: P = 4: 0: 0)

Course Outcome:

After successful completion of the course, the student is able to
CO1. Understand the details of E-Commerce
CO2. Learn the details of Basic Concepts Of Internet and WWW
CO3. Identify in depth Internet Security Methods
CO4. Learn in details with examples Concepts of Electronic Data Exchange and applications
CO5. Learn in details with examples Planning For E-Commerce
CO6. Understand in depth Features of Internet Marketing

Unit - 1 15 Hours

An introduction to Electronic commerce: What is E-Commerce (Introduction And Definition), Main activities E-Commerce, Goals of E-Commerce, Technical Components of E-Commerce, Functions of E-Commerce, Advantages and disadvantages of E-Commerce, Scope of E-Commerce, Electronic Commerce Applications, 9 Electronic Commerce and Electronic Business(C2C)(C2G,G2G, B2G, B2P, B2A, P2P, B2A, C2A, B2B, B2C)

The Internet and WWW: Evolution of Internet, Domain Names and Internet Organization (.edu, .com, .mil, .gov, .net etc.) , Types of Network, Internet Service Provider, World Wide Web, Internet & Extranet, Role of Internet in B2B Application, building own website, Cost, Time, Reach, Registering a Domain Name, Web promotion, Target email, Banner, Exchange, Shopping Bots.

Unit - 2 15 Hours

Internet Security: Internet Security Issues Overview –Computer Security Classifications- Intellectual Property threats- Threats to the security of client computers-Threats to the security of communication channels- Threats to the security of Server computers- digital Certificates

Secure Transaction, Computer Monitoring, Privacy on Internet, Corporate Email privacy, Computer Crime(Laws , Types of Crimes), Threats, Attack on Computer System, Software Packages for privacy, Hacking, Computer Virus(How it spreads, Virus problem, virus protection, Encryption and Decryption, Secret key Cryptography, DES, Public Key Encryption, RSA, Authorization and Authentication, Firewall, Digital Signature(How it Works)

Unit - 3 15 Hours

Electronic Data Exchange: Introduction, Concepts of EDI and Limitation, Applications of EDI, Disadvantages of EDI, EDI model, Electronic Payment System: Introduction, Types of Electronic Payment System, Payment Types, Value Exchange System, Credit Card System, Electronic Fund Transfer, Paperless bill, Modern Payment Cash, Electronic Cash.

Online payment basics- Payment cards-E-cash-Holding Electronic cash: online and offline

Cash-Advantages and disadvantages of electronic cash system-electronic wallets-Microsoft.NET passport-yahoo Wallet-EGML standard-stored value cards-magnetic strip Cards-smart cards.

Unit - 4 15 Hours

Planning for Electronic Commerce: Planning Electronic Commerce initiates, linking objectives to business strategies, measuring cost objectives, Comparing benefits to Costs, Strategies for developing electronic commerce web sites.

Internet Marketing: The PROS and CONS of online shopping, The cons of online shopping, Justify an Internet business, Internet marketing techniques, The E-cycle of Internet marketing, Personalization e-commerce.

Technologies for Electronic Commerce: Web Server Hardware and Software- Web server Basics- Types of web sites- web clients and web servers-Software for Web servers-website and utility programs-Web server hardware-Web Hosting Choices.

Reference Books:

1. G.S.V.Murthy, E-Commerce Concepts, Models, Strategies- :- Himalaya Publishing House, 2011.
2. Kamlesh K Bajaj and DebjaniNag , E- Commerce , 2005.
3. Gray P. Schneider , Electronic commerce, International Student Edition, 2011,
4. HENRY CHAN, RAYMOND LEE, THARAM DILLON, ELIZABETH CHANG E COMMERCE, FUNDAMENTALS AND APPLICATIONS, Wiely Student Edition, 2011

ECF21501

VI SEMESTER

DSE 4C: Elective: E-Commerce Technologies Lab

Credit (L: T: P = 0: 0: 2)

Software Lab based on E-Commerce Technologies

E-commerce concepts are to be implemented in developing a website using a combination of following technologies:

1. HyperText Markup Language (HTML)
2. Cascading Style Sheets (CSS)
3. JavaScript
4. ASP
5. PHP
6. XML
7. Joomla

ECF22001

VI SEMESTER

DSE 5A: Cloud Computing
Credit (L: T: P = 4: 0: 0)

Course Outcome

After successful completion of the course, the student is able to

CO1. Learn in depth Fundamentals of Cloud Computing
CO2. Understand the details of Cloud Services and File System
CO3. Learn in depth Concept of Collaborating with Cloud
CO4. Understand the details of Virtualization in cloud
CO5. Learn the classification and characteristics of Security challenges in Cloud Computing
CO6. Specify the classification and characteristics of Security challenges in Cloud Computing
CO7. Understand the details of Security challenges in Cloud Computing
CO8. Understand the Common standards of Cloud Computing
CO9. Deliberate in details with examples Various Application of Cloud Computing

Unit - 1 15 Hours

Cloud Introduction: Cloud Computing Fundamentals: Cloud Computing definition, Types of cloud, Cloud services: Benefits and challenges of cloud computing, Evolution of Cloud Computing , usage scenarios and Applications , Business models around Cloud– Major Players in Cloud Computing - Issues in Cloud - Eucalyptus - Nimbus - Open Nebula, CloudSim.

Cloud Services and File System: Types of Cloud services: Software as a Service - Platform as a Service – Infrastructure as a Service - Database as a Service - Monitoring as a Service – Communication as services.

Unit - 2 15 Hours

Service providers- Google App Engine, Amazon EC2, Microsoft Azure, Sales force.

Collaborating With Cloud: Collaborating on Calendars, Schedules and Task Management – Collaborating on Event Management, Contact Management, Project Management – Collaborating on Word Processing, Databases – Storing and Sharing Files- Collaborating via Web-Based Communication Tools – Evaluating Web Mail Services – Collaborating via Social Networks – Collaborating via Blogs and Wikis.

Unit - 3 15 Hours

Virtualization For Cloud: Need for Virtualization – Pros and cons of Virtualization – Types of Virtualization – System Vm, Process VM, Virtual Machine monitor – Virtual machine properties - Interpretation and binary translation, HLL VM - Hypervisors – Xen, KVM , VMWare, Virtual Box, Hyper-V.

Unit - 4 15 Hours

Security, Standards, And Applications: Security in Clouds: Cloud security challenges – Software as a Service Security, Common Standards: The Open Cloud Consortium –The Distributed management Task Force – Standards for application Developers – Standards for Messaging – Standards for Security, End user access to cloud computing, Mobile Internet devices and the cloud.

Reference Books:

1. Bloor R., Kanfman M., Halper F. Judith Hurwitz "Cloud Computing" Wiley India Edition,2010
2. John Rittinghouse& James Ransome, "Cloud Computing Implementation Management and Strategy", CRC Press, 2010
3. Antohy T Velte,Cloud Computing: "A Practical Approach", McGraw Hill,2009
4. Michael Miller, Cloud Computing: "Web-Based Applications That Change the Way You Work and Collaborate Online", Que Publishing, August 2008.
5. James E Smith, Ravi Nair, "Virtual Machines", Morgan Kaufmann Publishers, 2006.

Online Reading/Supporting Material

1. Haley Beard, "Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing", Applications and Data Centers in the Cloud with SLAs, Emereo Pty Limited, July 2008
2. Webpages.iust.ac.ir/hsalimi/.../89.../Cloud%20Common%20standards.pptop ennebula.org,
3. www.cloudbus.org/cloudsim/, http://www.eucalyptus.com/
4. hadoop.apache.org
5. http://hadoop.apache.org/docs/stable/hdfs_design.html
6. http://static.googleusercontent.com/external_content/untrusted_dlcp/research.google.com /en//archive /mapreduce-osdi04.pdf

ECF22101

VI SEMESTER

DSE 5A: Cloud Computing Lab
Credit (L: T: P = 0: 0: 2)

Software Lab based on Cloud Computing:

1. Create virtual machines that access different programs on same platform.
2. Create virtual machines that access different programs on different platforms.
3. Exploring Google cloud for the following
   a) Storage
   b) Sharing of data
   c) Manage your calendar, to-do lists,
   d) A document editing tool
4. Exploring Open source cloud (Any two)

ECF22201

VI SEMESTER
DSE 5B: Elective: Data Mining and Data Warehousing
Credit (L: T: P = 4: 0: 0)

Course Outcome:

After successful completion of the course, the student is able to

CO1. Understand the characteristics of Data Warehousing

CO2. Understand the details of Data Warehousing Architecture

CO3. Deliberate in depth Data Mining

CO4. Learn in details with examples Association Rule Mining

CO5. Specify the details of Classification and Prediction Techniques

CO6. Learn in depth Clustering Methods

CO7. Write down in depth Application of Data Mining

Unit - 1 15 Hours

Data Warehousing: Introduction- Definition and description need for data ware housing need `for strategic information, failures of past decision support systems, OLTP v/s DWH-DWH requirements-trends in DWH-Application of DWH.

Data Warehousing Architecture: Reference architecture- Components of reference architecture - Data warehouse building blocks, implementation, physical design process and DWH deployment process.

Unit - 2 15 Hours

A Multidimensional Data, Model Data Warehouse Architecture.

Data Mining: Data mining tasks-Data mining vs KDD- Issues in data mining, Data Mining metrics, Data mining architecture - Data cleaning- Data transformation- Data reduction - Data mining primitives.

Unit - 3 15 Hours

Association Rule Mining: Introduction - Mining single dimensional Boolean association rules from transactional databases - Mining multi-dimensional association rules.

Classification and Prediction: Classification Techniques - Issues regarding classification and prediction - decision tree - Bayesian classification –Classifier accuracy.

Unit - 4 15 Hours

Clustering: Clustering Methods - Outlier analysis.

Applications and Other Data Mining Methods: Distributed and parallel Data Mining Algorithms, Text mining- Web mining.

Reference Books:

1. Jiawei Han and MichelineKamber," Data Mining Concepts and Techniques", Morgan Kaufmann Publishers, USA, 2006.
2. Berson,"DataWarehousing, Data Mining and OLAP", Tata McGraw Hill Ltd, New Delhi, 2004.
3. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining, , Pearson Education.

4. Arun K Pujari,"Data mining techniques", Oxford University Press, London, 2003.
5. Dunham M H,"Data mining: Introductory and Advanced Topics". Pearson Education, New Delhi, 2003.
6. MehmedKantardzic," Data Mining Concepts, Methods and Algorithms", John Wiley and Sons, USA, 2003.
7. Soman K. P., DiwakarShyam, Ajay V., Insight into Data mining: Theory and Practice, PHI 2006

ECF22301

VI SEMESTER

DSE 5B: Elective: Data Mining and Data Warehousing Lab

Credit (L: T: P = 0: 0: 2)

Software Lab based on Data Mining:

Practical List: Practical are to be done using Weka, and a report prepared as per the format*. The operations are to be performed on built-in dummy data sets of weka and/or the downloadable datasets mentioned in references below. Also wherever applicable, the parameter values are to be varied (upto 3 distinct values). The 'Visualize' tab is to be explored with each operation.

1. Pre-processing: Apply the following filters –
   a. weka>filter>supervised>attributed> AddClassification, AttributeSelection, Discretize, NominalToBinary
   b. weka>filter>supervised>instance: StratifiedRemoveFolds, Resample
   c. weka>filter>unsupervised>attribute>Add, AddExpression, AddNoise ,Center , Discretize , MathExpression ,MergeTwoValues , NominalToBinary , NominalToString, NormalizeNumericToBinary ,NumericToNominal , NumericTransform , PrincipalComponent, RandomSubset , Remove , RemoveType , ReplaceMissingValues , Standardize
   d. weka>filter>unsupervised>instance>Normalize , Randomize , Standardize, RemoveFrequentValues, RemoveWithValues , Resample , SubsetByExpression
2. Explore the 'select attribute' as follows
   weka>attributeSelection> , FilteredSubsetEval , WrapperSubsetEval
3. Association mining
   weka>associations> , Apriori, FPGrowth
4. Classification**
   weka>classifiers>bayes> , NaïveBayes , weka>classifiers>lazy> : IB1, IBkweka>classifiers>trees , SimpleCart , RandomTree , ID3
5. Clustering**
   weka>clusters> , SimpleKMeans , FarthestFirst algorithm, DBSCAN, hierarchicalClusterer

ECF22401

VI SEMESTER
DSE 5C: Elective: Artificial Intelligence and Expert Systems
Credit (L: T: P = 4: 0: 0)

Course Outcome

After successful completion of the course, the student is able to

CO1. Deliberate in details with examples Artificial intelligence system
CO2. Learn the characteristics of Concepts of Representation of knowledge
CO3. Understand in details with examples Concepts of Representation of knowledge
CO4. Understand the details of knowledge inference methods
CO5. Understand in details with examples Concepts of Machine Learning Techniques
CO6. Learn the details of Expert System

Unit - 1 15 Hours

INTRODUCTION TO AI AND PRODUCTION SYSTEMS: Introduction to AI-Problem formulation, Problem Definition -Production systems, Control strategies, Search strategies. Problem characteristics, Production system characteristics -Specialized production system-Problem solving methods - Problem graphs, Matching, Indexing and Heuristic functions -Hill Climbing-Depth first and Breath first, Constraints satisfaction - Related algorithms, Measure of performance and analysis of search algorithms.

REPRESENTATION OF KNOWLEDGE: Game playing - Knowledge representation, Knowledge representation using Predicate logic

Unit - 2 15 Hours

Introduction to predicate calculus, Resolution, Use of predicate calculus, Knowledge representation using other logic-Structured representation of knowledge.

KNOWLEDGE INFERENCE: Knowledge representation -Production based system, Frame based system. Inference - Backward chaining, Forward chaining, Rule value approach, Fuzzy reasoning - Certainty factors, Bayesian Theory-Bayesian Network-Dempster -Shafer theory.

Unit - 3 15 Hours

PLANNING AND MACHINE LEARNING: Basic plan generation systems - Strips - Advanced plan generation systems - Kstrips -Strategic explanations -Why, Why not and how explanations. Learning- Machine learning, adaptive Learning.

Unit - 4 15 Hours

EXPERT SYSTEMS: Expert systems - Architecture of expert systems, Roles of expert systems -Knowledge Acquisition –Meta knowledge, Heuristics. Typical expert systems - MYCIN, DART, XOON, Expert systems shells.

Reference Books:

1. Kevin Night, Elaine Rich, Nair B., "Artificial Intelligence (SIE)",McGraw Hill- 2008. (Unit-1,2,4,5)
2. Dan W. Patterson, "Introduction to AI and ES", Pearson Education, 2007. (Unit-III)
3. Peter Jackson, "Introduction to Expert Systems", 3rd Edition, Pearson Education, 2007.
4. Stuart Russel, Peter Norvig "AI – A Modern Approach", 2nd Edition, Pearson Education 2007.

ECF22501

VI SEMESTER
DSE 5C: Elective: Artificial Intelligence and Expert Systems Lab
Credit (L: T: P = 0: 0: 2)

1. Implement Breadth First Search (for 8 puzzle problem or Water Jug problem or any AI search problem)
2. Implement Depth First Search (for 8 puzzle problem or Water Jug problem or any AI search problem)
3. Implement Best First Search (for 8 puzzle problem or Water Jug problem or any AI search problem)
4. Implement Single Player Game (Using Heuristic Function)
5. Implement Two Player Game (Using Heuristic Function)
6. Implement A* Algorithm
7. Implement Propositional calculus related problem
8. Implement First order propositional calculus related problem
9. Implement Certainty Factor problem
10. Implement Syntax Checking of English sentences-English Grammar
11. Develop an Expert system for Medical diagnosis.
12. Develop any Rule based system for an application of your choice.

ECF23001

VI SEMESTER

DSE 6: Elective: Dissertation / Project
Credit (L: T: P = 0: 0: 6) 12 Hours/Week

Course Outcome:

After successful completion of the course, the student is able to

CO1. Identify in details with examples Problem identification
CO2. Write down in depth System Analysis
CO3. Understand and Develop SRS for selected System Problem
CO4. Understand and Develop System Design for selected System Problem
CO5. Learn in details and Develop a Code and Test the System
CO6. Understand the details of Presentation and Demo of Project Work

- ✓ This option is to be offered only in 6th Semester.
- ✓ The students will be allowed to work on any project based on the concepts studied in
- ✓ Core/elective or skill based elective courses.
- ✓ The group size should be maximum of THREE (03) students.
- ✓ Each group will be assigned a teacher as a supervisor who will handle both their theory as Well as lab classes.
- ✓ A maximum of Four (04) projects would be assigned to one teacher.

ECF24101

VI SEMESTER

SEC 3A: Elective: AJAX
Credit (L: T: P = 0: 0: 2)

Course Outcome:

After successful completion of the course, the student is able to

CO1. Deliberate in details with examples AJAX

CO2. Learn the details of AJAX Overview

CO3. Specify the details of Steps for Implementation of AJAX

CO4. Learn the details of Design and use of AJAX

Term work: Design& Develop Small web application using AJAX

Reference Books:

1. Steven Holzner, "Ajax A Beginner's Guide", The McGraw-Hill Companies.
2. Edmond Woychowsky,"Ajax: Creating Web Pages with AsynchronousJavaScript and XML", Pearson Education, Inc.
3. Thomas A. Powell, "Ajax: The Complete Reference", McGraw-Hill Companies.

ECF24301

VI SEMESTER

SEC 3B: Elective: Angular JS
Credit (L: T: P = 0: 0: 2)

Course Outcome:

After successful completion of the course, the student is able to

CO5. Deliberate in details with examples Angular JS

CO6. Learn the details of Angular JS Overview

CO7. Specify the details of Steps for Implementation of Angular JS

CO8. Learn the details of Design and use of Angular JS

Term work: Design & Develop Small web application using AngularJS

Reference Books:

1. Valeri Karpov, Diego Netto, "Professional AngularJS", WROX
2. Sheppard, Miller, Liptak, "Sams Teach Yourself-AngularJS for .NET Developer in 24 Hours", Pearson Education India; First edition

ECF24501

VI SEMESTER

SEC 3C: Elective: Wordpress
Credit (L: T: P = 0: 0: 2)

Course Outcome:

After successful completion of the course, the student is able to

CO1. Deliberate in details with examples Word press

CO2. Learn the details of Word pressOverview

CO3. Specify the details of Steps for Implementation of Word press

CO4. Learn the details of Design and use of Word press

Term work: Design & Develop Small Web Site usingWord press

Reference Books:

1. Lisa Sabin-Wilson, Cory Miller, Kevin Palmer, Andrea Rennick, and Michael Torbert, " WordPress® All-in-One For Dummies®", Wiley Publishing, Inc.
2. Tris Hussey, "WordPress Absolute Beginner's Guide", Que Publishing

ECF25101

VI SEMESTER

SEC 4A: Elective: Python Programming
Credit (L: T: P = 0: 0: 2)

Course Outcome:

After successful completion of the course, the student is able to

CO1. Learn the details of Python Programming Structure
CO2. Deliberate the characteristics of Python Programming
CO3. Understand in details with examples - Python Programming Languages
CO4. Specify in depth OOPs, Event Driven and GUI features in Python

Software Lab using Python

Section: A (Simple programs)

1. Write a menu driven program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon user's choice.
2. WAP to calculate total marks, percentage and grade of a student. Marks obtained in each of the three subjects are to be input by the user. Assign grades according to the following criteria
   Grade A: Percentage >=80
   Grade B: Percentage>=70 and <80
   Grade C: Percentage>=60 and <70
   Grade D: Percentage>=40 and <60
   Grade E: Percentage<40
3. Write a menu-driven program, using user-defined functions to find the area of rectangle, square, circle and triangle by accepting suitable input parameters from user.
4. WAP to display the first n terms of Fibonacci series.
5. WAP to find factorial of the given number
6. WAP to find sum of the following series for n terms: 1 – 2/2! : 3/3!----------n/n!
7. WAP to calculate the sum and product of two compatible matrices.

Section: B (Visual Python)

All the programs should be written using user defined functions, wherever possible.

1. Write a menu-driven program to create mathematical 3D objects
   I. Curve
   II. Sphere
   III. Cone
   IV. Arrow
   V. Ring
   VI. Cylinder.
2. WAP to read n integers and display them as a histogram.
3. WAP to display sine, cosine, polynomial and exponential curves.

4. WAP to plot a graph of people with pulse rate p vs. height h. The values of p and h are to be entered by the user.
5. WAP to calculate the mass m in a chemical reaction. The mass m (in gms) disintegrates according to the formula m=60/(t:2), where t is the time in hours. Sketch a graph for t vs. m, where t>=0.
6. A population of 1000 bacteria is introduced into a nutrient medium. The population p grows as follows:

P(t) = (15000(1:t))/(15: e)

Where the time t is measured in hours. WAP to determine the size of the population at given time t and plot a graph for P vs t for the specified time interval.

7. Input initial velocity and acceleration, and plot the following graphs depicting equations of motion:

I. Velocity wrt time (v=u:at)
II. Distance wrt time (s=u*t:0.5*a*t*t)
III. Distance wrt velocity (s=(v*v-u*u)/2*a)

Reference Books:

1. P. K. Sinha&PritiSinha , "Computer Fundamentals", BPB Publications, 2007.
2. Dr. Anita Goel, Computer Fundamentals, Pearson Education, 2010.
3. T. Budd, Exploring Python, TMH, 1st Ed, 2011
4. Python Tutorial/Documentation www.python.or 2010
5. Allen Downey, Jeffrey Elkner, Chris Meyers , How to think like a computer scientist : learning with Python , Freely available online.2012

ECF25301

VI SEMESTER

SEC 4B: Elective: R Programming
Credit (L: T: P = 0: 0: 2)

Course Outcome:

After successful completion of the course, the student is able to

CO1. Learn the details of R Programming Structure
CO2. Deliberate the characteristics of R Programming
CO3. Understand in details with examples - R Programming Languages

Software Lab Based on R Programming

1. Write a program that prints 'Hello World' to the screen.
2. Write a program that asks the user for a number n and prints the sum of the numbers 1 to n
3. Write a program that prints a multiplication table for numbers up to 12.
4. Write a function that returns the largest element in a list.
5. Write a function that computes the running total of a list.
6. Write a function that tests whether a string is a palindrome.
7. Implement the following sorting algorithms: Selection sort, Insertion sort, Bubble Sort
8. Implement linear search.
9. Implement binary search.
10. Implement matrices addition, subtraction and Multiplication

Reference Books:

1. William N. Venables and David M. Smith, An Introduction to R. 2nd Edition. Network Theory Limited.2009
2. Norman Matloff, the Art of R Programming - A Tour of Statistical Software Design, No Starch Press.2011

ECF25501

VI SEMESTER

SEC 4C: Elective: CodeIgniter
Credit (L: T: P = 0: 0: 2)

Course Outcome:

After successful completion of the course, the student is able to

CO1. Learn the details of CodeIgniter - Application Development Framework
CO2. Deliberate the Features of CodeIgniter

Term work: Design & Develop Small web application using CodeIgniter framework

Reference Books:

https://www.guru99.com/codeigniter-tutorial.html
https://www.javatpoint.com/codeigniter-preventing-enabling-from-csrf

Question Paper Pattern
Theory (3 or 4 Credits)

Time: 3 Hours Max. Marks: 70

Part – A

I. Answer any Eleven Question out of given Twelve Questions.11 X 2 = 22

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.

Note: Three Questions each from the Units 1, 2, 3, and 4

Part - B

II. Answer any Two Sub Questions from each main Question.

13. A) **2 X 6 = 12**
B)
C)

14. A) **2 X 6 = 12**
B)
C)

15. A) **2 X 6 = 12**
B)
C)

16. A) **2 X 6 = 12**
B)
C)

Note: Each Main questions contains 3 sub questions carries 06 Marks (may have internal Split-ups) and from Units 1, 2, 3 and 4 respectively

Question Paper Pattern

Theory (1 or 2 Credits)

Time: 2 Hours Max. Marks: 35

Part – A

I. Answer all Questions. 05 X 02 = 10

1.
2.
3.
4.
5.

Part - B

II. Answer any Four Questions out of given Five Questions. 5 X 5 = 25

6.
7.
8.
9.
10.

Note: Each Main questions contains 3 sub questions carries 06 Marks (may have internal Split-ups) and from Units 1 & 2 respectively

Question Paper Pattern

Practical / Project (1 or 2 Credits)

Time: 3 Hours Max. Marks: 35

Practicals

1. Two Experiments/ Programs 20 Marks Each 2 x 10 = 20 Marks

   a. Write-ups 5 X 2 = 10 Marks

   b. Conducting & Results 3 X 5 = 10 Marks (Any One for 2 Hours of Practical's)

2. Viva – Voice 10 Marks

3. Record 05 Marks

Project

1. Project Presentation 10% Marks
2. Project Demo 20% Marks
3. Viva – Voice 20% Marks
4. Record / Report 20% Marks
5. IA (C1 & C2) 30% Marks

Question Paper Pattern

Theory (SEC 1A/B: Mathematics / Business Mathematics)

Time: 2 Hours **Max. Marks: 35**

Part – A

1. Answer any five Questions. **5 X 2 = 10**

a.
b.
c.
d.
e.
f.

Part – B

2. Answer any two Questions. **2 X 5 = 10**

a.
b.
c.

3. Answer any two Questions. **2 X 5 = 10**

a.
b.
c.

4. Answer any one of the following. **1 X 5 = 5**

a.
b.

Question Paper Pattern

Project (6 Credits)

Time: 3 Hours Max. Marks: 70

IA (C1 & C2) = Max. Marks: 30

Practicals

Project

1.	Project Presentation	10 Marks
2.	Project Demo	30 Marks
3.	Viva – Voice	20 Marks
4.	Record / Report	10 Marks
5.	IA (C1 & C2)	(15 & 15) Marks

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE
(An autonomous College of University of Mysuru)
Re-accredited by NAAC with 'A' grade
Ooty road, Mysuru-570 025, Karnataka

DEPARTMENT OF BIOCHEMISTRY

SYLLABUS
FOR

I and II Semester B. Sc.
(Basic/Honors) Program in
Biochemistry

Biochemistry & Biotechnology
Biochemistry & Microbiology

Under

NATIONAL EDUCATION
POLICY -2020 (NEP-2020)

SYLLABUS
CHOICE BASED CREDIT SYSTEM
FOR
III, IV, V and VI Semester B.Sc. PROGRAMME

Biochemistry, Microbiology & Biotechnology
Botany, Biochemistry & Microbiology

2021-2022

B.Sc syllabus - Programme: Biochemistry-Biotechnology and Biochemistry-Microbiology

Scheme for examination and assessment for B.Sc. Biochemistry under NEP scheme 2021-22

Year	Sem	Course Type	Title of the Course	Combination	Course Code	Credits	Maximum Marks in the Exam/ Assessment				Exam Duration	
						L:T:P	SEE		IA			
I BSc	I	*DSC-1 Theory*	Chemical Foundations of Biochemistry-1	*BC-BT*	*FSA49040*	*4:0:0*	*60*	-	*40 (20+20)*	-	*2.5h*	-
				BC-MB	*FSA49042*							
		DSC-1 Practicals	Chemical Foundations of Biochemistry-1	*BC-BT*	*FSA49040*	*0:0:2*	-	*25*	-	*25 (10+15)*	-	*3 h*
				BC-MB	*FSA49042*							
		OE-1 Theory	Biochemistry in Health and Diseases	-	-	*3:0:0*	*60*	-	*40 (20+20)*	-	*2.5h*	-
		SEC-1 Theory	Biochemical Techniques-1	-	-	*2:0:0*	*60*	-	*40 (20+20)*	-	*2.5h*	-
		SEC-1 Theory	Microbiological quality of food and water	-	-	*2:0:0*	*60*	-	*40 (20+20)*	-	*2.5h*	-
	II	*DSC-2 Theory*	Chemical Foundations of Biochemistry -2	*BC-BT*	*FSB49040*	*4:0:0*	*60*	-	*40 (20+20)*	-	*2.5h*	-
				BC-MB	*FSB49042*							
		DSC-2 Practicals	Qualitative and Quantitatve analysis	*BC-BT*	*FSB49040*	*0:0:2*	-	*25*	-	*25 (10+15)*	-	*3 h*
				BC-MB	*FSB49042*							
		OE-2 Theory	Nutrition and Dietetics	-	-	*3:0:0*	*60*	-	*40 (20+20)*	-	*2.5h*	-
		SEC-2 Theory	Biochemical Techniques-2	-	-	*2:0:0*	*60*	-	*40 (20+20)*	-	*2.5h*	-
		SEC-2 Theory	Bioinformatics	-	-	*2:0:0*	*60*	-	*40 (20+20)*	-	*2.5h*	-

Preamble

Biochemistry, today is considered as an application oriented integrated basic science. It's an interdisciplinary science that has emerged by the confluence of principles of Chemistry, Physics and Mathematics to Biology. Advances in Biochemistry have immense positive implications on the understanding of biochemical interactions, cellular communications, hormonal mechanisms and the cross talks between them. The research in Biochemistry has been translational and there is a shift from hypothesis driven research to data dependent research that promises translational, product oriented research. Much of the advancement in Biochemistry is in the advancement of Biotechnology, as a basic science disciplineBiochemistry lead to Biotechnological advancement. Considering its pivotal role in Biological sciences, it is imperative to strengthen the fundamental concepts of Biochemistry. The current pattern is designed to provide a focused learning outcome-based syllabus at the Honors level providing structured teaching-learning experiences catering to the needs of the students. The honors course will prepare the students academically and prepare them for employability. The program also inculcate various attributes at the Honors level. These attributes encompass values related to emotional stability, social justice, creative and critical thinking, well-being and various skills required for employability, thus preparing students for continuous learning and sustainability. The new curriculum based on learning outcomes of B. Sc. (Honors) in Biochemistry offers basic knowledgeof chemistry in general, including the concepts in organic, inorganic, physical, analytical, spectroscopy and pharmaceutical chemistry. The course defines clearly the objectives and the learning outcomes, enabling students to choose the elective subjects broadening their skills. The course also offers skills to pursue research in the field of Biological Chemistry and thus would produce best minds to meet the demands of society.

Curriculum

Name of the Degree Program : B.Sc. (Basic/Hon0rs)
Discipline Core : Biochemistry
Total Credits for the Program :184 Starting year of implementation: 2021-22

The learning outcomes are designed to help learners understand the objectives of studying B.Sc. Biochemistry (Honors) that is, to analyze, appreciate, and understand the basic concepts of biomolecular processes and chemical reactions occurring in the living system. This course is fundamental to tackle many of the health – related challenges facing society. Considering the rapid and far-reaching advances in biological sciences in 21st century, it is imperative to have curriculum incorporating these updated emerging concepts of biochemistry. The current pattern is designed to impart concept-based learning with emphasis on hands-on training, skill development and research. Aimed at multi-faceted development of a student, the curriculum includes courses encompassing core courses, intra and inters discipline specific courses, skill and ability enhancement courses to impart in-depth knowledge in biochemistry complemented with varied subjects and skills. The course seeks to discover and nurture typical attributes of a competent science graduate such as; spirit of inquiry, critical thinking, problem solving, analytical reasoning, aptitude to research/industry and entrepreneurial instincts.

Program Learning Outcome: *The learning outcome-based curriculum is specific in terms of changes in cognitive and psychomotor behavior of students. Biochemistry Honors course is intended to provide a broad framework enabling students to acquire a skill set that helps them understand and appreciate the field of biochemistry. The structure or design of this framework shall ensure a high standard of the Honors degree in Biochemistry at national level. The program specification are intended as a reference point for prospective students, current students, academic in delivering the program and realizing its objectives. Keeping in pace with the developmental trends in Biochemistry and allied areas, it is expected that the students undertaking Biochemistry (Honors) course become conversant with the essence of Biochemistry and exhibit certain levels of learning outcomes as proposed below;*

PROGRAMME OUTCOME (PO)

PO1	*To create interest in Biochemistry and appreciation for chemical basis of biological processes.*
PO2	*To inculcate the spirit of inquiry and value of systematic study of a discipline. Provide a general understanding of the related disciplines with a holistic knowledge generation in biological sciences.*
PO3	*To provide an in-depth understanding of chemical reaction mechanisms in biological processes.*
PO4	*To provide a flavor of historical developments of enzymes and their applications in research, diagnostics and various industries.*
PO5	*Gain proficiency in basic laboratory techniques and be able to apply the scientific method to the processes of experimentation, hypothesis testing, data interpretation and logical conclusions.*
PO6	*Develop problem solving and analytical skills through case studies, research papers and hands-on-experience*
PO7	*To appreciate biochemical mechanistic basis of physiological processes, metabolism under normal and pathological conditions importance and levels of metabolic regulations.*
PO8	*To apply and effectively communicate scientific reasoning and data analysis in both written and oral forms. They will be able to communicate effectively with well-designed posters and slides in talks aimed at scientific audiences as well as the general public.*
PO9	*To bridge the knowledge and skill gap between academic out and industry requirements.*
PO10	*To give students experience in conducting independent, hypothesis-driven, biological research, project planning and management*
PO11	*To provide skills to publish research findings, and awareness of IP rights, and scientific publication ethics and problems of plagiarism.*
PO12	*To prepare competent human resource with better knowledge, hands-on-experience and scientific attitude, at national and global levels for careers in research and development, academia and Pharma-, biotech- and agro-, and food processing industries.*

GRADUATE ATTRIBUTES B. Sc. BIOCHEMISTRY (Honors):

Graduates with strong academic knowledge, discipline-specific and generic skills complemented with social responsibility are greatest asset of the country. The curriculum frame work under NEP for Biochemistry graduates aims to build the following attributes;

Disciplinary Knowledge:

a) *Ability to comprehend fundamental concepts of biology, chemistry and apply basic principles of chemistry to biological systems.*
b) *Ability to relate various interrelated physiological and metabolic events.*
c) *Ability to critically evaluate a problem and resolve to challenge blindly accepted concepts*
d) *Ability to think laterally and in an integrating manner and develop interdisciplinary*
e) *Good experimental and quantitative skills and awareness of laboratory safety*
f) *A general awareness of current developments at the forefront in biochemistry and allied subjects.*
g) *Awareness of resources, and their conservation.*

Communication Skills:

a) *Ability to speak and write clearly in English and local language*
b) *Ability to listen to and follow scientific viewpoints and engage with them.*
c) *Ability to understand and articulate with clarity and critical thinking one's position.*

Critical Thinking:

a) *Ability to conceptualize critical readings of scientific texts in order to comprehend.*
b) *Ability to place scientific statements and themes in contexts and also evaluate them in terms of generic conventions.*

Problem Solving:

a) *Ability make careful observation of the situation, and apply lateral thinking and analytical skills.*

Analytical Reasoning:

a) *Ability to evaluate the strengths and weaknesses in scholarly texts spotting flaws in their arguments. b. Ability to use scientific evidences and experimental approach to substantiate one's argument in one's reading of scientific texts.*

Research Skills:

a) *Ability to formulate hypothesis and research questions, and to identify and consult relevant sources to find answers.*
b) *Ability to plan and write a research paper.*

Teamwork and Time Management:

a) *Willingness to participate constructively in class room discussions and contribute to group work.*
b) *Ability to meet a deadline.*

Scientific Reasoning:

a) *Ability to analyze theories and beliefs, evaluate ideas and scientific strategies.*
b) *Ability to formulate logical and convincing arguments.*

Reflective Thinking:

a) *Ability to locate oneself and see the influence of location—regional, national, global— on critical thinking.*

Self-Directing Learning:

a) *Ability to work independently in terms of organizing laboratory, and critically analyzing scientific literature.*
b) *Ability to postulate hypothesis, questions and search for answers.*

Digital Literacy:

a) *Ability to use digital resources, and apply various platforms to convey and explain concepts of biochemistry.*

Multicultural Competence:

a) *Ability to engage with and understand cultures of various nations and respect and transcend differences.*

Moral and Ethical Values:

a) *Ability to interrogate one's own ethical values, and to be aware of ethical and environmental issues.*
b) *Ability to read values inherited in society and criticism vis-a-vis, the environment, religion, spirituality, and structures of power.*

Leadership qualities:

a) *Ability to lead group discussions, to formulate questions related to scientific and social issues.*

Life-long Learning:

a) *Ability to retain and build on critical thinking skills, and use them to update scientific knowledge and apply them in day to day business.*

Exit Options and credit requirement

Progressive Certificate in Science, Diploma in Science, Bachelor of Science Degree or Bachelor of Science Degree with Honors in Biochemistry is awarded at the completion of every progressive year.

A student will be allowed to enter/re-enter only at the ODD semester and can only exit after EVEN semester. Re-entry at various as lateral entrants in academic programs based on the above mentioned earned credits and proficiency test records.

Exit with	**Credit requirements**
CERTIFICATE IN SCIENCE *at the successful completion of First year (Two Semesters) of the Four Years Multidisciplinary Undergraduate Degree Program.*	*50*
DIPLOMA IN SCIENCE *at the successful completion of Second year (Four Semesters) of the Four Years Multidisciplinary Undergraduate Degree Programme.*	*100*
BACHELOR OF SCIENCE DEGREE *at the successful completion of Three year (Six Semesters) of the Four Years Multidisciplinary Undergraduate Degree Programme.*	*142*
BACHELOR OF SCIENCE DEGREE WITH HONOURS IN BIOCHEMISTRY *at the successful completion of Four year (Eight Semesters) of the Four Years Multidisciplinary Undergraduate Degree Program.*	*184*

Syllabus Theory and Practical

B.Sc. (Basic/Honors) Semester-I

Course code:DSC-1T: BC-101;
Course Title: Chemical Foundations of Biochemistry-1 (Theory)

Course title	Chemical Foundation of Biochemistry-1
Couse code	*DSC-1T: BC-101*
Course credits	*04*
Total contact hours	*56*
Duration of ESA (Hour)	*03*
Formative assessment marks	*40*
Summative assessment marks	*60*

Course Outcome:
This will inculcate confidence and clarity of mind in students to understand the chemistry of Biomolecules, and Biological reactions.

Course Outcomes /Program Outcomes	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
Aptitude	*x*	*x*	*x*									
Critical thinking		*x*										
Subject clarity	*x*	*x*										*x*
Analytical Skill	*x*				*x*	*x*						

Content of Theory course- Chemical Foundation of Biochemistry-1 Total credits = 4	**56hr**
Unit 1: Scope of Biochemistry and Units of measurement	**14 hr**
Origin of life, types of organisms, prokaryotes, eukaryotes, unicellular, multicellular, compartmentation of functions in lower and higher organisms, and common physiological events of organisms, chemical composition of living organisms, subcellular organelles, SI units, mass, volume, temperature, amount, length and time. An overview on the metric system, atomic weight, molecular weight, equivalent weight, basicity of acids, acidity of bases, Avogadro`s number, molarity, normality, molality, Dalton concept, mole concept, concentration, mole to molar conversion, oxidation number and its significance, density and specific gravity, their significances.	
Unit 2 : Atomic structure and Chemical bonds	**14 hr**
Structure of an atom, electrons and Quantum numbers, orbitals, shapes of orbitals, s, p, d, and f subshells, K, L, M, N, O, P, and Q shells. Illustration of Pauli`s exclusion principle, Aufbau principle, and Hund`s rule, electron configuration, octet rule. Formation and properties of noncovalent and covalent bonds, hydrogen bonds, ionic bonds, van der Waals interactions, London forces, dipole-dipole interactions, electrostatic interactions, and hydrophobic interactions. Sigma, pi and co-ordinate bonds, back bonding.	

Corresponding energy associated, outline of theories of bonding.	
Unit 3: Buffers and Colligative properties	**14 hr**
Acids, bases, Arrhenius concept, proton transfer theory, Lewis concept, Lowry and Bronsted concepts. Buffers, composition, pH, pH scale, Henderson-Hasselbalch equation, titration curve of H_3PO_4, pK value, isoelectric pH, ionization of HCl, HNO3, H2SO4. Colligative properties and anomalous colligative properties of solutions, structure of water, phase diagram of pure water, ionic product of water, special properties of water, buffers in animal system. Solutions and types, ionizable solutes, non-ionizable solutes, vapor pressure and its application in distillation, Vant Hoff law, Roult`s law, boiling point, freezing point, de-icing, osmosis and osmotic pressure determination, reverse osmosis, surface tension.	
Unit 4: Electrochemistry and Redox reactions	**14 hr**
Scope of electrochemistry, electrochemical cells, Daniel cell, galvanic cell, electrode potential and its measurement, electrolysis, types of electrolytes, primary and secondary batteries, electrodes, half-cell reaction, standard electrodes. Laws of thermodynamics, entropy and enthalpy, their relation, Gibb`s energy, free energy change, Lewis concept, ions, redox reactions, redox potential, application of redox potential, energy linked to redox reactions, reduction of oxygen, oxidation and reduction of iron in hemoglobin, biological active forms of zinc, calcium, nickel, molybdenum, selenium, and cobalt, NAD+/NADH, NADP+/NADPH, FAD/FADH2, FMN/FMNH2. Molecularity and order of a reaction.	

References:

1. *Advanced Inorganic Chemistry: A comprehensive Text,1999, Cotton A and Geoffrey Wilkinson, 6th edition, Wiley publication*
2. *Inorganic Chemistry, 2014, Miessler GL, Paul Fischer PJ, and Tarr DA, 5th edition,Pearson Publication*
3. *Inorganic Chemistry, 2004, Catherine E and Sharpe AG, ACS publication*
4. *Inorganic Chemistry, 2015, Overton, Rourke, Weller , Armstrong and Hagerman,Oxford Press*
5. *Physical Chemistry: A molecular approach ,2019, Donald A, McQuarrie and Simon JD,Viva Books Publication*
6. *Physical chemistry 2019, Atkins P, Paula JD, Keeler J , 11th edition , Oxford press*

Pedagogy: MOOC/desk work/book chapter/problem solving /assignment

Formative Assessment	
Assessment occasion	*Weightage in marks*
Class test (Two class tests)/ Continuous evaluation	*20*
Seminar/ class work	*10*
Assignment/ open discussion/ quiz	*10*
Total	*40*

Course code: DSC-1P: BC-102;
Course Title: Volumetric Analysis – Practicals-1

Course title	Volumetric analysis – practicals-1
Couse code	*DSC-1P: BC-102*
Course credits	*02*
Total contact hours	*56 (4 h/ week)*
Duration of ESA (Hour)	*3*
Formative assessment marks	*25*
Summative assessment marks	*25*

Content of Practical course- Volumetric analysis- Practical-1	
Total Teaching Hours = 56; **Total Credits = 2**	**56 hr**
List of experiments to be conducted	
1. Concept of molarity, molality and normality. Calculation and preparation of molarsolutions. (Problems to be given in exams). Calculation and preparation of normalsolutions and percent solutions and dilute solutions. *2. Calibration of volumetric glassware's (Burette, pipette).* *3. Preparation of standard Sodium carbonate solution, standardization of HCl (Methylorange) and estimation of NaOH in the given solution. (methyl orange or phenolphthalein).* *4. Preparation of standard Oxalic acid. Standardization of NaOH and estimation of H_2SO_4 in the given solution (phenolphthalein).* *5. Preparation of standard Oxalic acid. Standardization of $KMnO_4$ and estimation of H_2O_2 in the given solution.* *6. Preparation of standard $K_2Cr_2O_7$. Standardization of $Na_2S_2O_3$ and estimation of $CuSO_4$ in the given solution.* *7. Preparation of $ZnSO_4$. Standardization of EDTA and estimation of total hardness of water using Eriochrome-Black-T indicator.* *8. Preparation of standard potassium bipthalate. Standardization of NaOH and estimation of HCl in the given solution. (Phenolphthalein).* *9. Estimation of sulphuric acid and oxalic acid in a mixture using standard NaOH solution and standard $KMnO_4$ solution.* *10. Preparation of standard Potassium dichromate and estimation of ferrous/ferric mixture using diphenylamine indicator (Demonstration).* *11. Preparation of standard oxalic acid solution. Standardization of NaOH solution and estimation of acidity in vinegar.* *12. Preparation of standard potassium bi-phthalate solution, standardization of sodium hydroxide solution and estimation of alkalinity of antacids* *13. Preparation of standard Oxalic acid solution. Standardization of $KMnO_4$ solution and estimation of calcium in milk.*	

References

1. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
2. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.
3. Dr. O. P. Pandey, D. N. Bajpai, dr. S. Giri, Practical Chemistry S. Chand and Co. Ltd.,

4. *Principles of Practical Chemistry- M. Viswanathan*
5. *Instrumental Methods of chemical Analysis B.K Sharma.*
6. *Experiments in Physical Chemistry R.C. Das and B. Behra, Tata McGraw Hill*
7. *Advanced Practical Physical Chemistry J.B.Yadav, Goel Publishing House*
8. *Advanced Experimental Chemistry. Vol-I J.N.Gurtu and R Kapoor, S.Chand and Co.*
9. *Practical Chemistry K.K. Sharma, D. S. Sharma (Vikas Publication).*
10. *General Chemistry experiment – Anil J Elias (University press).*
11. *Vogel textbook of quantitative chemical analysis G.H. Jeffery, J. Basset.*
12. *Quantitative chemical analysis S. Sahay (S. Chand & Co.).*
13. *Practical Chemistry Dr O P Pandey, D N Bajpai, Dr S Giri. S. Chand Publication*
14. *College Practical Chemistry. V K Ahluwalia, SunithaDingra, Adarsh Gulati*
15. *Practical Physical Chemistry- B. Viswanathan, P S Raghavan. MV Learning Publication*

Pedagogy: MOOC/desk work/book chapter/problem solving /assignment

Formative Assessment	
Assessment occasion	*Weightage in marks*
Class test (Two class tests)/ Continuous evaluation	*20*
Practical record and Viva voce	*05*
Total	*25*

Open Elective Course Code: OE-1T:BC-103;
Course Title: Biochemistry in Health and Diseases (theory)

COURSE TITLE	Biochemistry in Health and Diseases
Couse code	*OE-1T: BC-103*
Course credits	*03*
Total contact hours	*42*
Duration of ESA (Hour)	*03*
Formative assessment marks	*30*
Summative assessment marks	*70*

Course Outcome*: This open elective course offering to students of various streams gives knowledge about health and various terminologies used in health and disease conditions; Difference between communicable and non-communicable diseases; Health promotion and treatments for various diseases and disorders.*

Content of Theory course- Biochemistry in Health and Diseases Total credits =3	**42 hr**
Unit 1: Introduction	**14 hr**
WHO definition of health, Health and hygiene, General health care, Factors affecting health, Indices and evaluation of health, Disease patterns in developed and developing world; Classification of diseases - Endemic, Epidemic, Pandemic; Professional health hazards. *Disease conditions: Acute disease, Chronic disease, Incurable disease, Terminal disease, Illness, disorders, Syndrome, Pre-disease.*	
Treatment: Psychotherapy, Medications, Surgery, Medical devices, and Self-care. Dimensions of Health: Physical, Mental, Spiritual, Emotional, Environmental, and Philosophical.	
Unit 2: Types of Diseases	**14 hr**
Tuberculosis, Cholera, Typhoid, Conjunctivitis. *Sexually transmitted diseases (STD): Information, statistics, and treatment guidelines for STD, Prevention: Syphilis, Gonorrhea, AIDS, etc.* *Non-communicable diseases: Malnutrition- Under nutrition, Over nutrition, Nutritional deficiencies; Anemia, Stroke, Rheumatic heart disease, Coronary heart disease, Cancer, blindness, accidents, mental illness, Iodine deficiency, Fluorosis, Epilepsy, Asthma.* *Genetic disorders: Down's syndrome, Klinefelter's syndrome, Turner's syndrome, Thalassemia, Sickle cell anemia.* *Lifestyle disorders: Obesity, Liver cirrhosis, Diabetes mellitus, Hypertension (Causative agents, symptoms, diagnosis, treatment, prognosis, prevention)*	

Unit 3: Health Promotions	**14 hr**
Preventing drug abuse, Oral health promotion by tobacco control. *Mental hygiene and mental health: Concepts of mental hygiene and mental health, Characteristics of mentally healthy person, Warning signs of poor mental health, Promotive mental health, strategies and services, Ego defense mechanisms and implications, Personal and social adjustments, Guidance and Counseling.* *Infection control: Nature of infection, Chain of infection transmission, Defenses against* *infection transmission*	

References

1. *Modern Nutrition in Health and Disease 2006 10th Edition by Maurice E. Shils, Moshe Shike, A Catharine Ross.*
2. *Clinical Biochemistry and Metabolic Medicine, 2012 Eighth Edition by Martin Andrew Crook, CRC Press,*
3. *Nutrition & Health in Developing Countries, 2000, Editors: R. Semba and M.W. Bloem, Humana Press*

Pedagogy: MOOC/desk work/book chapter/problem solving /assignment

Formative Assessment	
Assessment occasion	*Weightage in marks*
Class test (Two class tests)/ Continuous evaluation	*20*
Seminar/ class work	*10*
Assignment/ open discussion/ quiz	*10*
Total	*40*

Skill enhancement course: Course Code: SEC-1T:BC-104.1; Course Title: Biochemical Techniques-1 (theory)

Course title	Biochemical Techniques-1
Course code	*SEC-1T: BC-104.1*
Course credits	*02*
Total contact hours	*28*
Duration of ESA (Hour)	*03*
Formative assessment marks	*40*
Summative assessment marks	*60*

Course Level Learning Outcomes: *Students will be exposed to various spectrophotometry and chromatographic techniques and their applications in separation of chemicals like biomolecules, organic chemicals, drugs etc.*

Content of Theory course- Biochemical Techniques-1 Total credits =2	**28 hr**
Unit 1: Photometry	*14 hr*
Principle of light absorption by molecules. Beer-Lambert law, Types of spectrophotometers. Principals and working of colorimeter, Visible spectrophotometer, UV-Visible spectrophotometer, Fluorescent spectrophotometry, nano-drop-spectrophotometry, Atomic absorption spectrophotometry. Types of Detectors-Phototube, Photomultiplier tube, Photo diode, Diode array detector, Charge coupled device detectors. Applications of spectrophotometry in estimation of organic compounds, enzyme assays, enzyme kinetics, recording spectrum, time-lapse studies,	
Unit 2: Chromatography	*14 hr*
Separation of small molecules by TLC, column chromatography, HPLC, and GLC.RP-HPLC, normal phase HPLC, HILIC. Column materials, ODS v/S BDS columns, Different columns used in HPLC, and GLC. Different types of detectors used in HPLC and GLC. Preparation of sample for separation by HPLC and GLC. Importance of column material and pore size. Isocratic v/s gradient HPLC	
References 1. *Biophysical Chemistry, Principles & Techniques – Upadhyay, Upadhyay and Nath –Himalaya Publ. House.* 2. *Principles & Techniques of Practical Biochemistry – Wilson, Walker- Cambridge Univ.Press.* 3. *Chromatography – G. Abbott.* 4. *Physical Biochemistry- Application to biochemistry and molecular biology by David Freifelder. W. H. Freeman & Co. San Fransisco. 2nd Edition*	

Pedagogy: MOOC/desk work/book chapter/problem solving /assignment

Formative Assessment	
Assessment occasion	*Weightage in marks*
Class test (Two class tests)/ Continuous evaluation	*20*
Seminar/ class work	*10*
Assignment/ open discussion/ quiz	*10*
Total	*40*

Skill enhancement course: Course Code: SEC-1T: BC-104.2; Course Title: Microbiological quality of food and water (Theory)

Course title	Microbiological quality of food and water
Couse code	*SEC-1T: BC-104.2*
Course credits	*02*
Total contact hours	*28*
Duration of ESA (Hour)	*03*
Formative assessment marks	*40*
Summative assessment marks	*60*

Course Level Learning Outcomes: *Students will learn various means of microbial contaminations in water and food and their implications on health. Student will learn about the standard methods of detection of contaminating microorganisms in food and water samples.*

Content of Theory course- Microbiological quality of food and water **Total credits =2**	**28 hr**
Unit 1: Water Quality & Assessment	**14 hr**
Sampling of water to detect the microbiological quality of water. Isolation of microorganisms from water sample. Medium: Growth medium, differential medium and specific medium. *Treatment and safety of drinking (potable) water, methods to detect potability of water samples: (a) standard qualitative procedure: presumptive test/MPN test, confirmed and completed tests for fecal coliforms (b) Membrane filter technique and (c) Presence/absence tests*	
Unit 2: Microbiology of Food	**14 Hr**
Intrinsic and extrinsic factors that affect growth and survival of microbes in foods, natural flora and source of contamination of foods in general. Principles, Spoilage of vegetables, fruits, meat, eggs, milk and butter, bread, canned Foods. *Cultural and rapid detection methods of food borne pathogens in foods. Food borne diseases: Food intoxication, food infection, shigellosis. Food sanitation and control: HACCP, Indices of food sanitary quality and sanitizers.*	

References:

1. *Adams MR and Moss MO. (1995). Food Microbiology. 4th edition, New Age International (P) Limited Publishers, New Delhi, India.*
2. *Banwart JM. (1987). Basic Food Microbiology. 1st edition. CBS Publishers and Distributors, Delhi, India.*
3. *Davidson PM and Brannen AL. (1993). Antimicrobials in Foods. Marcel Dekker, NY.*
4. *Dillion VM and Board RG. (1996). Natural Antimicrobial Systems and Food Preservation. CAB International, Wallingford, Oxon.*

5. *Frazier WC and Westhoff DC. (1992). Food Microbiology. 3rd edition. Tata McGraw-Hill Publishing Company Ltd, New Delhi, India.*
6. *Gould GW. (1995). New Methods of Food Preservation. Blackie Academic and Professional, London.*
7. *Jay JM, Loessner MJ and Golden DA. (2005). Modern Food Microbiology. 7th Ed., CBS Publishers and Distributors, Delhi, India.*
8. *Lund BM, Baird Parker AC, and Gould GW. (2000). The Microbiological Safety and Quality of Foods. Vol. 1-2, ASPEN Publication, Gaithersberg, MD.*
9. *Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An Introduction. 9th edition. Pearson Education.*

Pedagogy: MOOC/desk work/book chapter/problem solving /assignment

Formative Assessment	
Assessment occasion	*Weightage in marks*
Class test (Two class tests)/ Continuous evaluation	*20*
Seminar/ class work	*10*
Assignment/ open discussion/ quiz	*10*
Total	*40*

Syllabus Theory and Practical

B.Sc. (Basic/Honors) Semester-II

Course code:DSC-2T: BC-201;

Course Title: Chemical Foundations of Biochemistry -2(theory)

Course title	**Chemical Foundations of Biochemistry -2**
Couse code	*DSC-2T: BC-201*
Course credits	*04*
Total contact hours	*56*
Duration of ESA (Hour)	*03*
Formative assessment marks	*40*
Summative assessment marks	*60*

Course Outcome: *These topics will enable students to understand the fundamentals of chemical processes in biological systems*

Course Outcomes / Program Outcomes	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
Aptitude	*x*	*x*	*x*									
Critical thinking	*x*	*x*										
Subject clarity	*x*	*x*										*x*
Analytical Skill	*x*	*x*			*x*	*x*						

Content of Theory course- Chemical Foundations of Biochemistry-2 **Total credits = 4**	**56 hr**
Unit 1: Chemical Catalysis	**14 hr**
Definition, characteristics, types, intermolecular, multifunctional, theories of catalysis, properties, characteristics of enzyme catalysis, autocatalysis, industrial catalysis and their role in biological systems (brief). Colloids: true solutions, classification, peptisation, purification, ultrafiltration, Brownian movements, electric properties, coagulation, mutual, lyophilic sols, boiling, dialysis, electro and persistent dialysis, addition of electrolytes, colloids in daily life and applications. Emulsion, types, micelles with biomolecules and its biological applications.	
Unit 2: Nomenclature of Organic Compounds	**14 hr**
Classification, naming- IUPAC nomenclature, compounds containing one, two functional groups with chains, homologous series. Stereochemistry, geometrical and structural Isomerism, conformation and free rotation. Optical isomerism, symmetry of elements, plane polarized light and optical purity. Nomenclature of enantiomers, epimers, racemic mixture, resolution. Fischer and Newman projection formulae, molecule with one and two chiral and achiral centers. Priority rules; E and Z (CIP rules), R and S, D and L notations, absolute (r and s) and relative (d and l) configuration. Role of stereochemistry in biological systems.	

Unit 3: Organometallic Compounds	**14 hr**
Metal atom linked organic compounds. Preparation of Grignard reagents and structure, limitations, protonolysis and reactions. Organolithium compounds, preparation and reactions. Organozinc compounds. Organoboranes its mechanisms. Ferrocenes. *Introduction to mineral and ores, classification, concentration, extraction, refining, uses of minerals and metals and its importance.* *Porphyrins and Metal ions: Role of metal ions in biological systems, Fe, Cu, Zn, structureand functions of porphyrins, metalloporphyrins and iron-sulphur clusters with suitableexamples and their role in biological systems.*	
Unit 4: Inorganic Chemistry	**14 hr**
Nomenclature of inorganic molecules and coordination compounds, formula. IUPACnomenclature. Central metal ion, ligand, coordination number, sphere, complex ion, oxidation number of central atom, homoleptic and heteroleptic complexes. Isomerism in complexes, structural, ionisation, solvate, linkage and coordination, Stereoisomerism, geometrical, optical isomerism with simple inorganic complexes. Applications of qualitative, quantitative analysis, photographic, metallurgy, medicine, catalysis and biosystems. *Heavy Metal Poisons: Introduction, poisons, lead, mercury, aluminium, arsenic, corrosives, cyanide, irritants, phosphorus, CO2, SO2, SO3, NO2, halides and acid fumes, poisoning, sources, signs and symptoms. Free radicals: introduction, definition, generation and scavenger systems. Redox reactions, types, stock notations, change in oxidation number and combination. Endergonic and exergonic reactions with examples. The Importance in biological systems.*	

References

1. *Physical Chemistry 2006, Peter Atkins. 8th edition, W.H. Freeman and Company*
2. *Inorganic Chemistry: Principles of structure and Reactivity, 2006, Huheey JE, Keiter EA, Keiter RL, Pearson Education India*
3. *Stereochemistry: Conformation and Mechanism, 2009, Kalsi PS, New Age International Publications*
4. *Introduction to Stereochemistry 2012, Kurt Mislow, Dover Publications*
5. *A text book of Organic Chemistry 2016, Raj K Bansal, 6th edition, New Age International Publications*
6. *Advanced Inorganic Chemistry 1999, Cotton et al , 6th edition, A Wiley - International*
7. *Principles of physical Chemistry by Puri, Sharma and Pathania.*
8. *Physical Chemistry by R. L. Madan, G. D. Tuli. S. Chand and Co.*
9. *A Text Book of Physical Chemistry by K.L.Kapoor. Vol.2.Mc. Millan Publisher, India Ltd.*
10. *Advanced Organic Chemistry by Bahl and Arun Bahl.*

Pedagogy: MOOC/desk work/book chapter/problem solving /assignment

Formative Assessment	
Assessment occasion	*Weightage in marks*
Class test (Two class tests)/ Continuous evaluation	*20*
Seminar/ class work	*10*
Assignment/ open discussion/ quiz	*10*
Total	*40*

Course code: DSC-2P: BC-202;
Course Title: Qualitative and Quantitatve analysis – practicals-2

Course title	**Qualitative and Quantitative analysis-practical's-2**
Couse code	*DSC-2P: BC-202*
Course credits	*02*
Total contact hours	*56 (4 h/ week)*
Duration of ESA (Hour)	*3*
Formative assessment marks	*25*
Summative assessment marks	*25*

Course Outcome: The Course Objective is to provide experimental practice of quantitative and qualitative analysis. Also it provides training in physical chemistry laboratory techniques. Upon successful completion, students should develop skills in handling instruments and understand its application in research work.

Content of Practical course- Qualitative and quantitative analysis-2	
Total Teaching Hours = 56; **Total Credits = 2**	**56 hr**
List of experiments to be conducted	
1. *Systematic Semi micro–Qualitative Analysis of Inorganic Salt Mixtures* *Systematic semi micro qualitative analysis of two acid and two basic radicals in the given inorganic salt mixture. The constituent ions in the mixture to be restricted to the following. (Any four binary mixtures shall be given)* *Anions: HCO -, CO_2-, Cl-, Br-, NO -, BO 3-, SO 2- and PO_3-.* *Cations: Pb_2+, Al_3^+, Fe_2^+, Fe_3^+, Mn_2^+, Zn_2^+, Ca_2^+, Sr_2^+, Ba_2^+, Mg_2^+, K^+, Na^+ and NH^+.* *Determination of density and viscosity of the given liquid using specific gravity bottleand Ostwald's viscometer.* 2. *Determination of density and surface tension of the given liquid using specific gravity bottle and stalagnometer.* 3. *Determination of molecular weight of non-volatile solute by Walker-Lumsden method.* 4. *Determination of rate constant of decomposition of H_2O_2 using $KMnO_4$ by volumetric analysis method using ferric chloride as catalyst.* 5. *Determination of distribution coefficient of benzoic acid between water and benzene or iodine between water and carbon tetrachloride.* 6. *Separation of Two Components from given Binary Mixture of Organic Compounds Qualitatively. (Types of binary mixtures- Solid – Solid, Solid – Liquid, Liquid – Liquid)* 7. *Verification of Beer's Law. Estimation of unknown concentration of a*	

biomolecule by using colorimeter 8. *Calibration of pH meter and determination of pH of aerated soft drinks.*	

References

1. *Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.*
2. *Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.*
3. *Dr. O. P. Pandey, D. N. Bajpai, dr. S. Giri, Practical Chemistry S. Chand and Co. Ltd.,*
4. *Principles of Practical Chemistry- M. Viswanathan*
5. *Instrumental Methods of chemical Analysis B.K Sharma.*
6. *Experiments in Physical Chemistry R.C. Das and B. Behra, Tata McGraw Hill*
7. *Advanced Practical Physical Chemistry J.B.Yadav, Goel Publishing House*
8. *Advanced Experimental Chemistry. Vol-I J.N.Gurtu and R Kapoor, S.Chand and Co.*
9. *Practical Chemistry K.K. Sharma, D. S. Sharma (Vikas Publication).*
10. *General Chemistry experiment – Anil J Elias (University press).*
11. *Vogel textbook of quantitative chemical analysis G.H. Jeffery, J. Basset.*
12. *Quantitative chemical analysis S. Sahay (S. Chand & Co.).*
13. *Practical Chemistry Dr O P Pandey, D N Bajpai, Dr S Giri. S. Chand Publication*
14. *College Practical Chemistry. V K Ahluwalia, SunithaDingra, Adarsh Gulati*
15. *Practical Physical Chemistry- B. Viswanathan, P S Raghavan. MV Learning Publication*

Pedagogy: MOOC/desk work/book chapter/problem solving /assignment

Formative Assessment	
Assessment occasion	*Weightage in marks*
Class test (Two class tests)/ Continuous evaluation	*20*
Practical record and Viva voce	*05*
Total	*25*

Open Elective Course Code: <u>OE-2T:BC-203</u>;
Course Title: <u>Nutrition and Dietetics</u> (theory)

Course title	**Nutrition and Dietetics**
Couse code	*OE-2T: BC-203*
Course credits	*03*
Total contact hours	*56*
Duration of ESA (Hour)	*03*
Formative assessment marks	*40*
Summative assessment marks	*60*

Course outcomes:

- *The student will gain knowledge about energy requirements and the Recommended Dietary Allowances.*
- *The student will understand the functions and role of macronutrients, their requirements and the effect of deficiency and excess*
- *The student learns the impact of various functional foods on our health*
- *The student will be able to apply basic nutrition knowledge in making foods choices and obtaining an adequate diet.*
- *The student gains competence in connecting the role of various nutrients in maintaining health and learn to enhance traditional recipes.*

Content of Theory course- Nutrition and Dietetics **Total credits =3**	**42 hr**
Unit 1: Basic Concepts of Nutrition	**14 hr**
Introduction, Basic principles of a balanced diet to provide energy and nutrients. Composition of foods and proximate analysis of foods. Calorific value of foods and Basal metabolism. Basal Metabolic Rate (BMR), Factors affecting BMR, Energy requirements for different physical activities, Specific dynamic action of food, Nutritive value of proteins. Energy requirements and recommended dietary allowance (RDA) for infants, children and pregnant women. Protein calorie malnutrition.	
Unit 2: Macronutrients and Micronutrients	**14 hr**
Carbohydrates- Digestible and non-digestible, Dietary fibers, Essential fatty acids, lipoproteins and cholesterol. Essential amino acids, Fortification of foods, Protein requirement for different categories. *Vitamins-Sources, requirements, functions and deficiency symptoms of Vitamin-C, Thiamine, Riboflavin, Pyridoxine, Folic acid, Vitamin B12. Absorption of fat-soluble vitamins- A, D, E and K.* *Micronutrients: Source, Daily requirement, functions and deficiency disease symptoms of Macro-minerals (Ca, P, and Cl) and micro minerals/trace elements (I, Fe, Zn and Se).*	

Unit 3: Dietetics and Diet Therapy	**14 hr**
Introduction. Food pyramid. Diet planning and introduction to diet therapy. Nutritional requirements for different age groups, anemic child, expectant women, and lactating women. Diet planning for prevention and cure of nutritional deficiency disorders. *Diet therapy: Functional foods, Anthropometric measurements, dietary considerations during fever, malaria, and tuberculosis. Prevention and correction of obesity, underweight, and metabolic diseases by diet therapy. Dietary interventions to correct and or manage the gastrointestinal diseases (indigestion, peptic ulcer, constipation, diarrhea, steatorrhea, irritable bowel syndrome.* *Functional foods-based diet therapy for diabetes, cardiovascular disease and cancer.*	

References

1. *Clinical Dietetics and Nutrition, 2002, Antia FP and Abraham P. Oxford University Press; 4th Edition. ISBN-10: 9780195664157.*
2. *Oxford Handbook of Nutrition and Dietetics, 2011, Webster-Gandy J, Madden A and Holds worth M. Oxford University Press, Print ISBN-13: 9780199585823.*
3. *Krause's Food, Nutrition and Diet therapy, 2003, Mahan KL and Escott-Stump S. Elsevier, ISBN: 9780721697840.*
4. *Human Nutrition and Dietitics. 1986, Passmore R. and Davidson S. Churchill Livingstone Publications, ISBN-10: 0443024863.*
5. *Rosemary Stanton's Complete Book of Food & Nutrition, 2007, Simon & SchusterPublishers, Australia, ISBN 10: 0731812999*
6. *Food Science and Nutrition, 2018, Roday S. Oxford University Press Publishers, ISBN: 9780199489084/0199489084.*
7. *Food Science, 2007, Srilakshmi S. New Age International (P) Limited Publishers, ISBN: 9788122420227/ 8122420222.*

Pedagogy: MOOC/desk work/book chapter/problem solving /assignment

Formative Assessment	
Assessment occasion	*Weightage in marks*
Class test (Two class tests)/ Continuous evaluation	*20*
Seminar/ class work	*10*
Assignment/ open discussion/ quiz	*10*
Total	*40*

Skill enhancement course: Course Code: SEC-2T:BC-204.1; Course Title: Biochemical Techniques-2 (theory)

Course title	Biochemical Techniques-2
Couse code	*SEC-2T: BC-204.1*
Course credits	*02*
Total contact hours	*28*
Duration of ESA (Hour)	*03*
Formative assessment marks	*40*
Summative assessment marks	*60*

Course Level Learning Outcomes: *Students will be exposed to various electrophoretic and mass spectrometry techniques and their applications in biomolecular separations and drug discovery. A thorough understanding of the above techniques would provide job opportunities in CROs for drug discovery and metabolism and also in diagnostic development companies.*

Content of Theory course- Biochemical Techniques-2 **Total credits =2**	**28 hr**
Unit 1: Electrophoresis	*14 hr*
Protein and nucleic acid Separations: PAGE, Non-denaturing PAGE, Non- reducing SDS-PAGE. 2-D electrophoresis, Preparation of pH gradient gel. Procedure of preparation of polyacrylamide gels, importance of buffers in electrophoretic separations, importance of stacking and resolving gels, use of denaturing agents and reducing agents in electrophoresis. Applications of electrophoretic techniques in disease diagnosis. Staining techniques- Coomassie staining, PAS staining, Silver staining, Fluorescent dye staining, Submerged-gel electrophoresis for the separation of nucleic acids. Nucleic acid staining Techniques. Zymography.	
Unit 2: Mass spectrometry	*14 hr*
Ionization techniques: Electro ionization, Fast-atom bombardment, Electro-spray ionization, Chemical ionization, Photo-ionization, MALDI. Construction and applications of Mass spectrometer, LC-MS/MS, GC-MS/MS. Preparation of samples for LC-MS and GC-MS. Detectors: Electron multiplier, Faraday's cup, Photomultiplier conversion dynode, Array detectors. Application of LC-MS and GC-MS in drug discovery and metabolic studies.	
References 1. *Biophysical Chemistry, Principles & Techniques – Upadhyay, Upadhyay and Nath –Himalaya Publ. House.* 2. *Principles & Techniques of Practical Biochemistry – Wilson, Walker- Cambridge Univ.Press.* 3. *Chromatography – G. Abbott.* 4. *Physical Biochemistry- Application to biochemistry and molecular biology by David Freifelder. W. H. Freeman & Co. San Fransisco. 2nd Edition* 5. *LC-MS in drug analysis Methods and protocols. Edr.Lorali J. Langman, Christine L H Snozek, Springer publications*	

Pedagogy: MOOC/desk work/book chapter/problem solving /assignment

Formative Assessment	
Assessment occasion	*Weightage in marks*
Class test (Two class tests)/ Continuous evaluation	*20*
Seminar/ class work	*10*
Assignment/ open discussion/ quiz	*10*
Total	*40*

Skill enhancement course: Course Code: SEC-2T:BC-204.2; Course Title: Bioinformatics (theory)

Course title	Bioinformatics
Couse code	*SEC-2T: BC-204.2*
Course credits	*02*
Total contact hours	*28*
Duration of ESA (Hour)	*03*
Formative assessment marks	*40*
Summative assessment marks	*60*

Course level learning outcomes:

By studying this course the students completing B.Sc. (Hons) Biochemistry will have an understanding of the tools of bioinformatics and computational biology and will be in a position to access biological data bases and softwares which will be helpful in understanding sequence alignments and predicting the structures of biomolecules such as proteins. Students will be exposed to available bioinformatics tools and databases. They will be in a position to comprehend the fundamental aspects of in-silico protein structure prediction. They will understand application of theoretical approaches to biological

systems. Students will get trained in the application of programs used for database searching, protein and DNA sequence analysis, and prediction of protein structures.

Content of Theory course- Bioinformatics **Total credits =2**	**28 hr**
Unit 1: Introduction to Bioinformatics	**14 hr**
Bioinformatics: Introduction, Basics of Computer and operating systems, Hardware, Software, Introduction to programming Languages and Paradigms, PERL/R programming, role of supercomputers in biology. *Scope of bioinformatics - Genomics, Proteomics, comparative and functional genomics, Genome annotation, gene prediction approaches and tools. Transcriptome and Proteome, Tools of proteome analysis. DNA microarray: understanding of microarray data and correlation of gene expression data to biological processes and computational analysis tools. Computer aided drug design (CADD) and Systems Biology.*	
Unit 2: Database & Sequence Alignment	**14 hr**
Biological databases: Introduction to biological databases - primary, secondaryand composite databases, useful programs, ClustalW, BLASTp. NCBI, EBI,ExPaSy, nucleic acid databases (GenBank, EMBL, DDBJ, NDB), proteindatabases (PIR, Swiss-Prot,TrEMBL, PDB), metabolic pathway database(KEGG, EcoCyc). *Sequence alignment: Similarity, identity and homology. Concept of Alignment: Pair-wise sequence alignment, gaps, gap-penalties, scoring matrices, PAM250, BLOSUM62, local and global sequence alignment, multiple sequence alignment, Progressive Alignment Algorithm, Application of multiple sequence alignment. BLAST and CLUSTALW.*	

References:

1. *Bioinformatics – 2008. Principles and Applications, 1st ed. Ghosh, Z. and Mallick, B., Oxford University Press (India),*
2. *M. Michael Gromiha, 2010. Protein Bioinformatics: From Sequence to Function, Academic Press.*
3. *Bioinformatics: Sequence and Genome Analysis (2001), 1st ed., Mount, D.W. Cold Spring Harbor Laborator Press (New York)*
4. *Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins (2005), 3rd ed., Baxevanis, A.D. and Ouellette, B.F., John Wiley & Sons, Inc. (New Jersey).*
5. *NCBI data base, open source learning*

Pedagogy: MOOC/desk work/book chapter/problem solving /assignment

Formative Assessment	
Assessment occasion	*Weightage in marks*
Class test (Two class tests)/ Continuous evaluation	*20*
Seminar/ class work	*10*
Assignment/ open discussion/ quiz	*10*
Total	*40*

B. Sc. Degree Examinations according to NEP 2021

60 : 40 pattern

Theory papers: Total marks = 100 marks

C1= 20 marks(IA)
C2= 20marks(IA)
C3= 60marks (Main exam.)

Practical papers: Total marks = 50 marks

C1= 10 marks (IA)
C2= 10 marks(IA) +05(Record)
C3= 25 marks (Main Exam.)

IA = Internal assessment (Assignment/seminar/test/viva-voce).

B.Sc. DEGREE (BASIC/HONS) I AND II SEMESTERS EXAMINATION
MODEL QUESTION PAPER
BIOCHEMISTRY

TIME : 2 h *MAX. MARKS: 60*

NOTE*: ALL SECTIONS ARE COMPULSORY*

SECTION – A

1. *Answer any FIVE of the following* *5 x 2 = 10*
   a.
   b.
   c.
   d.
   e.
   f.
   g.

SECTION – B

Answer any FOUR of the following *4x 5 = 20*

2.
3.
4.
5.
6.
7.

SECTION – C

Answer any THREE of the following *3 x 10 = 30*

8.
9.
10.
11.
12.

Note*: section C may include sub questions a, b*

B. SC. DEGREE (BASIC/ HONS.) I AND II SEMESTERS EXAMINATION MODEL QUESTION PAPER (PRACTICALS)

BIOCHEMISTRY

Time: 3 h *Max. Marks: 25*

1.	*Write the principle and procedure of_____experiment*	*05*
2.	*Major experiment (Conduct and report the results)*	*15*
3.	*Viva-voce*	*05*

B.Sc. DEGREE (BASIC/HONS) I AND II SEMESTERS EXAMINATION

SCHEME OF THEORY EXAMINATION

I B.Sc., I SEMESTER

DSC-I

TITLE: Chemical Foundations of Biochemistry-1

Times: 3hrs **Max Marks: 60**

Question Paper to be set for total of 94 marks including choices

UNITS	2 mark questions	5 mark questions	10 mark questions	Total Marks
UNITS: 1 **Scope of Biochemistry and Units of measurement**	2	1	1.5	24
UNITS: 2 **Atomic structure and Chemical bonds**	2	2	1	24
UNITS: 3 **Buffers and Colligative properties**	2	1	1.5	24
UNITS: 4 **Electrochemistry and Redox reactions**	1	2	1	22

I Main: 2x7=14 Marks

II Main: 5x6=30 Marks

III Main: 10x5=50 Marks

DSC 1- PRACTICALS
SCHEME OF PRACTICAL EXAMINATION
I B.Sc., I SEMESTER

TITLE: Volumetric Analysis-Practicals-1

Times:3hrs **Max Marks: 25**

Practical proper :15
Vivo voce : 05

NOTE :- Candidates are required to submit the records duly signed by the teacher-in charge and certified by the Head of the Dept.

PART- A **05 Marks**

I. Any one of the following experiment may be given for procedure writing.

1. Concept of molarity, molality and normality. Calculation and preparation of molarsolutions. (Problems to be given in exams). Calculation and preparation of normalsolutions and percent solutions and dilute solutions.
2. Calibration of volumetric glassware's (Burette, pipette).
3. Preparation of standard Sodium carbonate solution, standardization of HCl (Methylorange) and estimation of NaOH in the given solution. (methyl orange or phenolphthalein).
4. Preparation of standard Oxalic acid. Standardization of NaOH and estimation of H_2SO_4in the given solution (phenolphthalein).
5. Preparation of standard Oxalic acid. Standardization of $KMnO_4$ and estimation of H_2O_2 in the given solution.
6. Preparation of standard $K_2Cr_2O_7$. Standardization of $Na_2S_2O_3$ and estimation of $CuSO_4$ in the given solution.
7. Preparation of $ZnSO_4$. Standardization of EDTA and estimation of total hardness of water using Eriochrome-Black-T indicator.
8. Preparation of standard potassium bipthalate. Standardization of NaOH and estimation of HCl in the given solution. (Phenolphthalein).
9. Estimation of sulphuric acid and oxalic acid in a mixture using standard NaOH solution and standard $KMnO_4$ solution.
10. Preparation of standard Potassium dichromate and estimation of ferrous/ferric mixture using diphenylamine indicator (Demonstration).
11. Preparation of standard oxalic acid solution. Standardization of NaOH solution and estimation of acidity in vinegar.
12. Preparation of standard potassium bi-phthalate solution, standardization of sodium hydroxide solution and estimation of alkalinity of antacids
13. Preparation of standard Oxalic acid solution. Standardization of $KMnO_4$ solution and estimation of calcium in milk.

PART – B 15 Marks

II. Any one of the following experiment may be Set

1. Preparation of standard Sodium carbonate solution, standardization of HCl (Methylorange) and estimation of NaOH in the given solution. (methyl orange or phenolphthalein).
2. Preparation of standard Oxalic acid. Standardization of NaOH and estimation of H_2SO_4in the given solution (phenolphthalein).
3. Preparation of standard Oxalic acid. Standardization of $KMnO_4$ and estimation of H_2O_2 in the given solution.
4. Preparation of standard $K_2Cr_2O_7$. Standardization of $Na_2S_2O_3$ and estimation of $CuSO_4$ in the given solution.
5. Preparation of $ZnSO_4$. Standardization of EDTA and estimation of total hardness of water using Eriochrome-Black-T indicator.
6. Preparation of standard potassium bipthalate. Standardization of NaOH and estimation of HCl in the given solution. (Phenolphthalein).
7. Estimation of sulphuric acid and oxalic acid in a mixture using standard NaOH solution and standard $KMnO_4$ solution.
8. Preparation of standard Potassium dichromate and estimation of ferrous/ferric mixture using diphenylamine indicator (Demonstration).
9. Preparation of standard oxalic acid solution. Standardization of NaOH solution and estimation of acidity in vinegar.
10. Preparation of standard potassium bi-phthalate solution, standardization of sodium hydroxide solution and estimation of alkalinity of antacids
11. Preparation of standard Oxalic acid solution. Standardization of $KMnO_4$ solution and estimation of calcium in milk.

III. Viva-voce 05 Marks

Total marks: 25: [15 (Practical Exam) + 05 (viva)]

SCHEME OF VALUVATION
(ASSESMENT OF EXPARIMENTAL RESULTS)

PART - B

Preparation of standard solution and calculation of normality - 3 Marks

Standardization and estimation

Discrepancy in titre values	Standardization	Estimation
± 0.1 ml	4 Marks	4 Marks
± 0.2 ml	3 Marks	3 Marks
± 0.3 ml	2 Marks	2 Marks
± 0.5 ml (or) any other value	1 Marks	1 Marks
CALCULATIONS	2 Marks	2 Marks

III, IV,V and VI Semester BSc- B.Sc UG- syllabus - Programme: Biochemistry, Microbiology & Biotechnology

Scheme for examination and assessment for B.Sc. Biochemistry under CBCS scheme 2021-22

Year	Sem	Course Type	Title of the Course	Course Code	Credits	Maximum Marks in the Exam/ Assessment				Exam Duration	
						SEE		IA			
					L:T:P	Th	Pr	Th	Pr	Th	Pr
I BSc	I	DSC-1 Theory	Fundamentals Of Chemistry And Molecules Of Life	DMA 21006	4:0:0	70	-	30 (15+15)	-	3h	-
		DSC-1 Practicals	Fundamentals Of Chemistry And Molecules Of Life	DMA 21106	0:0:2	-	35	-	15 (7.5+7.5)	-	3h
	II	DSC-2 Theory	Physiology	DMB 21006	4:0:0	70	-	30 (15+15)	-	3h	-
		DSC-2 Practicals	Physiology	DMB 21106	0:0:2	-	35	-	15 (7.5+7.5)	-	3h
II BSc	III	DSC-3 Theory	Enzymology & Bioenergetics	DMC 21006	4:0:0	70	-	30 (15+15)	-	3h	-
		DSC-3 Practicals	Enzymology & Bioenergetics	DMC 21106	0:0:2	-	35	-	15 (7.5+7.5)	-	3h
	IV	DSC-4 Theory	Metabolism	DMD 21006	4:0:0	70	-	30 (15+15)	-	3h	-
		DSC-4 Practicals	Metabolism	DMD 21106	0:0:2	-	35	-	15 (7.5+7.5)	-	3h
III BSc	V	DSE-1 Theory	No. Of Course 1 Nutritional Biochemistry	DME 21006	4:0:0	70	-	30 (15+15)	-	3h	-
		DSE-1 Practicals	Nutritional Biochemistry	DME 21106	0:0:2	-	35	-	15 (7.5+7.5)	-	3h
		DSE-2 Theory	Molecular Basis Of Infectious Diseases	DME 21206	4:0:0	70	-	30 (15+15)	-	3h	-
		DSE-2 Practicals	Molecular Basis Of Infectious Diseases	DME 21306	0:0:2	-	35	-	15 (7.5+7.5)	-	3h
		SEC 1- Theory	No. Of Course 1 Tools And Techniques In Biochemistry	DME 21406	2:0:0	35	-	15 (15+15)	-	2h	-
		SEC 2- Theory	Clinical Biochemistry	DME 21606	2:0:0	35	-	15 (15+15)	-	2h	-
	VI	DSE-3 Theory	No. Of Course 1 Advanced Cell Biology And Endocrinology	DMF 21006	4:0:0	70	-	30 (15+15)	-	3h	-
		DSE-3 Practicals	Advanced Cell Biology And Endocrinology	DMF 21106	0:0:2	-	35	-	15 (7.5+7.5)	-	3h
		DSE-4 Theory	Plant Biochemistry	DMF 21206	4:0:0	70	-	30 (15+15)	-	3h	-
		DSE-4 Practicals	Plant Biochemistry	DMF 21306	0:0:2	-	35	-	15 (7.5+7.5)	-	3h

Practical weightage

Component	Marks
Knowledge of relevant processes	30%
Skills and operations involved	50%
Result/ products including calculations and reporting	20%

Scheme for examination and assessment for B.Sc. Biochemistry under CBCS scheme 2019-20

Year	Sem	Course Type	Title of the Course	Course Code	Credits	Maximum Marks in the Exam/ Assessment				Exam Duration	
						SEE		IA			
					L:T:P	Th	Pr	Th	Pr	Th	Pr
I BSc	I	*DSC-1 Theory*	*Fundamentals Of Chemistry And Molecules Of Life*	*DMA 21007*	*4:0:0*	*70*	*-*	*30 (15+15)*	*-*	*3h*	*-*
		DSC-1 Practicals	*Fundamentals Of Chemistry And Molecules Of Life*	*DMA 21107*	*0:0:2*	*-*	*35*	*-*	*15 (7.5+7.5)*	*-*	*3h*
	II	*DSC-2 Theory*	*Physiology*	*DMB 21007*	*4:0:0*	*70*	*-*	*30 (15+15)*	*-*	*3h*	*-*
		DSC-2 Practicals	*Physiology*	*DMB 21107*	*0:0:2*	*-*	*35*	*-*	*15 (7.5+7.5)*	*-*	*3h*
II BSc	III	*DSC-3 Theory*	*Enzymology & Bioenergetics*	*DMC 21007*	*4:0:0*	*70*	*-*	*30 (15+15)*	*-*	*3h*	*-*
		DSC-3 Practicals	*Enzymology & Bioenergetics*	*DMC 21107*	*0:0:2*	*-*	*35*	*-*	*15 (7.5+7.5)*	*-*	*3h*
	IV	*DSC-4 Theory*	*Metabolism*	*DMD 21007*	*4:0:0*	*70*	*-*	*30 (15+15)*	*-*	*3h*	*-*
		DSC-4 Practicals	*Metabolism*	*DMD 21107*	*0:0:2*	*-*	*35*	*-*	*15 (7.5+7.5)*	*-*	*3h*
III BSc	V	*DSE-1 Theory*	*No. Of Course 1 Nutritional Biochemistry*	*DME 21007*	*4:0:0*	*70*	*-*	*30 (15+15)*	*-*	*3h*	*-*
		DSE-1 Practicals	*Nutritional Biochemistry*	*DME 21107*	*0:0:2*	*-*	*35*	*-*	*15 (7.5+7.5)*	*-*	*3h*
		DSE-2 Theory	*Molecular Basis Of Infectious Diseases*	*DME 21207*	*4:0:0*	*70*	*-*	*30 (15+15)*	*-*	*3h*	*-*
		DSE-2 Practicals	*Molecular Basis Of Infectious Diseases*	*DME 21307*	*0:0:2*	*-*	*35*	*-*	*15 (7.5+7.5)*	*-*	*3h*
		SEC 1- Theory	*No. Of Course 1 Tools And Techniques In Biochemistry*	*DME 21407*	*2:0:0*	*35*	*-*	*15 (15+15)*	*-*	*2h*	*-*
		SEC 2- Theory	*Clinical Biochemistry*	*DME 21607*	*2:0:0*	*35*	*-*	*15 (15+15)*	*-*	*2h*	*-*
	VI	*DSE-3 Theory*	*No. Of Course 1 Advanced Cell Biology And Endocrinology*	*DMF 21007*	*4:0:0*	*70*	*-*	*30 (15+15)*	*-*	*3h*	*-*
		DSE-3 Practicals	*Advanced Cell Biology And Endocrinology*	*DMF 21107*	*0:0:2*	*-*	*35*	*-*	*15 (7.5+7.5)*	*-*	*3h*
		DSE-4 Theory	*Plant Biochemistry*	*DMF 21207*	*4:0:0*	*70*	*-*	*30 (15+15)*	*-*	*3h*	*-*
		DSE-4 Practicals	*Plant Biochemistry*	*DMF 21307*	*0:0:2*	*-*	*35*	*-*	*15 (7.5+7.5)*	*-*	*3h*

Practical weightage

Component	Marks
Knowledge of relevant processes	30%
Skills and operations involved	50%
Result/ products including calculations and reporting	20%

SCHEME OF VALUATION FOR PRACTICAL EXAMINATION

- A candidate appearing for the first time should submit a duly signed and certified practical record
- Each candidate has to perform one experiment in the specified duration of three hours for ***FIFTEEN*** **marks**
- Practical record has to be valued for ***FIVE marks*** by examiners at the time of examination
- Viva-voce for ***FIVE marks*** in practical is awarded by continuous assessment in the lab

Sl no	Component	Marks
1	Write up of the experiment	05
2	Conducting experiment	15
3	Result	05
4	Viva-voce	05
5	Practical record	05
	TOTAL	**35**

Programme Outcome for Bachelor of Science in Biochemistry, Microbiology & Biotechnology

After completing the graduation in the Bachelor of Science the students are able to:

PO1. Demonstrate the ability to justify and explain their thinking and/or approach

PO2. Develop state-of-the-art laboratory and professional communication skills

PO3. Apply the scientific method to design, execute, and analyze an experiment

PO4. Explain scientific procedures and their experimental observations

PO5. Demonstrate an understanding of fundamental biochemical principles, structure and function

PO6. Work as a laboratory technician, biochemists or medical scientist

PO7. Explain the processes used by microorganisms for the growth

PO8. Explain the theoretical basis of tools, technologies and methods of microbiology

PO9. Design and develop solution to Biotechnology problems

PO10. Applying appropriate tools keeping in mind safety factor for environment & society

PO11. Create, select, and apply appropriate techniques, resources, and modern tools

PO12. Support biotechnology research activity with strong technical background

Programme Specific Outcome

Bachelor of Science in Biochemistry, Microbiology & Biotechnology

After completing the graduation in the Bachelor of Science the students are able to;

PSO 1: Gain and understand biochemical and molecular processes

PSO2: Communicate scientific information effectively, relating to microbes and their role in ecosystem and health

PSO3: Acquire, articulate, retain and demonstrate laboratory safety skills

PSO4: Demonstrate applications of biochemical and biological sciences

PSO5: Apply appropriate tools and techniques in biotechnological manipulation

PSO6: Understand the responsibilities of biotechnological practices

Programme Outcome for Bachelor of Science in Botany, Biochemistry & Microbiology

After completing the graduation in the Bachelor of Science the students are able to:

PO1. Identify the taxonomic position of plants using principles and methods of nomenclature and classification in Botany

PO2. Understand the impact of the plant diversity in societal and environmental context

PO3. Demonstrate the knowledge of, and need for sustainable development

PO4. Use interdisciplinary approaches with quantitative skills to work on biological problems

PO5. Demonstrate the ability to justify and explain their thinking and/or approach

PO6. Develop state-of-the-art laboratory and professional communication skills

PO7. Apply the scientific method to design, execute, and analyze an experiment

PO8. Explain scientific procedures and their experimental observations

PO9. Demonstrate an understanding of fundamental biochemical principles, structure and function

PO10. Work as a laboratory technician, biochemists or medical scientist

PO11. Explain the processes used by microorganisms for the growth

PO12. Explain the theoretical basis of the tools, technologies and methods of microbiology

Programme Specific Outcome

Bachelor of Science in Botany, Biochemistry & Microbiology

After completing the graduation in the Bachelor of Science the students are able to;

PSO 1: Demonstrate applications of biochemical and biological sciences

PSO2: Inculcating proficiency in all experimental techniques and methods of analysis

PSO3: Acquire, articulate, retain and demonstrate laboratory safety skills

PSO4: Communicate scientific information effectively, relating to microbes and their role in ecosystem and health

PSO5: Gain proper procedures and regulations in handling and disposal of chemicals

PSO6: Understand biochemical and molecular processes that occur in and between the cells

DMC21006 / DMC21007

SEMESTER III
CORE: ENZYMOLOGY & BIOENERGETICS

(Credits: Theory – 04, Practical – 02) **Theory: 60 Hrs**

Course Outcome:
After completion of the course the student is able to;
CO1: Learn the characteristics of enzyme kinetics
CO2: Learn in depth enzyme inhibitions
CO3: Specify in detail with examples enzyme activity
CO4: Understand the classification and characteristics of bioenergetics

Unit : 1 **INTRODUCTION TO ENZYMES:** Nature of enzymes – protein and non-protein (ribozyme). Cofactor and prosthetic group, apoenzyme, holoenzyme. IUBMB classification of enzymes. **02 Hrs**

Unit : 2 **FEATURES OF ENZYME CATALYSIS:** Factors affecting the rate of chemical reactions, activation energy and transition state theory. Catalytic power and specificity of enzymes (concept of active site), Fischer's lock and key hypothesis, Koshland's induced fit hypothesis. **06 Hrs**

Unit : 3 **ENZYME KINETICS:** Relationship between initial velocity and substrate concentration, Michaelis-Menten equation, Lineweaver-Burk plot, Eadie-Hofstee and Hanes plot. Km and Vmax, Kcat and turnover number. Effect of pH, temperature and metal ions on the activity of enzyme. **08 Hrs**

Unit : 4 **ENZYME INHIBITION:** Reversible inhibition (competitive, uncompetitive, non-competitive).
Mechanism based inhibitors – antibiotics as inhibitors **05 Hrs**

Unit : 5 **MECHANISM OF ACTION OF ENZYMES:** General features – proximity and orientation, strain and distortion, acid base and covalent catalysis (chymotrypsin, lysozyme). **05 Hrs**

Unit : 6 **REGULATION OF ENZYME ACTIVITY:** Control of activities of single enzymes (end product inhibition) and metabolic pathways, feedback inhibition (aspartate transcarbomoylase). Occurrence and isolation, phylogenetic distribution and properties (pyruvate dehydrogenase, fatty acyl synthase) Isoenzymes – properties and physiological significance (lactate dehydrogenase). **06 Hrs**

Unit : 7 **INVOLVEMENT OF COENZYMES IN ENZYME CATALYSED REACTIONS:** TPP, FAD, NAD, Pyridoxal Phosphate, Biotin, Coenzyme A, Tetrahydrofolate, Lipoic Acid. **06 Hrs**

Unit: 8 **APPLICATIONS OF ENZYMES:** Application of enzymes in diagnostics (SGPT, SGOT, creatine kinase, alkaline and acid phosphatases), enzyme immunoassay (HRPO), enzyme therapy (Streptokinase). Immobilized enzymes. **06 Hrs**

Unit : 9 **INTRODUCTION TO BIOENERGETICS:** Laws of thermodynamics, equilibrium constant, coupled reactions, energy charge, ATP cycle, phosphorylation potential, phosphoryl group transfers. Chemical basis of high standard energy of hydrolysis of ATP, other phosphorylated compounds and thioesters. Redox reactions, standard redox potentials and Nernst equation. Universal electron carriers. **08 Hrs**

Unit: 10 **OXIDATIVE PHOSPHORYLATION:** Mitochondria. Electron transport chain – its organization and function. Inhibitors of ETC and uncouplers. Peter Mitchell's chemiosmotic hypothesis. Proton motive force. Fo F1ATP synthase, structure and mechanism of ATP synthesis. Metabolite transporters in mitochondria. Regulation of oxidative phosphorylation. ROS production and antioxidant mechanisms. Thermogenesis. Alternative respiratory pathways in plants. **08 Hrs**

DMC21106/ DMC21107 PRACTICALS

1. Determination of activity of Salivary amylase by DNS
2. Determination of specific activity of Salivary amylase by DNS
3. Determination of optimum temperature and energy of activation of Salivary amylase.
4. Determination of pH optimum of Salivary amylase.
5. Determination of Km and Vmax of Salivary amylase
6. Determination of initial velocity (time Kinetics) of Salivary amylase.
7. Effect of activators (Nacl) on Salivary amylase activity
8. Assay of enzyme activity of acid phosphatase.
9. Assay of specific activity of acid phosphatase.
10. Separation of photosynthetic pigments by coloumn chromatography
11. Partial purification of acid phosphatase from germinating mung bean.
12. Enzyme inhibition – calculation of Ki for competitive inhibition.
13. Estimation of SGOT
14. Estimation of SGPT

Note: Minimum of ten experiments to be done.

Reference:

1. Lehninger: Principles of Biochemistry (2013) 6th ed., Nelson, D.L. and Cox, M.M., W.H.Freeman and Company (New York), ISBN:13: 978-1-4641-0962-1/ ISBN:10:1-4292-3414-8.

2. Biochemistry (2011) 4th ed., Donald, V. and Judith G.V., John Wiley & Sons Asia Pvt.Ltd. (New Jersey), ISBN:978-1180-25024.

3. Fundamentals of Enzymology (1999) 3rd ed., Nicholas C.P. and Lewis S., Oxford University Press Inc. (New York), ISBN:0 19 850229 X.

SEMESTER IV
CORE: METABOLISM

(Credits: Theory – 04, Practical – 02) **Theory: 60 Hrs**

Course Outcome:
After completion of the course the student is able to;
CO1: Specify the detail of metabolism of lipids
CO2: Understand the detail of metabolism of carbohydrates
CO3: Deliberate the characteristics of metabolism of proteins
CO4: Understand the detail of metabolism of nucleic acids

Unit : 1	**INTRODUCTION TO METABOLISM:** Anabolism and catabolism, compartmentalization of metabolic pathways.	**02 Hrs**
Unit : 2	**METABOLISM OF CARBOHYDRATES:** Glycolysis - reactions, regulation and energetics. Entry of other carbohydrates (Fructose, Galactose and Mannose) into glycolytic pathway. Fates of pyruvate – Under airobic and anaerobic conditions (conversion of pyruvate to lactate, alcohol and acetyl coA.	**10 Hrs**
Unit: 3	**CITRIC ACID CYCLE:** Reactions, regulation and energetics. Amphibolic and integrating roles of TCA cycle. Anaplerosis. Pentose Phosphate pathway and its significance. Cori cycle - its significance. Rapoport and luebering cycle, Gluconeogenesis pathway & their significance.	**10 Hrs**
Unit: 4	**Uronic acid pathway** –Reactions and its significance. **Glyoxalate pathway** – Reactions and its significance. **Glycogen metabolism** – glycogenolysis and glycogen synthesis and its regulation	**06 Hrs**
Unit: 5	**METABOLISM OF LIPIDS 1:** Oxidation of fatty acid - α, β and ω - oxidation of saturated fatty acids, Energetics of β - oxidation. Biosynthesis of even number saturated fatty acids, ketone bodies-formation and its significance.	**08 Hrs**
Unit: 6	**METABOLISM OF LIPIDS 2:** Bio synthesis of triglycerides, glycolipids, phospholipids and spingolipids. Cholesterol - Outline of biosynthesis and its degradation	**08 Hrs**
Unit :7	**METABOLISM OF AMINO ACIDS:** General reaction of amino acid degradation – Transamination, deamination and decarboxylation (oxidative and non oxidative). Ketogenic and glucogenic amino acids. Urea cycle and its significance. Biosynthesis of amino acids (Phenyl alanine and Glutamic acid) and their degradation.	**08 Hrs**
Unit: 8	**NUCLEIC ACID METABOLISM:** Degradation of Nucleic acids by DNase I & II, pancreatic RNase and phosphodiesterases. Biosynthesis and degradartion of purine and pyrimidine nucleotides, salwage pathways, regulation of purine and pyrimidine synthesis.	**08 Hrs**

DMD21106/ DMD21107 PRACTICALS

1 Glucose by DNS method.
2 Amino acid by Ninhydrine method.
3 Protein by Lowry's method.
4 Urea by DAMO or nitroprusside method.
5 Creatinine by Jaffe's method.
6 Inorganic Phosphate by Fiske and Subbarow's method.
7 Iron by Wong's method.
8 Ketoacids by DNPH method
9 Glycogen by anthrone method
10 Cholesterol by Zak's method
11 Isolation of phospholipids by egg yolk
12 Isolation of cholesterol from egg yolk and its estimation.
13 Separation of plasma proteins
14 Protein by Biuret method

Note: Minimum of ten experiments to be done.

Reference:

1. Lehninger: Principles of Biochemistry (2013) 6th ed., Nelson, D.L. and Cox, M.M., W.H.Freeman and Company (New York), ISBN:13:978-1-4641-0962-1 / ISBN:10:1-4641-0962-1.

2. Textbook of Biochemistry with Clinical Correlations (2011) 7th ed., Devlin, T.M., JohnWiley & Sons, Inc. (New York), ISBN: 978-0-470-28173-4 / BRV ISBN: 978-0-470-60152-5.

DSE -1: NUTRITIONAL BIOCHEMISTRY

(Credits: Theory – 04, Practical – 01) **Theory: 60 Hrs**

Course Outcome:

After completion of the course the student is able to;

CO1: Understand the characteristics of energy metabolism
CO2: Specify the characteristics of dietary carbohydrates
CO3: Identify in detail with examples dietary lipid & health
CO4: Understand the characteristics of minerals

Unit : 1 **INTRODUCTION TO NUTRITION & ENERGY METABOLISM** **09 Hrs**

Defining Nutrition, role of nutrients. Unit of energy, Biological oxidation of foodstuff. Measurement of energy content of food, Physiological energy value of foods, SDA.

Measurement of energy expenditure. Direct and Indirect Calorimetry, factors affecting thermogenesis, energy utilization by cells, energy output – Basal and Resting metabolism, physical activity, factors affecting energy input - hunger, appetite, energy balance Energy expenditure in man. Estimating energy requirements, BMR factors Recommended Nutrient Intakes (RNI) and Recommended Dietary Allowances for different age groups (Adult man, women and children).

Unit: 2 **DIETARY CARBOHYDRATES & HEALTH**: Review functions of carbohydrates. Digestion, absorption, utilization and storage, hormonal regulation of blood glucose. Dietary requirements and source of carbohydrates, blood glucose level. **07 Hrs**

Unit :3 **DIETARY LIPID & HEALTH:** Review of classification, sources, functions, digestion, absorption, utilization and storage. **08 Hrs**

Essential Fatty Acids; Functions of EFA, RDA, – excess and deficiency of EFA. Lipotropic factors, role of saturated fat, cholesterol, lipoprotein and triglycerides. Importance of the following: a) Omega – fatty acids. Omega 3/ omega 6 ratio b) Phospholipids c) Cholesterol in the body d) Mono, Polyunsaturated and Saturated Fatty Acids.

Unit: 4 **DIETARY PROTEINS & HEALTH:** Review of functions of proteins in the body, Digestion and absorption. Essential and Nonessential amino acids. Amino acid Supplementation. Effects of deficiency. Food source and Recommended Dietary Allowances for different age group. Amino acid pool. NPU, Biological Value, Nitrogen balance. PEM and Kwashiorkor. **08 Hrs**

Unit :5 **FAT & WATER SOLUBLE VITAMINS:** Vitamin A, C, E, K and D Dietary sources, RDA, Absorption, Distribution, Metabolism and excretion (ADME), Deficiency. Role of Vitamin A as an antioxidant, in Visual cycle, dermatology and immunity. Role of Vitamin K in Gamma carboxylation. Role of Vitamin E as an antioxidant. Role of Vitamin D and its effect on bone physiology. **10 Hrs**

Hypervitaminosis. Vitamin C role as cofactor in amino acid modifications. Niacin- Metabolic interrelation between tryptophan, Niacin and NAD/ NADP. Vitamin B6-Dietary source, RDA, conversion to Pyridoxal Phosphate. Role in metabolism, Biochemical basis for deficiency symptoms. Vitamin B12 and folate; Dietary source, RDA, absorption, metabolic role Biochemical basis for deficiency symptoms.

Unit: 6 **MINERALS:** Calcium, Phosphorus and Iron - Distribution in the body **09 Hrs**

digestion, Absorption, Utilization, Transport, Excretion, Deficiency, Sources, RDA.
Iodine, Fluoride, Mg, Cu, Zn, Se, Manganese - Absorption, Utilization, Transport, Excretion, Deficiency, Sources, RDA.

Unit: 7 **ASSESSMENT OF NUTRITIONAL STATUS:** Anthropometric measurements; Z scores, BMI, skinfold, circumference ratios. Biochemical assessment; Basal metabolic panel, Comprehensive metabolic panel, CBC, Urine Analysis, Assessment of Anemia, ROS assessment. **05 Hrs**

Unit: 8 **FOOD & DRUG INTERACTIONS & NUTRICEUTICALS:** Nutrient interactions affecting ADME of drugs, Alcohol and nutrient deficiency, Antidepressants, psychoactive drugs and nutrient interactions. **04 Hrs**

DME21106/ DME21107 PRACTICALS

1. Bioassay for vitamin B12/B1.
2. Extraction of oil from oil seeds by soxlet.
3. Separation of sugars by circular paper chromatography
4. Anthropometric identifications for Kwashiorkor, Marasmus and Obesity.
5. Extraction of cafein from tea leaves
6. Vitamin A/E estimation in serum.
7. Determination of moisture content of food sample
8. Detection of adulterants in food.
9. Estimation of Calcium in ragi.
10. Estimation of Vitamin – C in lemon or gooseberries by DPPH method
11. Estimation of Lactose in milk by Benedict's method
12. Estimation of iron in drumsticks
13. Determination of iodine value of an oil or fat
14. Determination of saponification value of an oil or fat

Note: Minimum of eight experiments to be done.

Reference:

1. Textbook of Biochemistry with Clinical Correlations (2011) Devlin, T.M. John Wiley & Sons, Inc. (New York), ISBN: 978-0-4710-28173-4.

2. Nutrition for health, fitness and sport (2013) Williams.M.H,Anderson,D.E, Rawson,E.S. McGraw Hill international edition. ISBN-978-0-07-131816-7.

3. Krause's Food and Nutrition Care process (2012); Mahan, L.K Strings,S.E, Raymond,J. Elsevier's Publications. ISBN- 978-1-4377-2233-8.

4. The vitamins, Fundamental aspects in Nutrition and Health (2008); G.F. Coombs Jr. Elsevier's Publications. ISBN-13- 978-0-12- 183493-7.

5. Principles of Nutritional Assessment (2005) Rosalind Gibson. Oxford University Press.

DME21206 / DME21207 **SEMESTER V**

DSE -2: MOLECULAR BASIS OF INFECTIOUS DISEASES

(Credits: Theory – 04, Practical – 01) **Theory: 60 Hrs**

Course Outcome:

After completion of the course the student is able to;

CO1: Deliberate in depth infectious agents
CO2: Learn the detail of bacterial diseases
CO3: Understand the detail of viral diseases
CO4: Learn the characteristics of fungal diseases

Unit : 1 **CLASSIFICATION OF INFECTIOUS AGENTS:** Bacteria, Viruses, protozoa and fungi. Past and present emerging and re-emerging infectious diseases and pathogens. Source, reservoir and transmission of pathogens, Antigenic shift and antigenic drift. Host parasite relationship, types of infections associated with parasitic organisms. Overview of viral and bacterial pathogenesis. Infection and evasion **12 Hrs**

Unit: 2 **OVERVIEW OF DISEASES CAUSED BY BACTERIA:** Detailed study of tuberculosis: History, causative agent, molecular basis of host specificity, infection and pathogenicity, Diagnostics, Therapeutics, inhibitors and vaccines. Drug resistance and implications on public health. Other bacterial diseases including Typhoid, Diphtheria, Pertussis, Tetanus, Typhoid and Pneumonia. **18 Hrs**

Unit: 3 **OVERVIEW OF DISEASES CAUSED BY VIRUSES:** Detailed study of AIDS, history, causative agent, pathogenesis, Diagnostics, Drugs and inhibitors. Other viral diseases including hepatitis, influenza, rabies, chikungunya and polio. **12 Hrs**

Unit: 4 **OVERVIEW OF DISEASES CAUSED BY PARASITES:** Detailed study of Malaria, history, causative agents, Vectors, life cycle, Host parasite interactions, Diagnostics, Drugs and Inhibitors, Resistance, Vaccine development. Other diseases including leishmaniasis, amoebiasis. **08 Hrs**

Unit :5 **OVERVIEW OF DISEASES CAUSED BY OTHER ORGANISMS:** Fungal diseases, General characteristics. Medical importance of major groups, pathogenesis, treatment. **10 Hrs**

DME21306/ DME21307 PRACTICALS

1 WIDAL test
2 Gram staining
3 Acid fast staining
4 PCR based diagnosis
5 Preparation of media.
6 Isolation of bacteria from soil
7 Isolation of bacteria from water
8 Structural staining- (cellwall and endospore of bacteria).
9 Simple staining and Negative staining
10 Effect of temperature on growth of microorganisms
11 Effect of pH on growth of microorganisms
12 Demonstration of Bacterial Conjugation
13 Demonstration of bacterial transformation and transduction

14 Photographic demonstration of infectious diseases

Note: Minimum of eight experiments to be done.

Reference:

1. Prescott, Harley, Klein's Microbiology (2008) 7th Ed., Willey, J.M., Sherwood, L.M., Woolverton, C.J. Mc Graw Hill International Edition (New York) ISBN: 978-007-126727.

2. Mandell, Douglas and Bennett.S, Principles and practices of Infectious diseases, 7th edition, Volume, 2. Churchill Livingstone Elsevier.

3. Sherris Medical Microbiology: An Introduction to Infectious Diseases by Kenneth J.Ryan, C. George Ray, Publisher: McGraw-Hill.

4. Medical Microbiology by Patrick R. Murray, Ken S. Rosenthal, Michael A. Pfaller, Elsevier Health Sciences

DME21406/ DME21407

SEMESTER V
SEC-1: TOOLS AND TECHNIQUES IN BIOCHEMISTRY

(Credits: Theory – 02) **Theory: 30 Hrs**

Course Outcome:
After completion of the course the student is able to;
CO1: Understand in depth chromatography
CO2: Learn in depth electrophoresis technique
CO3: Deliberate the characteristics of centrifugation
CO4: Understand in detail with examples spectrophotometry

Unit : 1	**BIOCHEMICAL REAGENTS & SOLUTIONS:** Safety practices in the laboratory. Preparation and storage of solutions. Concepts of solution concentration and storing solutions. Quantitative transfer of liquids. Concept of a buffer, Henderson-Hasselbach equation, working of a pH meter. **Exercise** Preparation of a buffer of given pH and molarity.	**06 Hrs**
Unit : 2	Chromatography- Definition**,** types, Principles of Adsorption and Partition chromatography. Techniques of circular, 2D chromatography, Thin Layer Chromatography**-** and its advantages Column chromatography – Principle and applications of Gel Filtration chromatography, HPLC	**07 Hrs**
Unit : 3	Electrophoresis: Principle and applications of electrophoresis technique- PAGE, SDS - PAGE	**03 Hrs**
Unit : 4	Centrifugation: Principle of differential and density gradient centrifugation. Ultra centrifuge – construction and applications	**03 Hrs**
Unit: 5	**SPECTROPHOTOMETRIC TECHNIQUES:** Principle and instrumentation of UV-visible and fluorescence spectroscopy. **Exercises** Determination of the absorption maxima and molar extinction coefficient (of a relevant organic molecule). Measurement of fluorescence spectrum. Determination of concentration of a protein solution by Lowry/BCA method.	**05 Hrs**
Unit :6	**Introduction and importance of virtual labs in biochemistry**	**06 Hrs**

Reference:

1. Physical Biochemistry: Principles and Applications (2010) 2nd ed., Sheehan, D., Wiley Blackwell (West Sussex), ISBN:978-0-470-85602-4 / ISBN:978-0-470-85603-1.

2. Physical Biochemistry: Applications to Biochemistry and Molecular Biology (1982) 2nd ed., Freifelder, D., W.H. Freeman and Company, ISBN:0-7167-1315-2/ISBN:0-7167-1444-2.

3. An Introduction to Practical Biochemistry (1998) 3rd ed., Plummer D. T., Tata McGraw Hill Education Pvt. Ltd. (New Delhi), ISBN:13: 978-0-07-099487-4 / ISBN:10: 0-07-099487-0.

DME21606/ DME21607

SEMESTER V
SEC-2: CLINICAL BIOCHEMISTRY

(Credits: Theory – 02) **Theory: 30 Hrs**

Course Outcome:
After completion of the course the student is able to;
CO1: Specify the characteristics of clinical laboratory
CO2: Identify in depth blood glucose
CO3: Deliberate the detail of lipid profile
CO4: Learn in detail with examples cardiovascular diseases

Unit : 1 **INTRODUCTION:** Organization of clinical laboratory, Introduction to instrumentation and automation in clinical biochemistry laboratories safety regulations and first aid. General comments on specimen collection, types of specimen for biochemical analysis. Precision, accuracy, quality control, precautions and limitations. **04 Hrs**

Exercises
Collection of blood and storage.
Separation and storage of serum.

Unit :2 **EVALUATION OF BIOCHEMICAL CHANGES IN DISEASES:** Basic hepatic, renal and cardiovascular physiology. Biochemical symptoms associated with disease and their evaluation. Diagnostic biochemical profile. **04 Hrs**

Unit: 3 **ASSESSMENT OF GLUCOSE METABOLISM IN BLOOD**: Clinical significance of variations in blood glucose. Diabetes mellitus. **04 Hrs**

Exercises
Estimation of blood glucose by glucose oxidase peroxidase method.

Unit :4 **LIPID PROFILE:** Composition and functions of lipoproteins. Clinical significance of elevated lipoprotein. **04 Hrs**

Exercises
Estimation of triglycerides.

Unit :5 **LIVER FUNCTION TESTS** **04 Hrs**

Exercises
Estimation of bilirubin (direct and indirect).

Unit: 6 **RENAL FUNCTION TESTS & URINE ANALYSIS:** Use of urine strip / dipstick method for urine analysis. **06 Hrs**

Exercises
Quantitative determination of serum creatinine and urea.

Unit: 7 **TESTS FOR CARDIOVASCULAR DISEASES:** Involvement of enzymes in diagnostics of heart disease including aspartate transaminase, isoenzymes of creatine kinase and lactate dehydrogenase and troponin. **04 Hrs**

Exercises
Estimation of creatine kinase MB.

Reference:

1. Medical Laboratory Technology - a Procedure Manual for Routine Diagnostic Tests Vol.I (2010), Mukherjee, K.L., Tata Mc Graw–Hill Publishing Company Limited (New Delhi). ISBN: 9780070076594 / ISBN: 9780070076631.

2. Medical Laboratory Technology - a Procedure Manual for Routine Diagnostic Tests VoI. II (2010), Mukherjee, K.L., Tata Mc Graw – Hill Publishing Company Ltd. (New Delhi), ISBN: 9780070076648.

3. Medical Biochemistry (2005) 2nd ed., Baynes, J.W. and Dominiczak, M.H., Elsevier Mosby Ltd. (Philadelphia), ISBN:0-7234-3341-0.

SEMESTER VI
DSE-1: ADVANCED CELL BIOLOGY AND ENDOCRINOLOGY

(Credits: Theory – 04, Practical – 01) **Theory: 60 Hrs**

Course Outcome:
After completion of the course the student is able to;
CO1: Learn the detail of cell membrane
CO2: Understand in detail with examples cell-cell interactions
CO3: Identify in depth endocrine organs
CO4: Deliberate the detail of immunohistochemistry

Unit : 1	**PLASMA MEMBRANE & NUCLEAR TRANSPORT:** Properties and Composition of Cell Membrane; Structure of Nuclear Envelope; Nuclear Pore Complex; Transport Across Nuclear Envelope; Regulation of Nuclear Protein Import and Export.	**08 Hrs**
Unit: 2	**CELL-CELL INTERACTION:** Cell-Cell Interactions and Cell-Matrix Interactions; Components of Extracellular Matrix: Collagen and Non-Collagen Components; Tight Junctions; Gap Junctions; Desmosomes; Hemidesmosomes; Focal Adhesions And Plasmodesmata; Cell Wall; Role Of Cell Interaction In Development.	**10 Hrs**
Unit :3	**CELL CYCLE & PROGRAMMED CELL DEATH:** Overview of The Cell Cycle; Eukaryotic Cell Cycle; Events Of Mitotic Phase; Cytokinesis; Events Of Meiosis And Fertilization; Regulation Of Cell Division And Cell Growth; Apoptosis And Necrosis, Stem Cells And Maintenance of Adult Tissues, Hematopoiesis, Embryonic Stem Cells and Therapeutic Cloning.	**12 Hrs**
Unit :4	**CANCER BIOLOGY:** Development and causes Of Cancer; Genetic Basis of Cancer; Oncogenes, Tumor Viruses; Molecular Approach to Cancer Treatment.	**10 Hrs**
Unit: 5	**ADVANCED METHODS IN CELL BIOLOGY:** Ultracentrifugation, Fluorescence Microscopy- FACS, Confocal Microscopy, Electron Microscopy, Plant and Animal Cell Culture, Immunohistochemistry.	**10 Hrs**
Unit: 6	**ENDOCRINE SYSTEM:** Endocrine organs, hormones-classification, Hierarchy, interplay, dynamic balance and regulation of their secretions. Functions of the hormones of Hypothalamus, Pituitary, Adrenal, Thyroid, pancreas and Gonads.Concept of receptors- Membrane and cytosolic. Mechanism of hormone action - Steroid hormone and Peptide hormone (second messengers hypothesis. Eg: cAMP, DAG, IP3).	**10 Hrs**

PRACTICALS

1. Isolation of WBC using fical reagent method
2. Study of cell viability /death assay by use of trypan blue and MTT assay.
3. Study of apoptosis through analysis of DNA fragmentation patterns in mitochondria.
4. Identification and study of cancerous cells using permanent slides and photomicrographs.
5. Antigen-Antibody reaction

6	Cell counting methods: counting using Haemocytometer.
7	Calibration of ocular micrometer and Measurement of average cell size using Stage micrometer
8	Separation of cell organelles by differential centrifugation and assay of marker enzymes. (2 Practicals)
9	Photographic demonstration of different types of cells.
10	Isolation of chloroplast by differential centrifugation & its identification.
11	Buccal smear- barr bodies
12	Identification of normal & abnormal karyotype using permanant slides
13	Estimation of iodine by titrometric method from commertial salt
14	Industrial /Institution visit

Note: Minimum of eight experiments to be done.

Reference:

1. Cooper, G.M. and Hausman, R.E. 2009 The Cell: A Molecular Approach. 5th edition ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.

2. Karp, G. 2010 Cell and Molecular Biology: Concepts and Experiments. 6 edition. JohnWiley & Sons. Inc.

3. Alberts, B., Johnson,A., Lewis, J., and Enlarge, M. 2008 Molecular Biology of the Cell.5th ed., Garland Science (Princeton).

4. Lodish, H., Berk, A., Zipursky, S.L., Matsudaira, P., Baltimore, D. and Darnell. J. 2012. Molecular Cell Biology. 7th ed., W.H. Freeman & Company (New York).

DMF21206/ DMF21207

SEMESTER VI
DSE-2: PLANT BIOCHEMISTRY

(Credits: Theory – 04, Practical – 01) **Theory: 60 Hrs**

Course Outcome:

After completion of the course the student is able to;

CO1: Specify the characteristics of plant cell structure
CO2: Deliberate in detail with examples photosynthesis
CO3: Understand the detail of nitrogen metabolism
CO4: Learn in detail with examples secondary metabolites

Unit : 1	**INTRODUCTION TO PLANT CELL STRUCTURE:** Plasma membrane, Vacuole and tonoplast membrane, cell wall, plastids and peroxisomes.	**5Hr**
Unit :2	**PHOTOSYNTHESIS & CARBON ASSIMILATION:** Structure of PSI and PSII complexes, Light reaction, Cyclic and non cyclic photophosphorylation, Calvin cycle and regulation; C4 cycle and Crassulacean acid metabolism (CAM), Photorespiration.	**14Hr**
Unit :3	**NITROGEN METABOLISM:** Biological Nitrogen fixation by free living and in symbiotic association, structure and function of enzyme Nitrogenase. Nitrate assimilation: Nitrate and Nitrite reductase. Primary and secondary ammonia assimilation in plants; ammonia assimilation by Glutamine synthetase-glutamine oxoglutarate amino transferase (GS-GOGAT) pathway. Seed storage proteins in legumes and cereals.	**14Hr**
Unit :4	**REGULATION OF PLANT GROWTH:** Introduction to plant hormones and their effect on plant growth and development, Regulation of plant morphogenetic processes by light.	**7Hr**
Unit :5	**SECONDARY METABOLITES:** Representatives alkaloid group and their amino acid precursors, function of alkaloids, Examples of major phenolic groups; simple phenylpropanoids, Coumarins, Benzoic acid derivatives, flavonoids, tannins and lignin, biological role of plant phenolics, Classification of terpenoids and representative examples from each class, biological functions of terpenoids.	**12Hr**
Unit :6	**PLANT TISSUE CULTURE:** Cell and tissue culture techniques, types of cultures: organ and explants culture, callus culture, cell suspension culture and protoplast culture. Plant regeneration pathways: organogenesis and somatic embryogenesis. Applications of cell and tissue culture and somoclonal variation.	**8Hr**

PRACTICALS

1	Induction of hydrolytic enzymes β-galactosidase during germination
2	Extraction and assay of Urease from Jack bean
3	Estimation of carotene in fruits and vegetables
4	Estimation of ascorbic acid in fruits and vegetables
5	Estimation of phenols in fruits and vegetables
6	Estimation of tannins in fruits and vegetables
7	Culture of plant plants (explants)
8	Extraction of genomic DNA from coconut endosperm, quantification &determination of its purity by Spectrophotometric method.(2 Practicals)
9	Extraction of RNA from spinach leaves
10	Estimation of DNA by DPA method
10	Estimation of RNA by orcinol method
11	Extraction of Starch from potato
12	Extraction Casein from milk
13	Extraction of polyphenols
14	Industrial /Institution visit

Note: Minimum of eight experiments to be done.

Reference:

1. Plant Biochemistry (2008), Caroline Bowsher, Martin steer, Alyson Tobin, Garland science ISBN 978-0-8153-4121-5.

2. Biochemistry and molecular Biology of plant-Buchanan. (2005) 1 edition. Publisher: IK International. ISBN-10: 8188237116, ISBN-13: 978-8188237111.

3. Plant Biochemistry by P.M Dey and J.B. Harborne (Editors) (1997) Publisher: Academic Press ISBN-10:0122146743, ISBN-13:978-01221467.

Pattern of Question Paper
Semester III to VI
Paper III to V and VII (DSC and DSE)

Time : 3 Hrs **Max Marks: 70**

1. Answer all the questions 5 X 1 = 5

a. ----------
b. ----------
c. ----------
d. ----------
e. ----------

2. Answer any five of the following questions 5 X 3 = 15

a. ----------
b. ----------
c. ----------
d. ----------
e. ----------
f. ----------
g. ----------

3. Answer any four of the following questions 4 X 5 = 20

a. ----------
b. ----------
c. ----------
d. ----------
e. ----------
f. ----------

4. Answer any three questions of the following 3 X 10 = 30

a. ----------
b. ----------
c. ----------
d. ----------
e. ----------

(Note- 10 Marks may be divided in to 6+4 or 5+5)

Pattern of Question Paper
Semester V
Paper VI (SEC)

Time : 2 Hrs Max Marks: 35

1. Answer all the questions 5 X 1 = 5

   a. ----------
   b. ----------
   c. ----------
   d. ----------
   e. ----------

2. Answer any five of the following questions 5 X 3 = 15

   a. ----------
   b. ----------
   c. ----------
   d. ----------
   e. ----------
   f. ----------
   g. ----------

3. Answer any three of the following questions 3 X 5 = 15

   a. ----------
   b. ----------
   c. ----------
   d. ----------
   e. ----------

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE
(AUTONOMOUS)
OOTY ROAD, MYSORE – 25.

CURRICULUM FOR

For B.Sc., (Basic/ Hons.) Degree

BIOTECHNOLOGY

(As per NEP-2020 Model Curriculum)

Implementation Year 2021-22

2021-22

B.Sc., (Basic/ Hons.) Degree

Scheme of study for B.Sc. Biotechnology As per NEP-2020 Model from 2021-22

	YEAR	SEMESTER	CORE COURSE	COURSE CODE	TITLE OF THE PAPER	NO. OF CREDITS	LECTURE/ PRACTICAL/ HOUR/WEEK	TOTAL TEACHING HOURS
JSS	I BSc	I	DSC -I:Theory	FSA460	Cell biology & genetics	4	4	56
			DSC -I:Pract		Cell biology & genetics	2	4	56
			OE:Theory		Biotechnology for human welfare	3	3	42
			SEC-: Theory		Biotechnological Skills and Analytical Techniques	1	1	14
		II	DSC-II:Theory	FSB460	Microbiological Methods and Techniques	4	4	56
			DSC-II: Pract		Microbiological Methods and Techniques	2	4	56
			OE:Theory		Applications of Biotechnology in Agriculture	3	3	42

COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSORE **Scheme of Examination for B.Sc. Biotechnology As per NEP-2020 Model from 2021-22**

ear	Semester	Core course	Course code	Title of the paper	credits	Maximum Marks in exam/Assessment			Exam Duration	
					L:T:P	IA		Total	Th	Pr

						C-1	C-2	C-3			
B.Sc	I	**DSC - I:Theory**	**FSA460**	**Cell biology & genetics**	4: 0: 0	20	20	60	100	3h	3h
		DSC -I:Pract		**Cell biology & genetics**	0: 0: 2	10	15	25	50		
		OE:Theory		**Biotechnology for human welfare**	3:0:0	20	20	60	100	3h	3h
		SEC-: Theory		**Biotechnological Skills and Analytical Techniques**	0:0:1						
	II	**DSC- II:Theory**	**FSB460**	**Microbiological Methods and Techniques**	4: 0: 0	20	20	60	100	3h	3h
		DSC-II: Pract		**Microbiological Methods and Techniques**	0: 0: 2	10	15	25	50		
		OE:Theory		**Applications of Biotechnology in Agriculture**	3:0:0	20	20	60	100	3h	3h

MODEL CURRICULUM

Name of theDegreeProgram	**:**	**B.Sc. (Basic/Hons.)**
DisciplineCore	**:**	**Biotechnology**
Total Credits for theProgram	**:**	**B.Sc. Basic - 136 and B.Sc. Hons. - 176**
Starting yearofimplementation	**:**	**2021-22**

Program Outcomes:

Competencies need to be acquired by the candidate securing B.Sc. (Basic) or B.Sc. (Hons)

By the end of the program the students will be able to:

Competencies need to be acquired by a candidate securing B.Sc. (Basic) or B.Sc. (Hons) degree in Biotechnology.

1. Understanding concepts of Biotechnology and demonstrate interdisciplinary skills acquired in cell biology, genetics, biochemistry, microbiology, and molecular biology.

2. Demonstrating the Laboratory skills in cell biology, basic and applied microbiology with an emphasis on technological aspects

3. Competent to apply the knowledge and skills gained in the fields of Plant biotechnology, animal biotechnology and microbial technology in pharma, food, agriculture, beverages, herbal and nutraceutical industries.

4. Critically analyze the environmental issues and apply the biotechnology knowledge gained for conserving the environment and resolving the problems.

5. Demonstrate comprehensive innovations and skills in the fields of biomolecules, cell and organelles, molecular biology, bioprocess engineering and genetic engineering of plants, microbes, and animals with respect to applications for human welfare.

6. Apply knowledge and skills of immunology, bioinformatics, computational modelling of proteins, drug design and simulations to test the models and aid in drug discovery.

7. Critically analyze, interpret data, and apply tools of bioinformatics and multi omics in various sectors of biotechnology including health andFood.

8. Demonstrate communication skills, scientific writing, data collection and interpretation abilities in all the fields of biotechnology.

9. Learning and practicing professional skills in handling microbes, animals and plants and demonstrate the ability to identify ethical issues related to recombinant DNA technology, genetic engineering, animals handling, intellectual property rights, biosafety, and biohazards.

10. Exploring the biotechnological practices and demonstrating innovative thinking in addressing the current day and future challenges with respect to food, health, and environment.

11. Thorough knowledge and application of good laboratory and good manufacturing practices in biotech industries

12. Understanding and application of molecular biology techniques and principlesin forensic

and clinicalbiotechnology.

13. Demonstrate entrepreneurship abilities, innovative thinking, planning, and setting up small-scale enterprises orCROs.

Continuous Formative Evaluation/ Internal Assessment

Total Marks for each course = 100%

Continuous assessment (C1) = 20% marks

Continuous assessment (C2) = 20% marks

Semester End Examination (C3) = 60% marks.

a) The first component (C1) of assessment is for 20% marks. This shall be based on test, assignment, seminar, case study, field work, project work etc. This assessment and score process should be completed after completing 50% of syllabus of the course/s and within 45 working days of semester program.

b) The second component (C2) of assessment is for 20% marks. This shall be based on test, assignment, seminar, case study, field work, internship / industrial practicum / project work etc. This assessment and score process should be based on completion of remaining 50 percent of syllabus of the courses of the semester.

c) During the 17th – 19th week of the semester, a semester end examination shall be conducted by the University for each course. This forms the third and final component of assessment (C3) and the maximum marks for the final component will be 60%.

d) The outline for continuous assessment activities for Component-I (C1) and Component-II (C2) of a course shall be as under.

Outline for continuous assessment activities for C1 and C2

Activities	**C1 (% marks)**	**C2 (% marks)**	**C1 + C2 (% marks)**	**C3 (% marks)**
Session Test	10	10	20	-
Seminars/Presentations/Assignment /Activity	10	10	20	-
Semester end Examination	-	-	-	60
Total	20	20	**40**	**60**

- For practical course of full credits, Seminar shall not be compulsory. In its place, marks shall be awarded for Practical Record Maintenance.(the ratio is 50% : 50%)

- Conduct of Seminar, Case study / Assignment, etc. can be either in C1 or in C2 component at the convenience of the concerned teacher.

- The teachers concerned shall conduct test / seminar / case study, etc. The students should be informed about the modalities well in advance. The evaluated courses/assignments during component I (C1) and component II (C2) of assessment are immediately provided to the candidates after obtaining acknowledgement in the register by the concerned teachers(s) and maintained by the Chairman in the case of a University Post-Graduate Department and the Principal / Director in the case of affiliated institutions. Before commencement of the semester end examination, the evaluated test, assignment etc. of C1 and C2 shall be obtained back to maintain them till the announcement of the results of the examination of the concerned semester.

e) The marks of the internal assessment shall be published on the notice board of the department / college for information of the students.

f) The Internal assessment marks shall be communicated to the Registrar (Evaluation) at least 10 days before the commencement of the University examinations and the Registrar (E) shall have access to the records of such periodical assessments.

g) There shall be no minimum in respect of internal assessment marks.

h) Internal assessment marks may be recorded separately. A candidate, who has failed or rejected the result, shall retain the internal assessment marks.

Curriculum Structure for the Undergraduate Degree Program

B.Sc. (Basic / Hons.)

Total Credits for the Program : 176
Starting year of implementation : 2021-22

Name of the Degree Program : B.Sc. (Basic/Hons.) BIOTECHNOLOGY

Program Articulation Matrix:

Curriculum Structure for the Undergraduate Degree Program - BSc

Total Credits for the Program: 176

Starting year of implementation: 2021-22

Name of the Degree Program: B.Sc.

Discipline/Subject: **Biotechnology**

Program Articulation Matrix:

This matrix lists only the core courses. Core courses are essential to earn the degree in that discipline/subject. They include courses such as theory, laboratory, project, internships etc. Elective courses may be listed separately

Pedagogy for student engagement is predominantly lectures. However, other pedagogies enhancing better student engagement to be recommended for each course. The list includes active learning/ course projects/ problem or project-based learning/ case studies/self-study like seminar, term paper or MOOC

$ Every course needs to include assessment for higher order thinking skills (Applying/ Analyzing/ Evaluating/ Creating). However, this column may contain alternate assessment methods that help formative assessment (i.e. assessment for learning).

BSc Biotechnology (Basic / Hons.) Semester 1

Course Title: DSC-1T, BTC 101, Cell Biology and Genetics	
Total Contact Hours: **56**	Course Credits: **4+2**
Formative Assessment Marks:**40%**	Duration of ESA/Exam: **3 Hrs**
Model Syllabus Authors: **Curriculum Committee**	Summative Assessment Marks: **60%**

Course Pre-requisite(s):*Mention only course titles from the curriculum that are needed to be taken by the students before registering for this course.*

Course Outcomes (COs):

At the end of the course the student should be able to:
(Write 3-7 course outcomes. Course outcomes are statements of observable student actions that serve as evidence of knowledge, skills and values acquired in this course)

1. Would be able to comprehend the structure of a cell with itsorganelles
2. *Can explain the organization of genes and chromosomes, chromosome morphology and itsaberrations

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12
1. Would be able to comprehend the structure of a cell with its organelles	*	*			*							
2. Can distinguish between the Structure of prokaryotic and eukaryotic cell.	*	*			*							
3. Can explain the organization of genes and chromosomes, chromosome morphology and its aberrations	*	*			*							

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark ‘X’ in the intersection cell if a course outcome addresses a particular program outcome.

BSc Biotechnology (Basic / Hons.)

Semester 1

Title of the Courses:

Course 1 : DSC-1T, Cell Biology and Genetics
Course 2 : OE 1T, Biotechnology for human welfare
Course 3 : SEC 1T, Biotechnological Skills and Analytical Techniques

Course 1 : DSC-1T, BTC 101, **Cell Biology and Genetics**		Course 2 : OE 1T, BTC 301, **Biotechnology for human welfare**		Course 3 : SEC 1T, BTC 701, **Biotechnological Skills and Analytical Techniques**	
Number of Theory Credits	Number of lecture hours/semester	Number of Theory Credits	Number of lecture hours/semester	Number of Theory Credits	Number of lecture hours/semester
4	**56**	**3**	**42**	**1**	**14**

Content of Course 1: Theory: DSC-1T, BTC 101, Cell Biology and Genetics 56 Hrs

Unit – 1:Cell as a Basic unit of Living Systems and Cellular Organelles 14Hrs

Concept, Development and Scope of Biotechnology. Historical perspectives. Discovery of cell, the cell Theory, Ultra structure of prokaryotic and eukaryotic cell- (Both plant and animal cells),
Surface Architecture: Structural organization and functions of plasma membrane and cell wall of bacteria and plants.

Cellular Organelles: Structure and functions of cell organelles – Endoplasmic reticulum, Golgi complex, Mitochondria, Chloroplast, Ribosomes, Lysosomes, Peroxisomes, Nucleus (Nuclearenvelope with nuclear pore complex, Nucleolus, Nucleoplasm and Chromatin). Vacuole, Cytosol and Cytoskeleton structures (Microtubules, Microfilaments and Intermediate filaments).

Unit- 2. Chromosomes and Cell Division 14Hrs

General Introduction, Discovery, Morphology and structural organization – Centromere, Secondary constriction, Telomere, Chromonema, Euchromatin and Heterochromatin, Chemical composition and Karyotype. Single-stranded and multi- stranded hypothesis, folded- fibre and nucleosome models.
Special type of chromosomes: Salivary gland and Lampbrush chromosmes.

Cell Division: Cell cycle, phases of cell cycle, Regulation of cell cycle-, checkpoints and enzymes involved. Significance of cell cycle, interphase nucleus, stages of mitosis and meiosis, achromatic apparatus, synaptonemal complex.Cell Senescence and programmed cell death.

Unit-3.Genetics: **14Hrs**

Mendelian Genetics: Introduction and brief history of genetics. Mendelian theory: Laws of inheritance-dominance, segregation, incomplete dominance, codominance with an example. Law of independent assortment, test cross, back cross.

Gene interaction: Deviations to Mendelian inheritance- Supplementary factors: comb pattern in fowls, Complementary genes- Flower colour in sweet peas, Multiple factors–Skin colour in human beings, Epistasis– Plumage colour in poultry (13:3), Multiple allelism: Blood groups in Humans- ABO and Rh.

Maternal Inheritance: Plastid inheritance in Mirabilis, Petite characters in yeast and Kappa particles in Paramecium.

Sex-linked inheritance- Colour blindness, hemophilia, Y-linked traits.

Unit-4.Linkage and Crossing over **14Hrs**

Introduction,Chromosome theory of inheritance, Coupling and repulsion hypothesis, Linkage in maize and Drosophila, Mechanism of crossing over and its importance, chromosome mapping-linkage map in maize.

Chromosomal variations: A general account of structural and numerical aberrations, chromosomal evolution of wheat and cotton.

Mutations: Types of mutations, Spontaneous and induced, Mutagens: Physical and chemical, Mutation at the molecular level, Applications of mutations- plants, animals and microbes.

Sex Determination in Plants and animals: Concept of allosomes and autosomes, XX- XY, XX-XO, ZW-ZZ, ZO-ZZ types.

Human Genetics: Karyotype in man, inherited disorders – Allosomal(Klinefelter syndrome and Turner'ssyndrome), Autosomal (Down syndrome and Cri-Du-Chat Syndrome).

Epigenetics: Plant and humans

Course 1: Practical: DSC-1P, BTC 101, Cell Biology and Genetics

1) Study and maintenance of simple and compound microscope
2) Use of Micrometer and calibration, measurement of onion epidermal cells and yeast
3) Study of stages in mitosis from onion root tips
4) Study of stages in meiosis in grasshopper testes/onion or Rhoeo flower buds.
5) Mounting of polytene chromosomes
6) Buccal smear - Barrbodies
7) Karyotype analysis - Human and Onion
   Human – Normal and Abnormal – Down and Turner's syndromes
8) Isolation and staining of Mitochondria
9) Isolation and staining of Chloroplast
10) RBC cell count by Haemocytometer
11) Simple genetic problems based on theory

Text Books / References

Reference:

1. Molecular Biology of Cell - Bruce Alberts et al, Garlandpublications.
2. Animal Cytology and Evolution- MJD, White Cambridge UniversityPublications
3. Molecular Cell Biology-Daniel, Scientific AmericanBooks
4. Cell Biology - Jack d Bruke, The William TwilkinsCompany
5. Principles of Gene Manipulations- Old & Primrose, Black Well Scientific Publications
6. Cell Biology-Ambrose &Dorothy M Easty, ELBSPublications
7. Fundamentals of Cytology- L. W. Sharp, McGraw HillCompany
8. Cytology-Willson&Marrison, ReinformPublications
9. Molecular Biology- Christopher Smith, Faber & FaberPublications
10. Cell Biology & Molecular Biology – EDP De Robertis& EMF Robertis, Saunder College.
11. Cell Biology- C.B Powar, HimalayaPublications
12. Basic Genetics- Daniel L. Hartl, Jones &Barlett PublishersUSA
13. Human Genetics and Medicine lark Edward Arnold PLondon
14. Genetics – Monroe W Strickberger, Macmillain Publishers, NewYork
15. Genes V - Benjamin Lewin, Oxford UniversityPress.
16. Genes I - Benjamin Lewin, Wiley Eastern Ltd.,Delhi
17. Genes II - Benjamin Lewin, Wiley & SonsPublications
18. Genes III- Benjamin Lewin, Wiley & SonsPublications
19. Principles of Genetics- Sinnott, L.C. Dunn, Dobzhansky,McGraw-Hill.
20. Genetics – Edgar Altenburg Oxford & IBH publications
21. Principles of Genetics – E.J. Gardener, M.J. Simmons and D.P. Snustad, John Wiley & SonPublications
22. Genetics- P.K.Gupta, Rastogi Publication, Meert,India

Course 2: Theory: OE 1T, Biotechnology for Human Welfare

Course 2: OE 1T, Microbial Technology for Human Welfare 42Hrs

Unit – 1:Industry 14Hrs

Introduction, Scope, branches and applications of Biotechnology.

Biotechnology in industry:Industrial production of alcoholic beverage (wine), antibiotic (Penicillin), enzyme (lipase)

Applications of biotechnology in food, detergent and pharmaceutical industries

Unit – 2: Environment 14Hrs

Application of biotechnology in environmental aspects :

Bioremediation: Degradation organic pollutants, hydrocarbons and agricultural wastes, Superbug Bioplastics and Biofuels.

Unit – 3: Forensic and Health Sciences 14Hrs

Application of biotechnology in forensic science:

Solving crimes of murder and rape, paternity testing and theft using DNA finger printing techniques

Application of biotechnology in health:

Genetically engineered insulin, recombinant vaccines, gene therapy, diagnostics-ELISA and PCR, human genome project.

References:

1. Crueger W and Crueger A. (2000). Biotechnology: A textbook ofIndustrial Microbiology.2nd edition. Panima Publishing Co. NewDelhi.
2. Patel AH. (1996). Industrial Microbiology. 1st edition, MacmillanIndia Limited.
3. Stanbury PF, Whitaker A and Hall SJ. (2006). Principles ofFermentation Technology. 2nd edition, Elsevier ScienceLtd.
4. Environmental Biotechnology, Pradipta KumarMohapatra
5. Environmental Biotechnology – Concepts and Applications, Hans-Joachim Jordening andJesefWinter
6. B.B. Nanda and R.K. Tiwari, Forensic Science in India: A Vision for the TwentyFirst
   Century, Select Publishers, New Delhi (2001).
7. M.K. Bhasin and S. Nath, Role of Forensic Science in the NewMillennium, University of Delhi, Delhi(2002).
8. S.H. James and J.J. Nordby, Forensic Science: An Introduction toScientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton(2005).
9. W.G. Eckert and R.K. Wright in Introduction to Forensic Sciences,2nd Edition, W.G.Eckert (ED.), CRC Press, Boca Raton(1997).

Course 3: Theory: SEC 1T, Biotechnological Skills and Analytical Techniques

LEARNING OUTCOMES

- Skill enhancement as per National Occupational Standards (NOS) of Lab Technician/ Assistant" Qualification Pack issued by Life Sciences Sector Skill Development Council - LFS/Q0509, Level 3.
- Knowledge about major activities of biotech industry, regulations, and compliance, environment, health, and safety (EHS), good laboratory practices (GLP), standard operating procedures (SOP) and GMP as per the industry standards.
- Demonstrate soft skills, such as decision making, planning, organizing, problem solving, analytical thinking, critical thinking, and documentation.

Course 3: Theory: SEC 1T, Biotechnological Skills and Analytical Techniques **14Hrs**

1. **Insights into biotechnology industry:**

   Biotechnology Industry in Indian and Global context - organization in context of large/medium/ small enterprises, their structure andbenefits.

2. **Industry professional skills to be acquired:**

   Planning and organising skills, decision-making, problem-solving skills, analytical thinking,critical thinking, team management, risk assessment.

3. **Interpersonalskills:**

   Writing skills, reading skills, oral communication, conflict-resolution techniques, interpretation of research data, trouble shooting in workplace

4. **Digitalskills:**

   Basic Computer Skills (MS Office, Excel, Powerpoint, Internet) for Workplace. Professional Email drafting skills and Powerpoint presentation skills

Analytical Skills inlaboratory:

Solutions: Molarity, Molality, Normality, Mass percent % (w/w), Percent by volume (% v/v), parts per million (ppm), parts per billion (ppb), Dilution of concentrated solutions.Standard solutions, stock solution, solution of acids. Reagent bottlelabel reading and precautions

Course 3 :Practicals: SEC 1P, Biotechnological Skills and Analytical Techniques

1. **Methods and practices of cleaning and management of lab**

   Learning and Practice of Integrated clean-in-place (CIP) and sterilize-in-place (SIP) as per industry standards, material requirements for cleaning specific area, equipment, ventilation area, personal protective requirements

2. **Procedure of cleaning and storage of Lab ware:**

   Methodology for storage area, Cleaning procedure and materials to be used for various surfaces. Sign boards, labelling do's& don'ts

   Knowledge about standard procedures of cleaning or glass ware, plastic ware. Maintenance of inventory

3. **Principles and practices of lab safety:**

   Knowledge about safety symbols and hazard signs. Personal safety gears, utility, and disposal. Equipment safety protocols, chemical safety protocols. Documentation of chemical and equipment usage records. Handling hazardous chemicals.

4. **Best practices of usage and storage of chemicals:**

   Knowledge and practice in handling of chemicals, labelling and stock maintenance. SOP and material handling. Procedures to maintain chemicals, labelling, storage, and disposal.

5. **Record maintenance as per SOPs**

   Labelling of samples and reagents as per SOPs.

   Recording detail of work done for research experiments. Importance of study of manuals, health and safety instructions.

6. **Usage and maintenance of basic equipment of biotechnology lab**: Principles, calibrations, and SOPs of weighing balances, pH meters, autoclaves , laminar flows and biosafety cabinets (levels), basic microscopes, homogenizers, stirrers, colorimeters, UV, and Visible spectrophotometers.
7. **Preparation of solutions and standards -** Properties and uses of chemicals commonly used in life sciences laboratories. Maintaining safety standards for handling various solutions and chemicals. Preparation of test reagents and buffers,
   Protocols for proper mixing of chemicals. Safety precautions while preparation and storage of incompatible chemicals and reagents.

8. **Preparation of media**: Maintenance and storage of purified water for media (Plant Tissue culture media, Microbiological media, and Animal cell culture media) preparation.
   Preparation and storage of concentrated stock solutions. Documentation and disposal of expired stocks.

   Collection of indents of media requirement, preparation, and storage. Media coding, documentation, and purpose of usage.

9. Practical methods for decontamination and disposal:

Decontamination methods, Safe disposal practices of decontaminated media or materials.

10. Laboratory record writing

Method of record writing , data collection and recording , reporting of result, discussion of result , summary writing, effective power point presentation taking any experiment as example

11. Industry visit or Analytical laboratory visit

Pedagogy:

The general pedagogy to be followed for theory and practicals are as under. Lecturing, Tutorials, Group/Individual, Discussions, Seminars, Assignments, Counseling, Remedial Coaching. Field/Institution/Industrial visits, Hands on training, Case observations, Models/charts preparations, Problem solving mechanism, Demonstrations, Project presentations, Experiential documentation, and Innovative methods.

Active learning as per LSSSDC (NSDC) LFS/Q0509 guidelines, at skill training Level

3. Case studies about application of microbial biomolecules in various industries. Seminar on topics of microbial biochemistry

BSc Biotechnology (Basic / Hons.) Semester 2

Title of the Courses:

Course 1 : DSC-2T, Microbiological Methods and Techniques
Course 2 : OE- 2T, Applications of Biotechnology in Agriculture

Course 1: DSC-2T, BTC 102, **Microbiological Methods and Techniques**		Course 2: OE- 2T, BTC 302, **Applications of Biotechnology in Agriculture**	
Number of Theory Credits	Number of lecture hours/semester	Number of Theory Credits	Number of lecture hours/semester
4	**56**	**3**	**42**

Content of Course: DSC-2T, BTC 102, Microbiological Methods and Techniques 56 Hrs

Unit - 1 General Microbiology and Instrumentation 14Hrs

General Introduction to Microbiology: Scope and relevance of microbiology, important contributions by Robert Koch, Leeuwenhoek, Jenner, Pasteur, Flemming, Ivanowsky

General account on structure, classification and reproduction of bacteria, virus and fungi

Microscopy: Principles and applications of Compound microscope, Dark field microscope, Phase contrast microscope, Fluorescence Microscope, Confocal microscope, Electron Microscopes- TEM and SEM.
Analytical techniques: Working principles and applications: Centrifuge, Ultracentrifuge, Spectrophotometer, Chromatography: Paper, TLC, Column (adsorption, gel-filtration, ion exchange, affinity), HPLC, GC.

Unit - 2 Sterilization techniques 14Hrs

Definition of terms-sterilization, disinfectant, antiseptic, sanitizer, germicide, microbicidal agents, microbiostatic agent and antimicrobial agent.

Physical methods of control: Principle, construction and applications of moist heat sterilization-Pasteurization, Boiling, Fractional sterilization-Tyndallization and autoclave. Dry heat sterilization-Incineration and hot air oven.
Filtration – Diatomaceous earth filter, seitz filter, membrane filter and HEPA
Radiation : Ionizing radiation-γ rays and non ionizing radiation- UVrays

Chemical methods: Alcohol, aldehydes, phenols, halogen, metallic salts, Quaternary ammoniumcompounds and sterilizing gases as antimicrobial agents.

Unit – 3: Microbiological techniques 14Hrs

Culture Media: Components of media, natural and synthetic media, chemically defined media, complex media, selective, differential, indicator, enriched and enrichmentmedia

Pure culture methods: Serial dilution and plating methods (pour, spread, streak); cultivation, maintenance and preservation/stocking of pure cultures; cultivation of anaerobicbacteria

Microbial growth and its measurements: Growth curve, enumeration methods (turbidity, cell counting, colony counting)

Stains and staining techniques: Principles of staining, Types of stains-simple stains, structural stains, negative stain and differential stains.

Unit – 4: Antimicrobial agents 14Hrs

Antibiotic sensitivity testing methods: Disc and Agar well diffusion techniques

Five modes of action with one example each: Inhibitor of nucleic acid synthesis; Inhibitor of cell wall synthesis; Inhibitor of cell membrane function; Inhibitor of protein synthesis; Inhibitor of metabolism

Antifungal agents: Mechanism of action of Amphotericin B, Griseofulvin

Antiviral agents: Mechanism of action of Amantadine, Acyclovir,Azidothymidine Antibiotic resistance, MDR, XDR, MRSA,NDM-1

Course 1: Practicals: DSC-2P, Microbiological Methods and Techniques

1. To study the principle and applications of important instruments (biological safety cabinets, autoclave, incubator, BOD incubator, hot air oven, light microscope, pH meter) used in the microbiology and Biotechnologylaboratory.
2. Sterilization of medium using Autoclave and assessment forsterility
3. Sterilization of glassware using Hot Air Oven and assessment forsterility
4. Sterilization of heat sensitive material by membrane filtration and assessment for sterility
5. Preparation of culture media for bacteria, fungi and theircultivation.
6. Plating techniques: Spread plate, pour plate andstreakplate.
7. Isolation of bacteria and fungi from soil, water andair
8. Study of Rhizopus, Penicillium, Aspergillus using temporarymounts
9. Colony characteristics study of bacteria from air exposureplate
10. Staining techniques: Bacteria– Gram, Negative, Capsule, Endospore staining Fungi – Lactophenol cotton bluestaining
11. Water analysis - MPNtest
12. Biochemical Tests – IMViC, Starch hydrolysis, Catalase test, Gelatinhydrolysis
13. Bacterial cell motility - hanging drop technique

Text Books / References

1. Atlas RM. (1997). Principles of Microbiology. 2nd edition. WM.T. Brown Publishers.
2. Black JG. (2008). Microbiology: Principles and Explorations. 7th edition. Prentice Hall
3. Madigan MT, and Martinko JM. (2014). Brock Biology of Micro-organisms. 14th edition. Parker J. Prentice Hall International,Inc.
4. Pelczar Jr MJ, Chan ECS, and Krieg NR. (2004).Microbiology.
5. 5th edition Tata McGraw Hill.
6. Srivastava S and Srivastava PS. (2003). Understanding Bacteria. Kluwer Academic Publishers,Dordrecht
7. Stanier RY, Ingraham JL, Wheelis ML and Painter PR. (2005). General Microbiology. 5th editionMcMillan.
8. Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An Introduction. 9th edition PearsonEducation.
9. Willey JM, Sherwood LM, and Woolverton CJ. (2013). Prescott's Microbiology. 9th edition. McGraw Hill HigherEducation.
10. Cappucino J and Sherman N. (2010). Microbiology: A Laboratory Manual. 9th edition. Pearson EducationLimited
11. Microbiology- Concepts and applications by Paul A. Ketchum, WileyPublications
12. Fundamentals of Microbiology –Frobisher, Saunders & ToppanPublications
13. Introductory Biotechnology-R.B Singh C.B.D. India(1990)
14. Fundamentals of Bacteriology -Salley
15. Frontiers in Microbial technology-P.S. Bison, CBSPublishers.
16. Biotechnology, International Trends of perspectives A. T. Bull,G.
17. General Microbiology –C.B. Powar

Course 2 :Theory: OE- Applications of Biotechnology in Agriculture 42 Hrs

Unit – 1: Agricultural Biotechnology 14 Hrs

Concepts and scope of biotechnology in Agriculture. Plant tissue culture, micro propagation, entrepreneurship in commercial plant tissue culture. Banana tissue culture - primary and secondary commercial setups,Small scale bioenterprises: Mushroom cultivation

Unit – 2: Transgenic plants 14 Hrs

The GM crop debate – safety, ethics, perception and acceptance of GM crops

GM crops case study: Bt cotton, Bt brinjal, Biopesticides: Baculovirus pesticides, Mycopesticides Genetic Engineering for quality improvement: Golden rice, Seed storage proteins, Flavours– capsaicin, vanillin

Unit – 3: Molecular pharming and post harvest protection **14 Hrs**

Plants as biofactories for molecular pharming: edible vaccines, plantibodies, nutraceuticals
Post-harvest Protection:
Antisense RNA technology for extending shelf life of fruits and shelf life of flowers.
Biosafety, bioethics and IPR.

References

1. Chrispeels M.J.et al. Plants, Genes and Agriculture-Jones and Bartlett Publishers, Boston.1994.
2. Gamborg O.L. and Philips G.C.Plant cell, tissue and organ culture (2nd Ed.) Narosa Publishing House. NewDelhi.1998
3. Hammound J, P McGravey&Yusibov.V. Plant Biotechnology, Springerverlag.2000
4. Heldt. Plant Biochemistry and Molecular Biology.Oxford and IBH Publishing Co. Pvt.Ltd. Delhi.1997
5. LydianeKyte and John Kleyn.Plants from test tubes. An introductionto
6. Micropropagation (3 rd. Ed.). Timber Press, Portland.1996
7. Murray D.R. Advanced methods in plant breeding and biotechnology.Panima Publishing Corporation.1996
8. NickoloffJ.A.Methods in molecular biology, Plant cell electroporation and electrofusion protocols-Humana press incorp, USA.1995.
9. Sawahel W.A. Plant genetic transformation technology.Daya Publishing House, Delhi.1997
10. Gistou, P and Klu, H.Hand book of Plant Biotechnology (Vol. I & II).John Publication.2004
11. Sateesh M.K. 2008. Biosafety and Bioethics. Oxford and IBH Publishers, New Delhi.

Text Books / References

1. Prescott,Harley,Klein'sMicrobiology,J.M.Willey,L.M.Sherwood,C.J.Woolverton,7th International, edition 2008, McGraw Hill.

2. Foundations in Microbiology, K. P. Talaro, 7th International edition 2009, McGrawHill.
3. A Textbook of Microbiology, R. C. Dubey and D. K. Maheshwari, 1st edition, 1999, S. Chand & CompanyLtd.
4. Brock Biology of Microorganisms, M.T.Madigan, J.M.Martinko, P. V. Dunlap, D. P. Clark- 12th edition, Pearson International edition 2009, Pearson BenjaminCummings.
5. Microbiology – An Introduction, G. J.Tortora, B. R.Funke, C. L. Case, 10th ed. 2008,PearsonEducation.
6. General Microbiology, Stanier, Ingraham et al, 4th and 5th edition 1987, Macmillan educationlimited.
7. Microbiology- Concepts and Applications, PelczarJr,Chan, Krieg, International ed, McGraw Hill.
8. Alexopoulos, C.J., Mims, C.W., and Blackwell, M. 2002. Introductory Mycology. John Wiley and Sons (Asia) Pvt. Ltd. Singapore. 869pp.
9. Atlas, R.M. 1984. Basic and practical microbiology. Mac Millan Publishers, USA.987pp.
10. Black, J.G. 2008. Microbiology principles and explorations. 7edn. John Wiley and Sons Inc., New Jersey 846pp.
11. Pommerville, J.C. Alcamo's Fundamentals of Microbiology. Jones andBartlett Pub..Sudburry, 835 pp.

12. Schlegel, H.G. 1995.General Microbiology. Cambridge University Press, Cambridge, 655 pp.
13. Toratora, G.J., Funke, B.R. and Case, C.L. 2007. Microbiology 9th ed. Pearson Education Pte. Ltd., San Francisco.958pp.

GENERAL PATTERN OF THEORY EXAMINATION

B.Sc – BIOTECHNOLOGY

Theory Question Paper Pattern for DSC, DSE, and OE Courses

Duration: 3 Hours **Maximum: 60 Marks**

All questions are compulsory
Draw neat labeled diagrams wherever necessary

QNo. I Answer any EIGHT of the following 2X8=16
(1)
(2)
(3)
(4)
(5)
(6)
(7)
(8)
(9)
(10)

QNo. II Answer any SIX of the following 4X6=24
(11)
(12)
(13)
(14)
(15)
(16)
(17)
(18)

QNo. III Answer any TWO of the following 10X2=20
(19)
(20)
(21)
(22)

PATTERN OF PRACTICAL EXAMINATION

Practical examination – B. Sc BIOTECHNOLOGY

Duration: 3 hours	**Max. Marks: 25**
Q. 1 Major question	08 Marks
Q. 2 Minor question	05 Marks
Q. 3 Identify and comment	2X4 = 08Marks
Q. 4 Viva-voce	04 Marks

PATTERN OF FORMATIVE

ASSESMENT – PRACTICALS		**Max. Marks: 25**
1	IA 1	10 Marks
2	IA 2	10 Marks
3	Record	05 Marks

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE
(AUTONOMOUS)
OOTY ROAD, MYSORE – 25.

DEPARTMENT OF BIOTECHNOLOGY

SCHEMATIC SYLLABUS UNDER CHOICE BASED CREDIT SYSTEM (CBCS)

For B.Sc., programmes

Chemistry, Zoology and Biotechnology

Biochemistry, Microbiology and Biotechnology

2017-18

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSORE
Scheme of Examination Programme – B.Sc., CZBt ; Programme code –BSC

Year	Semester	Core course	Course code	Title of the paper	credits	Maximum Marks in exam/Assessment				Exam Duration	
					L:T:P	IA(Theory)			Total	Th	Pr
						C-1	C-2	C-3			
I B.Sc	I	DSC-I :Theory	DMA22005	Cell Biology and Genetics	4: 0: 0	15	15	70	100	3h	3h
		DSC-I: Pract	DMA22105	Cell Biology and Genetics	0: 0: 2	7.5	7.5	35	50		
	II	DSC-II:Theory	DMB22005	Biomolecules and Bio-analytical techniques	4:0:0	15	15	70	100	3h	3h
		DSC-II: Pract	DMB22105	Biomolecules and Bio-analytical techniques	0:0:2	7.5	7.5	35	50		
II B.Sc	III	DSC-III:Theory	DMC22005	Molecular biology and Genetic engineering	4:0:0	15	15	70	100	3h	3h
		DSC-III: Pract	DMC22105	Molecular biology and Genetic engineering	0:0:2	7.5	7.5	35	50		
	IV	DSC-IV: Theory	DMD22005	Plant Tissue culture and Animal Cell culture	4:0:0	15	15	70	100	3h	3h
		DSC-IV: Pract	DMD22105	Plant Tissue culture and Animal Cell culture	0:0:2	7.5	7.5	35	50		
III B.Sc.	V	DSE: Elective 1:Theory	DME22005	Elective 1: Immunology and Medical Biotechnology	4:0:0	15	15	70	100	3h	3h
		Elective 1: Pract	DME22105	Elective 1: Immunology and Medical Biotechnology	0:0:2	7.5	7.5	35	50		
		Elective 2: Theory	DME22205	Elective 2: Microbial technology and Agricultural Biotechnology	4:0:0	15	15	70	100		
		Elective 2: Pract	DME22305	Elective 2: Microbial technology and Agricultural Biotechnology	0:0:2	7.5	7.5	35	50		
		SEC 1: Theory	DME22405	SEC 1:Microbial Techniques	2:0:0	7.5	7.5	35	50	2h	-
		SEC 2: Theory	DME22505	SEC 2:Enzymology	2:0:0	7.5	7.5	35	50	2h	-
	VI	DSE: Elective 1:Theory	DMF22005	Elective 1: Environmental Biotechnology and Biostatistics	4:0:0	15	15	70	100	3h	3h
		Elective 1: Pract	DMF22105	Elective 1: Environmental Biotechnology and Biostatistics	4:0:0	15	15	70	100		
		Elective 2: Theory	DMF22205	Elective 2: Bioinformatics and Bioprocess technology	4:0:0	15	15	70	100		
		Elective 2: Pract	DMF22305	Elective 2: Bioinformatics and Bioprocess technology	4:0:0	15	15	70	100		

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSORE
Scheme of Examination Programme – B.Sc., BMBt ; Programme code –BSC

Year	Semester	Core course	Course code	Title of the paper	credits	Maximum Marks in exam/Assessment				Exam Duration	
					L:T:P	IA(Theory)			Total	Th	Pr
						C-1	C-2	C-3			
I B.Sc	I	**DSC-I :Theory**	**DMA22006**	Cell Biology and Genetics	4: 0: 0	15	15	70	100	3h	3h
		DSC-I: Pract	**DMA22106**	Cell Biology and Genetics	0: 0: 2	7.5	7.5	35	50		
	II	**DSC-II:Theory**	**DMB22006**	Biomolecules and Bio-analytical techniques	4:0:0	15	15	70	100	3h	3h
		DSC-II: Pract	**DMB22106**	Biomolecules and Bio-analytical techniques	0:0:2	7.5	7.5	35	50		
II B.Sc	III	**DSC-III:Theory**	**DMC22006**	Molecular biology and Genetic engineering	4:0:0	15	15	70	100	3h	3h
		DSC-III: Pract	**DMC22106**	Molecular biology and Genetic engineering	0:0:2	7.5	7.5	35	50		
	IV	**DSC-IV: Theory**	**DMD22006**	Plant Tissue culture and Animal Cell culture	4:0:0	15	15	70	100	3h	3h
		DSC-IV: Pract	**DMD22106**	Plant Tissue culture and Animal Cell culture	0:0:2	7.5	7.5	35	50		
III B.Sc.	V	**DSE: Elective 1:Theory**	**DME22006**	Elective 1: Immunology and Medical Biotechnology	4:0:0	15	15	70	100	3h	3h
		Elective 1: Pract	**DME22106**	Elective 1: Immunology and Medical Biotechnology	0:0:2	7.5	7.5	35	50		
		Elective 2: Theory	**DME22206**	Elective 2: Microbial technology and Agricultural Biotechnology	4:0:0	15	15	70	100		
		Elective 2: Pract	**DME22306**	Elective 2: Microbial technology and Agricultural Biotechnology	0:0:2	7.5	7.5	35	50		
		SEC 1: Theory	**DME22406**	SEC 1:Microbial Techniques	2:0:0	7.5	7.5	35	50	2h	-
		SEC 2: Theory	**DME22506**	SEC 2:Enzymology	2:0:0	7.5	7.5	35	50	2h	-
	VI	**DSE: Elective 1:Theory**	**DMF22006**	Elective 1: Environmental Biotechnology and Biostatistics	4:0:0	15	15	70	100	3h	3h
		Elective 1: Pract	**DMF22106**	Elective 1: Environmental Biotechnology and Biostatistics	4:0:0	15	15	70	100		
		Elective 2: Theory	**DMF22206**	Elective 2: Bioinformatics and Bioprocess technology	4:0:0	15	15	70	100		
		Elective 2: **Pract**	**DMF22306**	Elective 2: Bioinformatics and Bioprocess technology	4:0:0	15	15	70	100		

Programme Outcomes for Bachelor of Science in Chemistry, Zoology and Biotechnology:

After completing the graduation in the Bachelor of Science the students are able to:

PO1. Demonstrate the ability to justify, explain, and/or approach the concept both in written and oral forms

PO2. Demonstrate the ability to present clear, logical and succinct arguments

PO3. Develop state-of-the-art laboratory skills and professional communication skills.

PO4. Apply the scientific method to design, execute, and analyze an experiment.

PO5. Appreciate the central role of chemistry in the society and use this as a basis for ethical behaviour in issues facing chemists/drugs.

PO6. Understand Chemistry as an integral part for addressing social, economic, and environmental problems.

PO7. Identify the major groups of organisms with an emphasis on animals and plants.

PO8. Compare and contrast the characteristics of animals that differentiate themselves from other living and non-living creatures.

PO9. Give specific examples of physiological adaptations.

PO10. Design and develop solution to Biotechnology problems keeping in mind the safety measures for environment and society.

PO11. Support Biotechnology research activity with strong technical background knowledge.

Programme Outcomes for Bachelor of Science in Biochemistry, Microbiology and Biotechnology:

After completing the graduation in the Bachelor of Science the students are able to:

PO1. Demonstrate the ability to justify and explain their thinking approach, both written and oral.

PO2. Develop state-of-the-art laboratory skills and professional communication skills.

PO3. Apply the scientific method to design, execute, and analyze an experiment, to explain their scientific procedures and experimental observations.

PO4. Demonstrate an understanding of fundamental biochemical principles, structure and biological function and metabolic pathways.

PO5. Work as a laboratory technician, biochemists or medical scientist.

PO6. Describe/ explain the processes used by microorganisms for their replication, survival, and interaction with their environment and host populations.

PO7. Explain the theoretical basis of the tools, technologies and methods common to microbiology.

PO8. Design and develop solution to Biotechnology problems by applying appropriate tools while keeping in mind safety factor for environment & society.

PO9. Create, select, and apply appropriate techniques, resources, and modern tools with an understanding of the limitations.

PO10.Support biotechnology research activity with strong technical background knowledge.

Programme Specific Outcomes

Bachelor of Science in Chemistry, Zoology and Biotechnology:

After completing the graduation in the Bachelor of Science the students are able to:

PSO1. Find jobs at all level of chemical, pharmaceutical, food products and life oriented material Industries

PSO2. Apply appropriate techniques for the qualitative and quantitative analysis of chemicals in laboratories and in industries.

PSO3. Recognize the relationship between different structures and functions at different levels.

PSO4. Characterize the biological, chemical and physical features of environments that Animals inhabit.

PSO5. Demonstrate effectively the applications of biochemical and biological sciences.

PSO6. Know and apply appropriate tools and techniques in biotechnological manipulation

PSO7. Understand his or her responsibilities in biotechnological practices.

Programme Specific Outcomes

Bachelor of Science in Biochemistry, Microbiology and Biotechnology:

After completing the graduation in the Bachelor of Science the students are able to;

PSO 1: Gain and understand biochemical and molecular processes that occur in and between cells to expand understanding of biology

PSO2: Be knowledgeable in proper procedures and regulations in handling and disposal of chemicals.

PSO3: Communicate scientific information effectively, especially relating to microbes and their role in ecosystem and health related issues.

PSO4: Acquire, articulate, retain and demonstrate laboratory safety skills applicable to microbiological research or clinical methods.

PSO5: Demonstrate effectively the applications of biochemical and biological sciences

PSO6: Decide and apply appropriate tools and techniques in biotechnological manipulation.

POS7: Justify societal, health, safety and legal issues and understand his or her responsibilities in biotechnological practices.

DMA22005/ DMA22006

SEMESTER I
CELL BIOLOGY AND GENETICS (4 CREDITS)

Course Outcomes:
After completing the course students are able to:
CO1. Develop an understanding of the structure and functions of organelles.
CO2. Understand the structure of chromosomes, types, cell differentiation and features of cancer cells.
CO3. Gain comprehensive understanding of the chemical basis of heredity and methods.
CO4. Understand effect of mutation, mechanism and Chromosomal Aberrations.

CELL BIOLOGY **NO. HOURS**

UNIT I **15**
Cell: Introduction and Historical perspective, the cell theory, ultra-structure of plant and animal cell. Cell organelles: Structure and functions of – cell wall, plasma membrane, membrane protein, cytoplasm, mitochondria, chloroplast, Golgi complex , endoplasmic reticulum, ribosome, lysosomes, peroxisomes, nucleus. Extracellular Matrix: Composition, molecules that mediate cell adhesion, membrane receptors for extra cellular matrix, macromolecules, regulation of receptor expression and function. Signal transduction.

UNIT II **15**
Eukaryotic chromosomes: Types, chromatin structure, nucleosomes, and higher order chromatin organization.
Special chromosomes – Polytene and B chromosome, lamp brush chromosome.
Cell interaction and motility: Cell motility flagellar and ciliary motion .Structure and function of muscle cells, muscle contraction, nerve cell structure and function.
Stem cells, differentiation of stem cells (eg: Haematopoitic stem cells) and their application, blood cells, identification, structure and different types of blood cells, cancer cells.

GENETICS

UNIT III **15**
Introduction: Historical developments in the field of genetics. Organisms suitable for genetic experimentation and their genetic significance. Mendelian genetics: Mendel's experimental on monohybrid and di-hybrid crosses, Law of segregation & Principle of independent assortment. Verification of segregates by test and back crosses. Deviation to Mendelian inheritance of genes (13:3 ratio), incomplete dominance (Flower colour in sweet peas) , co dominance (Blood groups in human beings), epistasis(Dominant &recessive epistasis). Sex-linked inheritance (colour blindness), chromosomal theory of inheritance, linkage, crossing over and cytoplasmic inheritance (Plastid inheritance in Mirabilis)

UNIT IV **15**
Mutation: Natural and induced mutations, chemical, physical and biological mutagens with an example

each.
Structure and characteristics of bacterial and eukaryotic chromosome, chromosome morphology, concept of euchromatin and heterochromatin.
Chromosomal aberrations: Deletion, duplication, inversion and translocation. Chromosomal aberrations in human beings, abnormalities– Aneuploidy and Euploidy.

PRACTICALS **(2 CREDITS)**

HOURS : 4 HOURS /WEEK

1. Cell counting methods: using Haemocytometer.
2. Measurements with the help of light microscope.
    a. Calibration of ocular micrometer
    b. Measurement of biological materials (cells/spores etc.).
    c. Demonstration-Separation of cell organelles by differential centrifugation
3. Study of Mitosis -onion root tips.
4. Study of Meiosis –onion flowers buds/rheo flowers
5. Demonstration of plasmolysis and deplasmolysis
6. Isolation of chloroplast from leaves
7. Study of at least five simple mutants of Drosophila-Photographic demonstration
8. Preparation of polytene chromosome from salivary glands of Drosophila
9. Genetic Problems; Monohybrid, Di hybrid and interactions of Genes
10. Special Chromosomes; Lampbrush and Polytene chromosomes
11. Comment (Types of chromosome (slide/picture), chromosomal disorders in humans- Humans -Down's Turner's and Klinefelter's Syndrome

REFERENCES

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.

2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition.Lippincott Williams and Wilkins, Philadelphia.

3. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASMPress& Sunderland, Washington, D.C.; Sinauer Associates, MA.

4.Gardner, E.J., Simmons, M.J., Snustad, D.P. (2006). Principles of Genetics. VIII Edition John Wiley & Sons.

5.Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.

6.Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. IX Edition. Benjamin Cummings.

DMB22005/ DMB22006

SEMESTER II
BIOMOLECULES & BIO-ANALYTICAL TECHNIQUES (4 CREDITS)

Course Outcomes:
After completing the course students are able to:
CO1. Understand the properties, mechanisms and biological importance of Bio-molecules .
CO2. Comphrend the mechanism of enzyme action, factors affecting it and its applications.
CO3. Understand and able to relate the principles underlying various instruments in the field of Biology.
CO4. Compare and contrast the role of bio -molecules and enzymes.

BIOMOLECULES **NO. HOURS**

UNIT I: **15**
Carbohydrates: Structure (Fischer and Haworth structure), function and properties of Monosaccharide's (Glucose, Fructose), disaccharides (Sucrose, Maltose and Lactose) and Heteropolysaccharide's- hyaluronic acid and heparin. Reducing and Non reducing Sugars, Stereochemistry- Epimers, Enantiomers, Anomers and Isomers.
Proteins: Amino acids- Zwitter ionic structure, classification based on polarity, pka value. D and L amino acids, optical activity. Peptide bond, primary, secondary, tertiary and quaternary structural organization of proteins. Globular and fibrous proteins with special reference to structure of haemoglobin and collagen.

UNIT II: **15**
Lipids: Classification of lipids with examples. Simple and compound lipids, unsaturated and saturated fatty acids, physical and chemical properties of fats and oils. Structure and biological importance of phospholipids and cholesterol.
Nucleic acids: Structure of bases, nucleosides, nucleotides and secondary structure of DNA and different forms of DNA. Types and functions of RNA, cloverleaf structure of tRNA.

UNIT III: **15**
General characteristics of enzymes, nomenclature and classification of enzymes. Mechanism of enzyme action: active site, enzyme substrate complex formation-lock and key and induced fit theory. Concept of co-enzymes and cofactors with an example. Factors influencing enzyme activity: pH, temperature, substrate concentration, metal ion, inhibitors (allosteric) and activators, energy of activation. Isozymes,

multienzyme complex and multifunctional enzymes with an example to each

BIO-ANALYTICAL TECHNIQUES

UNIT IV: 15

Bio-analytical Techniques: Lambert-Beer Law, working principles of UV-Visible spectrophotometry and colorimetry.

Centrifugation: Basic principle of centrifugation, ultracentrifuge and its application.

Chromatography: Principles of chromatography, Types- Partition chromatography- paper and thin layer chromatography & Adsorption chromatography - column chromatography, ion exchange& molecular sieve (principle &application).

Isotopes: Their importance in biological studies, measure of radioactivity, GM counters

PRACTICALS (2 CREDITS)

HOURS : 4 HOURS /WEEK

1. Qualitative analysis of Carbohydrates.
2. Qualitative analysis of Lipids.
3. Estimation of reducing sugar by DNS method.
4. Estimation of Protein by Biuret method.
5. Estimation of amino acid by ninhydrin method /formal titration
6. Determination of activity and specific activity of enzyme-Salivary amylase.
7. Effect of pH on enzyme activity
8.. Effect of temperature on enzyme activity.
9. Effect of metal ions on enzyme activity.
10. Preparation of buffer solution.
11. Identification of amino acids by circular paper chromatography.

REFERENCES

1.Nelson, D.L., Cox, M.M. 2004 Lehninger Principles of Biochemistry, 4 th edition, W.H. Freeman and Company, New York, USA.

2. Biochemistry, LubertStryer, 6th Edition, WH Freeman, 2006.

3. Harper's illustrated Biochemistry by Robert K. Murray, David A Bender, Kathleen M.Botham, Peter J. Kennelly, Victor W. Rodwell, P. Anthony Weil. 28th Edition, McGrawHill, 2009.

4. Biochemistry, Donald Voet and Judith Voet, 2nd Edition, Publisher: John Wiley andSons, 1995.

5. Biochemistry by Mary K.Campbell& Shawn O.Farrell, 5th Edition, Cenage Learning,2005.

6. Fundamentals of Enzymology Nicholas Price and Lewis Stevens Oxford University Press 1999

7. Fundamentals of Enzyme Kinetics Athel Cornish-Bowden Portland Press 2004

8. Practical Enzymology Hans Bisswanger Wiley–VCH 2004

DMC22005/ DMC22006

SEMESTER III
MOLECULAR BIOLOGY & GENETIC ENGINEERING (4 CREDITS)

Course Outcomes:
After completing the course students are able to:
CO1. Display a broad understanding of core molecular Biology.
CO2. Discuss and differentiate the process of Transcription and Translation
CO3 Explain key concepts of genome organization and manipulation.
CO4. Demonstrate working knowledge in a defined skill set of molecular biology and biotechnology protocols.

MOLECULAR BIOLOGY **NO. HOURS**

UNIT I **15**

Central Dogma of Molecular biology and modification.
Concept of gene: Definition, types, generalized structure of Prokaryotes and Eukaryotes.
DNA Replication: DNA as genetic material, Replication of DNA in prokaryotes and eukaryotes: Semiconservative, conservative and dispersive method. Components of replication –lagging strand leading strand Okazaki fragment, role of SSBP, gyrase, helicase, RNA polymerase, DNA polymerase. Inhibitors of replication- role of actinomycin, novobioci, amphidicolin and N-ethylmaleimide.
Genetic code: outline of Deciphering of genetic code, major features of genetic code, Wobble hypothesis.

UNIT II **15**

Transcription and RNA processing : RNA structure and types of RNA, Transcription in prokaryotes: Prokaryotic RNA polymerase, role of sigma factor, promoter, Initiation, elongation and termination of RNA chains. Inhibitors of Transcription- rifampicin, actinomycin, alpha amantinin and platinum antitumor drugs. Transcription in eukaryotes: Eukaryotic RNA polymerases, transcription factors, promoters, enhancers, mechanism of transcription initiation, promoter clearance and elongation RNA splicing and processing: processing of pre-mRNA: 5' cap formation, polyadenylation, splicing, rRNA and tRNA splicing.
Translation: Activation of amino acids, ribosome (composition & components), formation of initiation complex. Initiation, elongation and termination, inhibitors of protein synthesis.

GENETIC ENGINEERING

UNIT III **15**

Enzymes in Genetic engineering and its importance-Restriction endonucleases-types of restriction enzymes, ligases, alkaline phosphatases, polynucleotide kinase, terminal deoxynucleotidyltransferase, S1 nuclease, Klenow fragment, taq DNA polymerases, ribonuclease, reverse transcriptase

Gene cloning vectors: Types of vectors –Cloning vector and expression vector . Plasmids (pBR322, pUC 19) and cosmids (pLFR5, pJB8). Importance of plasmids as cloning vectors, stability of plasmids, different forms of plasmid, concepts of YAC and BAC.

UNIT IV **15**

Recombinant DNA technology: Isolation of gene, construction and preparation of complementary DNA. Probes- types, preparation and hybridization, genomic library.

Genetic engineering techniques: Gel electrophoresis, southern and northern blotting techniques, PCR and its types, Sanger's, Maxam& Gilbert method of DNA sequencing.

Applications of Genetic Engineering: Therapeutic products produced by genetic engineering-blood proteins, human hormones.Genetic engineering in plants: Use of Agrobacterium tumefaciens and A. rhizogenes, Ti plasmids, Direct DNA transfer to plants.

PRACTICALS **(2 CREDITS)**

HOURS : 4 HOURS /WEEK

1.Preparation of stock solution for molecular biology experiments.
2. Colorimetric estimation of DNA.
3. Colorimetric estimation of RNA.
4. Demonstration of Tm value of DNA.
5. Extraction of DNA from plant and microbial source.
6. Quantification of DNA by spectrophotomery.
7. Determination of purity of DNA.
8. Agarose gel electrophoresis of DNA.
9. Southern blotting (demonstration).
10. Isolation of plasmid DNA.

REFERENCES

1. Russell, P.J. 2009 Genetics – A Molecular Approach. 3rdedition. Benjamin Co. 7. Sambrook&Russel. Molecular Cloning: A laboratory manual. (3rd edition) 8. Slater, A., Scott, N.W. & Fowler, M.R. 2008 Plant Biotechnology: The Genetic Manipulation of Plants, Oxford University Press.

2. Brown, T.A. (1998). Molecular biology Labfax II: Gene analysis. II Edition. Academic Press, California,USA.

3. Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M. (2009). An introduction to genetic analysis. IX Edition. Freeman & Co., N.Y., USA.

4. Watson, J.D., Myers, R.M., Caudy, A. and Witkowski, J.K. (2007). Recombinant DNAgenes and genomes- A short course. III Edition. Freeman and Co., N.Y., USA.

5. Brown, T. A. Gene cloning and DNA analysis: An Introduction. Blackwell Publication.

DMD22005/ DMD22006

SEMESTER IV

PLANT TISSUE & ANIMAL CELL CULTURE (4 CREDITS)

Course Outcomes:
After completing the course students are able to:
CO1. Develop concept of plant tissue and animal cell culture techniques and their application in biotechnology.
CO2. Comprehend the knowledge of transgenic plants in industrial and agricultural applications.
CO3. Establish and maintain various cell lines used in tissue culture.

PLANT CELL CULTURE **NO. HOURS**

UNIT I
15 Plant tissue culture introduction: History and development, Importance of plant tissue culture. Laboratory organization and culture techniques: general requirements and aseptic conditions. Media preparation, culture media, sterilization, and pre-treatment to explants. Principles of tissue culture: Callus culture- Definition of callus, initiation, maintenance, sub culture and organogenesis .Factors affecting organogenesis .organ culture- culture protocols and importance of root and meristem culture.

UNIT- II
15 Micropropagation in plants: stages of micropropagation, methods, advantages, applications. Somaclonal variation for disease resistance and agronomic traits.
Somatic embryogenesis: Embryoid and embryogenesis. Protocol and importance of somatic embryogenesis, Synthetic seeds and its applications, germplasm conservation and preservation.
Suspension culture: Batch and continuous cell suspension culture. Importance of suspension culture in production of secondary metabolites. Protoplast culture and fusion: Definition of protoplast, isolation

principle, culture protocol, action of enzymes, regeneration of plants, protoplast fusion, somatic cell hybridization and its application.

ANIMAL TISSUE CULTURE

UNIT - III **15**

Introduction: History, developments and importance of animal cell culture. Characteristics of animal cell growth, Advantages and disadvantages of tissue culture methods and laboratory facilities (Essential Equipment, Washing facilities, beneficial equipment's, Consumable items).

Animal tissue culture media: Culture media containing naturally occurring ingredients, blood plasma, blood serum, serum-free media, tissue extracts, complex natural media, chemically defined media, and basal salt solution –HBSS.

UNIT – IV **15**

Primary culture, cell lines and cloning: Preparation of primary culture –mechanical and enzymatic method. Primary and established cell lines, somatic cell fusion. Tissue cultures- cover slip method, watch glass method and use of agar.

Whole embryo culture. (e.g. Chick embryo).

Hybridoma technology: Production of monoclonal antibodies.

Gene transfer methods in Animals – Microinjection, Embryonic Stem cell, gene transfer, Retrovirus & Gene transfer. Animal propagation –Artificial insemination, superovulation, embryo transfer, in-vitro fertilization, embryo splitting. Genetic modification in Medicine -vectors in gene therapy

PRACTICALS **(2 CREDITS)**

HOURS : 4 HOURS /WEEK

1. Media preparation and sterilization techniques.
2. Callus cultures: choice of explants, preparation of explants, callus induction, subculture and maintenance.
3. Regeneration of plants from growth hormones.
4. Meristem culture for pathogen free plants.
5. Preparation synthetic seed
6. Suspension culture – initiation of suspension culture from callus.
7. Plant protoplast Isolation.
8 . Cell viability test by tryphan blue method.
9. Preparation of HSS and glasswares of cell culture experiments
10. Isolation of PMN leucocytes from human peripheral blood sample and staining and identification.(lishman stain).
11. Demonstration of dissegration of cells by mechanical and enzymatic methods.
12. Photographic Demonstration of Animal Cell culture Lab equipments

REFERENCES

1. Hopkins, W.G. and Huner, P.A. 2008 Introduction to Plant Physiology. John Wiley and Sons.

2. Mauseth, J.D. 1988 Plant Anatomy. The Benjammin/Cummings Publisher, USA.

3. Bhojwani, S.S. and Razdan 2004 Plant Tissue Culture and Practice.

4. Butler, M. (2004). Animal cell culture and technology: The basics. II Edition. Bios scientific publishers. 3. Glick, B.R. and Pasternak, J.J. (2009). Molecular biotechnology- Principles and applications of recombinant DNA. IV Edition. ASM press, Washington, USA.

5. Reinert, J. and Bajaj, Y.P.S. 1997 Applied and Fundamental Aspects of Plant Cell, Tissue and Organ Culture. Narosa Publishing House.

DME22005/DME22006

SEMESTER V

DSE: IMMUNOLOGY AND MEDICAL BIOTECHNOLOGY (4 CREDITS)

Course Outcomes:

After completing the course students are able to:

CO1. Understand the role of different types of Cells in immune system .

CO2. Discuss the principles and applications of immunological techniques.

CO3. Understand to diagnose diseases.

CO4. Comprehend the knowledge of therapeutic applications of enzyme and hormone.

IMMUNOLOGY **NO. HOURS**

UNIT I **15**

Historical account and chronological events of EdwardJenner and Louis Pasture.

Antigens: Definition, hatpins, epitops, antigenicity, blood group antigens. Antibodies: Definition, types, structure of IgG. Types of immunity – Innate- mechanism of innate immunity. Adaptive immunity – active and passive and adoptive immunity.

Cells and organs involved in immune system – T- cells, B-cells, antigen presentation and macrophages, their role in antigen recognition, clonal selection, and immunological memory. Immunological aspects of viral (HIV), bacterial and parasitic infection (one example each)

UNIT II **15**

Immune disorders: Hypersensitivity, auto immune disorders- organ specific and systemic specific Grave's diseases, Hashimoto's disease , systemic lupus erythematosus. Immuno techniques: Precipitation reaction, immuno diffusion-ODD and RID, RIA, Heamagglutination, ELISA, immunofluroscent, Western blotting. Major Histocompatibility complexes – class I & class II MHC antigens, antigen processing.Vaccines& Vaccination – adjuvants, cytokines, DNA vaccines, recombinant vaccines, bacterial vaccines, viral vaccines, vaccines to other infectious agents, passive & active immunization.

MEDICAL BIOTECHNOLOGY

UNIT III

15 Vaccine production: Introduction, new developments, types of vaccines – Inactivate Attenuated and Recombinant Vaccines-Peptide and DNA, production of vaccines using genetically engineered microorganisms (HBV).

Enzymes in diagnosis: Enzymes used for diagnosis, immobilized enzymes as diagnostic tools, proteins in diagnosis.

Nucleic acid analysis: Features of DNA probes and its applications in diagnosis, identification of *Mycobacterium tuberculosis* in clinical samples using PCR.

Enzymes in therapy: List of enzymes and their therapeutic applications.

UNIT IV

15

Hormone therapy: List of hormones and their therapeutic applications, production of humulin by recombinant DNA technology.

Therapeutic proteins: Cytokines as therapeutic proteins, production of interferon by recombinant DNA technology.

Human gene therapy: Definition, differences between somatic and germ line gene therapy, one example each, principle and applications.

Transgenic plants for production of biopharmaceutical (tobacco, tomatoes, and potatoes

PRACTICALS **(2 CREDITS)**

HOURS : 4 HOURS /WEEK

1 Determination of blood group

a) ABO blood grouping

b) Rh blood grouping.

2 Immuno diffusion :

a) ODD

b) RID.

3 Separation of serum from blood

4 Demonstration of ELISA

5 Demonstration of Western blotting

6 MIC assay

7 Isolation of antibiotic resistant strains using gradient plate method

8 Estimation of urea by BAMO method

9 Qualitative analysis of normal and abnormal constituents of urine

10 Photographic demonstration of transgenic animals and plants for production of biopharmaceutical

REFERENCES

1. Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6 th edition Saunders Publication, Philadelphia.

2. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology. 11th edition Wiley-Blackwell Scientific Publication, Oxford.

3. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.

4. Murphy K, Travers P, Walport M. (2008). Janeway'sImmunobiology. 7th edition Garland Science Publishers, New York.

5. Peakman M, and Vergani D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinberg.

6. Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.

DME22205/DME22206

SEMESTER V

DSE: MICROBIALTECHNOLOGY &AGRICULTURAL BIOTECHNOLOGY (4 CREDITS)

Course Outcomes:

After completing the course students are able to:

CO1. Develop skills associated with screening of Industrially Important Strains.

CO2. Understand principles underlying design of Fermentor, Fermentation Process and downstream processing

CO3. Discuss the various aspects for the improvement of crop plants.

CO4. Understand the application of r-DNA technology to enhance the production of crop plant .

MICROBIALTECHNOLOGY **NO. HOURS**

UNIT I **15**

Introduction to biotechnological importance of microorganisms.

Metabolic pathway involved in microbial products, primary and secondary metabolites, enzymes and microbial biomass.

Microbial production: Use of microbes in production of vitamins (vit-C), enzymes (Amylase), organic acids (citricacid),amino acids (glutamicacid),polysaccharides (xanthan),growth regulators (auxins), colorants (phycocyanin) ,flavors (diactyl), antibiotics (penicillin).

UNIT II **15**

Kinetics of microbial growth and product formation: Phase of cell growth in batch cultures and continuous culture. Growth associated and non-growth associated product formation kinetics, substrate and product inhibition on cell growth and product formation. Bioreactors- Types and functions. Purification & characterization of proteins, Upstream and downstream processing, solids and liquid handling. Distribution of microbial cells, centrifugation, filtration of fermentation broth, ultra centrifugation, liquid extraction, ion-exchange recovery of biological products. Immobilization of cell-Introduction and methods of microbial cell immobilization.

AGRICULTURAL BIOTECHNOLOGY

UNIT III **15**

Introduction: Biotechnology for crop improvement, future prospects of biotechnology for agriculture. Biological nitrogen fixation: Nitrogen fixing microorganisms, role of nitrogenase, genetics of nitrogen fixing microorganisms, regulation of nif gene expression and mechanism of nitrogen fixation.
Bio fertilizers and phyto-stimulations: Mechanism of growth promotion by microbial inoculants-microbial production and application methods of microbial inoculants- *Rhizobium, azospirillum, azotobacter, mycorhizae.*

UNIT IV **15**

Genetic engineering of crop plant: Gene transfer technique for desirable traits in crop plants. Agro bacterium mediated gene transfer, Direct gene transfer methods to protoplast. Few examples of transgenic plants, plants obtained through gene transfer techniques –BT cotton, herbicide tolerant soybean, virus resistance (papaya ring spot). Microbial pesticides: Fungicides and herbicides. Bacterial, fungal and viral bio agents- *Bacillus Thurengensis* (BT) and *BeaveriaBassiana*. Mechanism of control of plant disease-hypo virulence, competition antibiosis, induced resistance, mycoparasitism.

PRACTICALS **(2 CREDITS)**

HOURS : 4 HOURS /WEEK

1 . Identification of important microorganisms relevant to biotechnology: E.coli, sacchromycescervisiae, spirulina.

2 .Demonstration of commercial products-single cell proteins microbial flavours.

3 .Entrapment of yeast for enzyme action & estimation of invertase activity

4. Preparation of wine.

5. Estimation of percentage of alcohol by Specific gravity method .6 .Seed inoculation with rhizobium culture and observation for root nodulation.

7. Preparation of bio control formulations.

8. Biofertilizers formulation.

9. Isolation and identification of *Rhizobium.*

10. Isolation and identification of *azospirillum.*Isoalation and Identification of *azotobacter.*Study of morphology of*mycorhizae.*

11. Photographic demonstration of BT cotton, herbicide tolerant soybean, virus resistance (papaya ring spot).

12. Demonstration of steps involved in large scale production of biofertilizers.

REFERENCES

1. Casida LE. (1991). Industrial Microbiology. 1st edition. Wiley Eastern Limited.

2. Crueger W and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology. 2nd edition. Panima Publishing Co. New Delhi.

3. Mauseth, J.D. 1988 Plant Anatomy. The Benjammin/Cummings Publisher, USA.

4. Bhojwani, S.S. and Razdan 2004 Plant Tissue Culture and Practice.

5. Butler, M. (2004). Animal cell culture and technology: The basics. II Edition. Bios scientific publishers. 3. Glick, B.R. and Pasternak, J.J. (2009). Molecular biotechnology- Principles and applications of recombinant DNA. IV Edition. ASM press, Washington, USA.

6. Agricultural Biotechnology, S.S. Purohit

DMF22005/ DMF22006

SEMESTER VI

DSE: ENVIRONMENTAL BIOTECHNOLOGY AND BIOSTATISTICS (4 CREDITS)

Course Outcomes:
After completing the course students are able to:
CO1. Gain an understanding of the causes, types and control methods for Environmental Pollution.
CO2. Differentiate the application of different life forms in Environmental Remediation.
CO3. Apply Statistical Tools for Analysis of Biological Data.

ENVIRONMENTAL BIOTECHNOLOGY NO. HOURS
UNIT I
15 Introduction: Major issues in environment pollution. Role of Biotechnology to solve the problems. Biotechnological methods of pollution detection: General bioassay, cell biological methods, immunoassay, DNA based methods, use of biosensor.
Biotechnological methods in pollution abatement: reduction of CO2 emission, Waste water treatment – conventional waste treatment, Use of Algae, Eutrophication, Use of Cell Immobilization.

UNIT II

15 Biotechnology and biodegradation: Degradation of Xenobiotic compounds-organic (chlorinated hydrocarbons, substituted simple aromatic compounds, polyaromatic hydrocarbons, pesticides and surfactants.

Biohydrometallurgy and Biomining: Bioleaching, biosorption, oil degradation and creation of super bugs. Treatment of Industrial wastes: Pulp, Dye, leather and solid waste management. Genetically engineered microbes for waste treatment.

Ecofriendlybioproducts: Biomass resources, biogas, and alcohol as a fuel, biological hydrogen generation and biodegradable plastics.

BIOSTATISTICS

UNIT III

15 Introduction, Basic concepts- population, data, sample and variable. Types of data-primary and secondary, methods of data collection- direct personal interview, indirect oral interview, through correspondence, questionnaire and census. Classification of data- qualitative, quantitative and simple classification. Sampling methods- random and non-random. Tabulation of data- structure of a table, simple and complex table.

UNIT IV

15 Graphical and diagrammatic representation of data- histogram, bar graph and pie diagram. Frequency of distribution- without class intervals, with class intervals and cumulative frequency distribution. Measures of central tendency- mean, median and mode. Measure of dispersion- range, mean deviation, co-efficient of deviation and standard deviation.

PRACTICALS **(2 CREDITS)**

HOURS : 4 HOURS /WEEK

1 & 2. Analysis of sewage water for BOD & COD.

3 Estimation of Hydrogen sulphides in the sewage water.

b. Estimation of chloride in sewage water sample.

c. Estimation of residual chloride in sewage water sample.

d. Estimation of carbon dioxide in sewage water sample.

4. Identification of microbial flora in the given water sample.

5 . Estimation of percentage of alcohol by specific gravity bottle method

6 a. Photographic demonstration of septic tank, sand filters, Imhoff's tank and biosensors.

b. Photographic demonstration of creation of superbug.
c. Photographic demonstration of genetically modified microbes.
d. Photographic demonstration of genetically modified plants.
e. Photographic demonstration of genetically modified animals.

Biostatistics problems
7 Problems on graphical and diagrammatic representation of data
(histogram, bar graph and pie chart)
8 Calculation of mean, median, mode, standard deviation

REFERENCES

1. Environmental Science, S.C. Santra

2. Environmental Biotechnology, Pradipta Kumar Mohapatra

3. Environmental Biotechnology – Concepts and Applications, Hans-Joachim Jordening and Jesef Winter

4. Le CT (2003) Introductory biostatistics. 1st edition, John Wiley, USA

5. Glaser AN (2001) High YieldTM Biostatistics. Lippincott Williams and Wilkins, USA

6. Edmondson A and Druce D (1996) Advanced Biology Statistics, Oxford University Press.

7. Danial W (2004) Biostatistics : A foundation for Analysis in Health Sciences, John Wiley and Sons Inc.

DMF22205/ DMF22206

SEMESTER VI

DSE: BIOINFORMATICSAND BIOPROCESS TECHNOLOGY (4 CREDITS)

Course Outcomes:
After completing the course students are able to:
CO1. Understand the basic concepts and tools used in Bioinformatics.
CO2. Comprehend the knowledge of Genomics and Proteomics.
CO3. Develop an understanding of the various aspects of Bioprocess Technology.
CO4. Enhance the skills associated in Fermentation Process.

BIOINFORMATICS **NO. HOURS**

UNIT I
15

Bioinformatics and the Internet: Introduction, Internet basics, connecting to the internet electronic mail, File transfer protocol, The World Web.
Database- DNA, protein, genomic mapping database, sequence alignment software-pair wise& multiple alignments, gene families

UNIT II **15**
Information retrieval from databases: Databases similarity searching, FASTA, BLAST SEARCH, Clustal W, Clustal X,DIALIGN2,Multalign Navigating the NCBI web site.
Genomics and Proteomics: Types of genomes, bacterial genome sequence project.
Human genome project, Micro array technologies-types and applications.

BIOPROCESS TECHNOLOGY

UNIT-III **15**
Introduction to bioprocess technology. Range of bioprocess technology and its chronological development. Basic principle components of fermentation technology. Types of microbial culture and its growth kinetics– Batch, Fed batch and Continuous culture.

UNIT IV **15**
Design of bioprocess vessels- Significance of Impeller, Baffles, Sparger; Types of culture/production vessels- Airlift; Cyclone Column; Packed Tower and their application in production processes. Principles of upstream processing – Media preparation, Inoculation, development and sterilization. Introduction to oxygen requirement in bioprocess; mass transfer coefficient; factors affecting KLa. Bioprocess measurement and control system with special reference to computer aided process control.

PRACTICALS **(2 CREDITS)**

HOURS : 4 HOURS /WEEK

1. Sequence information resource
2. Understanding and use of various web resources: EMBL, Genbank, Entrez, Unigene, Protein information resource (PIR)
3. Understanding and using: PDB, Swissprot, TREMBL
4. Using various BLAST and interpretation of results.
5. Retrieval of information from nucleotide databases.
6. Sequence alignment using BLAST.

7. Multiple sequence alignment using Clustal W.
8. Bacterial growth curve.
9. Production and analysis of ethanol.
10. Production and analysis of amylase.
11. Production and analysis of lactic acid.
12. Isolation of industrially important microorganism from natural resource.

REFERENCES

1. Stanbury PF, Whitaker A and Hall SJ. (2006). Principles of Fermentation Technology. 2nd edition, Elsevier Science Ltd.

2. Salisbury, Whitaker and Hall. Principles of fermentation Technology,

4. Waste Water Engineering, Metcalf and Eddy, Tata McGraw hill

5.Wong, K.C.92016). Computational bilolgy and bioinformatics: gene regulation, CRC press/ Taylor & Francis Group.

6. Joyce, A. P.; Zhang, C.; Bradley, P.; Havranek, J. J. (2015). "Structure –based modeling of protein : DNAspecificity". Briefings in Functional Genomics.

DME22405/ DME22406

SEC

MICROBIAL TECHNIQUES (2 CREDITS)

Course Outcomes:

After completing the course students are able to:

CO1. Understand and demonstrate basic sterilization techniques.

CO2. Analyze the anatomy of prokaryotic cell and structural detail of eukaryotic cell.

CO3. Acquire the knowledge of Culture media and their applications.

CO4. Assess the growth measurement and pattern of microorganism.

MICROBIAL TECHNIQUES **NO. HOURS**

UNIT I **07**

General introduction. Concept of Prokaryotes and Eukaryotes. General account on Structure, Classification & Reproduction of Bacteria, Fungi & Viruses.

UNIT II **08**

Microbial Techniques: Sterilization: Principles and applications of
a. Physical Methods: Autoclave, Hot air oven, Laminar airflow, Seitz filter, Sintered glass Filter, membrane filter.
b. Chemical Methods: Alcohol, Aldehydes, Phenols, Halogens and Gaseous agents.
c. Radiation Methods: UV rays and Gamma rays.

UNIT III **08**

Microscopy: working principle and applications of Light microscopy, phase contrast microscopy and electron microscopy.
Staining-Types, Simple and differential (Gram's and acid fast)

UNIT IV **07**

Microbial nutrition and growth: nutritional classes of microorganisms, culture media, pure culture, microbial growth pattern and methods of growth measurements, method of maintenance and preservation of cultures.
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REFERENCES

1 Prescott L.M. Harley J.P and Klein D.A (Microbiology 5th Edition)
2. Pelzar Jr, M.J. Chan, E.C.S. and Krieig N.R (Microbiology)
3. Salle. A.J Fundamental Principles of Bacteriology .
4. Caldmell, D.R. Microbial Physiology and metabolism

DME22605/ DME22606:

SEC

ENZYMOLOGY **(2 CREDITS)**

Course Outcomes:

After completing the course students are able to:
CO1. Understand relationship between the structure and function of enzymes.
CO2. Interpret mechanisms of enzymatic action kinetics and molecular interactions and specifies importance of enzymes.
CO3. Characterise the inhibitor affects on enzyme kinetics.
CO4. Enumerate methods in immobilization of enzymes.

ENZYMOLOGY **NO. HOURS**

UNIT – I **7**

Enzyme classification . Enzyme substrate complex: concept of E-S complex, binding sites, active site, specificity, factors affecting initial rate, E, S, temp. &pH.

UNIT – II **8**

Kinetics of enzyme activity, Michaelis-Menten equation, Different plots for the determination of Km and Vmax and their physiological significance. Enzyme inhibition types of inhibition, Mechanism of enzyme action: General mechanistic principle.

UNIT – III **7**

Allosteric enzymes with special reference to phosphofructokinase. Kinetics of allosteric enzymes. Isoenzymes– multiple forms of enzymes with special reference to lactate dehydrogenase. Multienzyme complexes. Ribozymes. Multifunctional enzyme- eg Fatty Acid synthase.

UNIT – IV **8**

Enzyme Technology: Methods for large scale production of enzymes. Immobilized enzyme and their comparison with soluble enzymes, Methods for immobilization of enzymes. Immobilized enzyme reactors. Application of Immobilized and soluble enzyme in health and industry.

REFERENCES

1.Nelson, D.L., Cox, M.M. 2004 Lehninger Principles of Biochemistry, 4 th edition, W.H. Freeman and Company, New York, USA.

2. Biochemistry, LubertStryer, 6th Edition, WH Freeman, 2006.

3. Harper's illustrated Biochemistry by Robert K. Murray, David A Bender, Kathleen M.Botham, Peter J. Kennelly, Victor W. Rodwell, P. Anthony Weil. 28th Edition, McGrawHill, 2009.

4. Biochemistry, Donald Voet and Judith Voet, 2nd Edition, Publisher: John Wiley andSons, 1995.

5. Biochemistry by Mary K.Campbell& Shawn O.Farrell, 5th Edition, Cenage Learning,2005.

6. Fundamentals of Enzymology Nicholas Price and Lewis Stevens Oxford University Press 1999

Pattern of Question Paper
Semester I to VI
Paper I to VI (DSC)

Time : 3 Hrs Max Marks: 70

I. Answer all the questions 5 X 1 = 5

1 ----------
2----------
3----------

4----------
5----------

II. Answer any five questions 5 X 3 = 15

6----------
7----------
8----------
9----------
10----------
11----------

III. Answer any four questions 4 X 5 = 20

12 ----------
13----------
14----------
15----------
16----------

IV. Answer any three questions 3 X 10 = 30

17----------
18----------
19----------
20----------

(Note- 10 Marks may be divided in to 6+4 or 5+5)

Pattern of Question Paper
Semester VI
(SEC)

Time : 2 Hrs Max Marks: 50

I. Answer all the questions 5 X 1 = 5

1 ----------
2----------
3----------

4----------
5----------

II. Answer any five questions 5 X 3 = 15

6----------
7----------
8----------
9----------
10----------
11----------

III. Answer any four questions 4 X 5 = 20

12 ----------
13----------
14----------
15----------
16----------

IV. Answer any one question 1 X 10 = 10

17----------
18----------

(Note- 10 Marks may be divided in to 6+4 or 5+5)

LIST OF APPROVED PANEL OF EXAMINERS:

Sl. No	Name	Designation and DOB	Joining Date	Phone number
	Internal Examiners			
1.	Dr.Prathibha S JSS College, Ooty Road, Mysore	Asso. Prof. 28/04/1964	28/08/1986	9243707241
2.	Gayathri Devi N Jss College, Ooty Road, Mysore	Asst. Prof.	01-01-2005	8050684736
3.	Kiran B L JSS College, Ooty Road, Mysore	Asst. Prof.	23-09-2015	9638219347
4.	Pooja N JSS College, Ooty Road, Mysore	Asst. Prof.	30-08-2017	9844210414
	External Examiners			
5.	Dr. Ravikumar B S AVK College For Women, Hassan	Asso. Prof. 13/07/1962	16/07/1987	8861716456
6.	Mallikarjunamiah M N Maharani`s Science college For Women, Mysore	Asso. Prof. 05/11/1963	14/08/1992	9880006223
7.	Dr. Hemavathi C Govt. First grade college, Vijayanagar, Mysuru	Asso. Prof. 05/04/1966	17/08/1992	9980748813
8.	Dr. Vijay C R Maharani`s Science College For Women, Mysore	Asso. Prof. 01/10/1962	29/12/1992	9448028585
9.	Dr. Shivalingaiah Maharani`s Science College for Women, Mysore	Asst. Prof. 01/06/1968	08/01/1996	9036766869
10.	Dr. Purushotham S P Maharani`s Science College for Women, Mysore	Asst. Prof. 15/05/1967	02/08/1996	9448115524
11.	Dr. Lingaraju D P AVK College for Women, Hassan	Asst. Prof. 26/02/1965	23/10/2002	9108585024
12.	Dr. Basavaraju G L Govt College for Women, Mandya	Asst. Prof. 21/07/1976	30/01/2004	
13.	Dr. Devika M Saradavilas College, Mysore	Asst. Prof. 14/03/1970	14/12/2005	9880024483
14.	Dr. Pruthviraj Sri Mahadeshwara Govt. First grade college	Asso. Prof.		9448925262
15.	Dr. Nataraju Maharani`s Science College for Women, Mysore	Asso. Prof.		9448033901
16.	Dr. Suresh N S Maharani`s Science College for Women, Mysore	Asst. Prof. 25/02/1975	02/05/2006	9242243601
17.	Dr. Jayalakshmi B Maharani`s Science College for Women, Mysore	Asst. Prof. 18/11/1974	14/07/2006	9482640645
18.	Sowmya H K Govt Science College,Hassan	Asst. Prof. 18/06/1970	22/12/2007	7338466887
19.	Dr. Thoyajaksha Govt Science College, Hassan	Asst. Prof. 20/07/1970	24/12/2007	9743779983
20.	Sandhya Rani D Maharani`s Science College for Women, Mysore	Asst. Prof. 24/08/1972	24/12/2007	9448602597
21.	Dr. Pushpalatha H G Maharani`s Science College for Women, Mysore	Asst. Prof. 23/12/1979	26/12/2007	9480442844
22.	Dr. Ashok N Pyati Maharani`s Science College for Women, Mysore	Asst. Prof. 22/04/1970	28/12/2007	7204661365
23.	Dr. Deepa Hebbar Maharani`s Science College for Women, Mysore	Asso. Prof.		9632869690

24.	Indushree PES College, Mandya	Asst. Prof.		8151917465
25.	Dr. Lalitha V Maharani`s Science College for Women, Mysore	Asst. Prof.		8105004148
26.	Revanamaba B Maharani`s Science College for Women, Mysore	Asst. Prof.		9448528471
27.	Dr. Sharvani, K.A Yuvarajas college, Mysore.	Asst. Prof.		9845885896
28.	Dr. Krishna Yuvarajas college, Mysore.	Asst. Prof.		
29.	Dr. Krishnamurthy Yuvarajas college, Mysore.	Asst. Prof.		
30.	Kalpashree Yuvarajas college, Mysore	Asst. Prof.		8088413446
31.	Dr. Anil Kumar Yuvaraja College, Mysuru	Asst. Prof.		8970945497
32.	Dr. Girijamba Maharani`s Science College for Women, Mysore	Asst. Prof.		9945616792
33.	Dr. Netra Maharani`s Science College for Women, Mysore	Asst. Prof.		9620782198
34.	Dr. Poornima Yuvaraja College, Mysuru	Asst. Prof.		8217642534
35.	Nayana, K. N. Yuvaraja College, Mysuru	Asst. Prof.		9964041544
36.	Dr. Shamala Maharani`s Science College for Women, Mysore	Asst. Prof.		7019453250

Aims of Bachelor's degree programme in Botany

The broad aims of the bachelor's degree programme in Botany are:

1. To provide an environment that ensures the cognitive development of students in a holistic manner. A dialogue about plants and their significance is fostered in this framework, rather than didactic monologues on mere theoretical aspects
2. To provide the latest subject matter, both theoretical as well as practical, such a way to foster their core competency and discovery learning. A botany graduate as envisioned in this framework would be sufficiently competent in the field to undertake further discipline-specific studies, as well as to begin domain-related employment.
3. To mould a responsible citizen who is aware of the most basic domain-independent knowledge, including critical thinking and communication.
4. To enable the graduate to prepare for national as well as international competitive examinations, especially UGC-CSIR NET, and UPSC Civil Services Examination.

Program Learning Outcomes

The students graduating with the Degree B.Sc. Three years and B. Sc. (Honors) Botany should be able to acquire.

Core competency: Students will acquire core competency in the subject Botany, and allied subject areas.

1. The student will be able to identify major groups of plants and compare the characteristics of lower (e.g. algae and fungi) and higher (angiosperms and gymnosperms) plants.
2. Students will be able to use the evidence-based comparative botany approach to explain the evolution of organisms and understand the genetic diversity on the earth. The students will be able to explain various plant processes and functions, metabolism, concepts of gene, genome, and how organism's function is influenced at the cell, tissue, and organ level.
3. Students will be able to understand the adaptation, development, and behavior of different forms of life.
4. The understanding of networked life on earth and tracing the energy pyramids

through nutrient flow is expected from the students.

5. Students will be able to demonstrate the experimental techniques and methods of their area of specialization in Botany.

Analytical ability:

The students will be able to demonstrate the knowledge in understanding research and addressing practical problems.

1. Application of various scientific methods to address different questions by formulating the hypothesis, data collection, and critically analyze the data to decipher the degree to which their scientific work supports their hypothesis.

Critical Thinking and problem-solving ability:

An increased understanding of fundamental concepts and their applications of scientific principles is expected at the end of this course. Students will become critical thinkers and acquire problem-solving capabilities.

Digitally equipped:

Students will acquire digital skills and integrate the fundamental concepts with modern tools. **Ethical and Psychological strengthing:** Students will also strengthen their ethical and moral values and shall be able to deal with psychological weaknesses.

Team Player: Students will learn team workmanship in order to serve efficiently institutions, industry, and society

Independent Learner:

Apart from the subject-specific skills, generic skills, especially in botany, the program outcome would lead to gain knowledge and skills for further higher studies, competitive examinations, and employment. Learning outcomes-based curriculum would ensure equal academic standards across the country and a broader picture of their competencies. The Bachelor's program in Botany and Botany honors may be mono-disciplinary or multidisciplinary with following broad objectives.

1. Critically evaluation of ideas and arguments by collecting relevant information about the plants, to recognize the position of the plant in the broad classification and Phylogenetic level.
2. Identify problems and independently propose solutions using creative approaches, acquired through interdisciplinary experiences, and a depth and breadth of knowledge/expertise in the field of Plant Identification.
3. Accurately interpretation of collected information and use taxonomical information to evaluate and formulate a position of the plant in taxonomy.

4. Students will be able to apply the scientific method to questions in botany by formulating testable hypotheses, collecting data that address these hypotheses, and analyzing those data to assess the degree to which their scientific work supports their hypotheses.
5. Students will be able to present scientific hypotheses and data both orally and in writing in the formats that are used by practicing scientists.
6. Students will be able to access the primary literature, identify relevant works for a particular topic, and evaluate the scientific content of these works.
7. Students will be able to apply fundamental mathematical tools (statistics, calculus) and physical principles (physics, chemistry) to the analysis of relevant biological situations.
8. Students will be able to identify the major groups of organisms with an emphasis on plants and be able to classify them within a phylogenetic framework. Students will be able to compare and contrast the characteristics of plants, algae, and fungi that differentiate them from each other and other forms of life.
9. Students will be able to use the evidence of comparative biology to explain how the theory of evolution offers the only scientific explanation for the unity and diversity of life on earth. They will be able to use specific examples to explicate how descent with modification has shaped plant morphology, physiology, and life history.
10. Students will be able to explain the ecological interconnectedness of life on earth by tracing energy and nutrient flow through the environment. They will be able to relate the physical features of the environment to the structure of populations, communities, and ecosystems
11. Students will be able to demonstrate proficiency in the experimental techniques and methods of analysis appropriate for their area of specialization within biology.

B. Sc. Botany Programme outcomes as per NEP 2020

Name of the Degree Program: B.Sc. **Discipline Core: Botany**

Total Credits for the Program: 176 **Starting year of implementation: 2021-22**

Program Outcomes:

By the end of the program the students will be able to:

(Refer to literature on outcome based education (OBE) for details on Program Outcomes)

PO1: Skill development for the proper description using botanical terms, identification, naming and classification of life forms especially plants and microbes.

PO2: Acquisition of knowledge on structure, life cycle and life processes that exist among plant and microbial diversity through certain model organism studies.

PO3: Understanding of various interactions that exist among plants and microbes; to develop the curiosity on the dynamicity of nature.

PO4: Understanding of the major elements of variation that exist in the living world through comparative morphological and anatomical study.

PO5: Ability to explain the diversity and evolution based on the empirical evidences in morphology, anatomy, embryology, physiology, biochemistry, molecular biology and life history.

PO6: Skill development for the collection, preservation and recording of information after observation and analysis- from simple illustration to molecular database development.

PO7: Making aware of the scientific and technological advancements- Information and Communication, Biotechnology and Molecular Biology for further learning and research in all branches of Botany..

PO8: Internalization of the concept of conservation and evolution through the channel of spirit of inquiry.

PO 9: To enable the graduates to prepare for national as well as international level competitive examinations like UGC-CSIR, UPSC, KPSC etc.

PO10: To enable the students for practicing the best teaching pedagogy as a biology teacher including the latest digital modules.

PO 11: The graduates should be knowledgeable and competent enough to appropriately deliver on aspects of global importance like climate change, SDGs, green technologies etc at the right opportunity.

PO 12: The graduate should be able to demonstrate sufficient proficiency in the hands-on experimental techniques for their area of specialization within biology during research and in the professional career

B. Sc. Botany Programme specific outcomes as per NEP 2020

PSO1: The framework of curriculum for the Bachelor's program in Botany aims to transform the course content and pedagogy to provide a multidisciplinary, student-centric, and outcome-based, holistic education to the next generation of students.

PSO2: Aside from structuring the curriculum to be more in-depth, focused, and comprehensive with significant skill-set for all exit levels; keeping in mind the job prospects; the emphasis has been to maintain academic coherence and continuum throughout the program of study and help build a strong footing in the subject, thereby ensuring a seamless transition into their careers.

PSO3: Special attention is given to eliminate redundancy, discourage rote learning, and espouse a problem-solving, critical thinking, and inquisitive mindset among learners.

The curriculum embraces the philosophy that science is best learned through experiential learning, not limited to the confines of a classroom but rather through hands-on training, projects, field studies, industrial visits, and internships.

PSO4: This updated syllabus, with modern technology, helps students stay informed on the leading- edge developments in plant sciences and promotes curiosity, innovation, and a passion for research, that will serve them well in their journey into scientific adventure and discovery beyond graduation.

PSO5: The goal is to equip students with holistic knowledge, competencies, professional skills, and a strong positive mindset that they can leverage while navigating the current stiff challenges of the job market.

SUGGESTED METHODOLOGY FOR TEACHING, LEARNING AND EVALUATION

TEACHING-LEARNING

The whole programme is an Outcome Based Education. Different methods are to be used for teaching learning evaluation; in order to attain the fixed outcomes.

Theory:

Student*:* Review of Literature, Assignment, Presentation, e-learning, Discussion and Debate with peer group, teachers and experts.

Teacher: Lecture, Demonstration, Presentation, Discussion and Debate.

Practical:

Student: Identification, Comparison, Differentiation and Categorization of different plants and their parts by observing Permanent Slides, Hand sectioning etc., Demonstration, Experimentation, Field visit, Report Writing and Keeping records

Teacher: Demonstration, Experimentation, Field visit, Certification

Project: The finalization of the topic should be done at the beginning of the fourth semester and the list should be kept with the HOD for the perusal of the University Examination authorities. There should be at least three projects from a department. The selection of the topic and group should be student centered as far as possible. A project log book/register is to be maintained by each student and submitted along with the project report during the final submission.

Student: Suggestion of Topic, Discussion with the Project guide and Peer group, Review of Literature, Project planning and Designing, Experimentation, Data Analysis and Project Report Preparation and Presentation.

Teacher: Confirmation of Topic, Demonstration, Planning of Experimentation, Guidance and Correction and Certification.

Experiential Learning (Internships etc.):

Student should choose one of the topics for self-study from the beginning of the seventh semester. A report should be submitted by the end of Eighth Semester.

Suggested topics include: Studies on mangroves / Sacred groves / Campus flora; Cultivation of RET / Fruit / Vegetable / Medicinal plants / Mushroom; Topics related to Social responsibility- River restoration, PBR (People Biodiversity Register) preparation, Herbarium arrangement, VFC (Village Forest Committee), VNRC (Village Natural Resource Committee) formation, Landscaping and Green Auditing.

Field Study / Study Tour:

The plant diversity studies should be carried out with the support of Field Study / Study Tour. During each year there should be a field study of 1-5 days duration, with a minimum of 5 days for the completion of the programme.

EVALUATION

External Evaluation:

External assessment by the University level examinations on specified times announced by the University for all the courses, theory, practical and Project/Viva Voce. Each student should go through the evaluation process according to the University Regulations 2021-2022

End Semester Evaluation-Theory:

The components of external evaluation and their unit wise and each theory and practical course and the time of examination will be in accordance with the calendar prepared by

the University for each academic year. At the end of each semester, there will be an examination for theory courses. The duration of examinations for all theory and practical courses in Botany will be three hours, except for the Generic Elective Course papers.

External –Practical:

Practical Courses have external examination for all semester. There will be an external practical examiner and an internal examiner / skilled assistant for every practical examination of three hour duration. The external evaluation should be carried out by the team of examiners.

EXTERNAL – PROJECT / FIELD STUDY / VIVA VOCE

The Project/Field Study/General Viva Voce will be conducted in I/II/III/IV/V/VI/VII/ VIII Semester Practical Examination.

Viva should be based on:

Project work

Experiential Learning (Internships

etc) Field Study

General Learning Activity of four years:

For the external evaluation the components and weightage of Project/Field Study/ Viva Voce can be discussed and determined finally by the Board of Examiners; the suggested components and their weightage is given below. The project viva should be based on the Project and importance should be given to the Scientific method undertaken in that project. The general viva should be on based the changes in the outlook of the student after the learning activity of the 4 year programme, field study and Experiential Learning (Internships etc.). Time taken for each practical batch should be 3 hrs, by giving nearly 10-15 minutes for each student. The project/field study/viva voce evaluation should be conducted by external examiners and internal examiner.

ELIGIBILITY TO APPEAR FOR PRACTICAL EXAMINATION

1. 80% Attendance (All Sem.)
2. Certified Bona-fide Record (All Sem.)
3. Herbarium and Field Book (Respective Sem.)
4. Field Study Reports (Respective Sem.)
5. Certified Bona-fide Project Report (Eighth Sem.)
6. Report on Experiential Learning (Internships etc.) (Eighth Sem.)

CONTINUOUS INTERNAL EVALUATION

Internal evaluation is a continuous evaluation in all types of courses- theory/ practical / Project / Field study. The teacher has flexibility in deciding the components and their weightage in accordance with the University Regulations, 2021-22. Internal evaluation should be verytransparent to the students and the components and relative weightage should be announced at the beginning of each learning activity by the concerned teacher. Internal evaluation should be published in the notice board, one week before the closure of each semester.

INTERNAL –THEORY

The percentile system can be adopted for calculating the internal component, test paper.

Sl. No.	COMPONENTS	WEIGHTAGE
1	**Attendance**	**10**
	Test Papers	**40**
2	**Assignment**	**20**
	Seminar	**20**
	Viva	**10**

INTERNAL – PRACTICAL

The internal evaluation may be regular internal assessment on hourly basis or unit wise, whichever is communicated with the student.

Sl. No.	COMPONENTS	WEIGHTAGE
1	**Regularity**	**25**
2	**Practical Skill**- (Sectioning, Drawing, Labeling, Record Keeping Etc)	**50**
3	**Regular Viva/Model Examination**	**25**

INTERNAL - PROJECT/FIELD STUDY/VIVA VOCE

Internal evaluation of the project should start with the beginning of the project and can be finalized by the project viva.

Sl. No.	COMPONENTS	WEIGHTAGE
1	**Participation**	**50**
2	**Viva**	**25**
3	**Field Study and other Assignment Reports**	**25**

Curriculum Structure for the Undergraduate Degree

Program B.Sc. BOTANY

Total Credits for the Program: 176 **Starting year of implementation:**

2021-22 Name of the Degree Program: B.Sc. **Discipline/Subject: BOTANY**

Program Articulation Matrix:

This matrix lists only the core courses. Core courses are essential to earn the degree in that discipline/subject. They include courses such as theory, laboratory, project, internships etc. Elective courses may be listed separately.

Semester	Title / Name Of the course	Program outcomes that the course addresses (not more than 3 per course)	Pre-requisite course(s)	Pedagogy	Assessments
1	BOT A1 Microbial Diversity and Technology	PO1	---	Ex. MOOC	Quiz
2	BOT A2 Diversity of Non flowering Plants	PO2, PO3	BOT A1	Desk Work	Debate
3	BOT A3 Plant Anatomy and	PO4, PO5	BOT A1 and A2	Problem solving,	

	Developmental Biology			Book Chapter Seminar, Project based learning, Term paper Assignment, Group Discussion Research Project Instrumentation	Class work Class work Seminar Project writing Articles writing, Interpretation of results
4	BOT A4 Ecology and Conservation Biology	PO4, PO5	BOT A1 A2 A3		
5.	BOT A5 Plant Taxonomy and Resource Botany	PO6, PO7	BOT A1 A2 A3		
	BOT A6 Cell Biology and Genetics	PO6, PO7	BOT A6 A1 A2 A3 A4 A5		
6.	BOT A7 Plant Physiology and Biochemistry	PO6, PO7, PO9	BOT A5		
	BOT A8 Plant Biotechnology	PO8. PO9	BOT A5		
7.	BOT A9 Molecular Biology	PO8, PO9	BOT A6 A8		
	BOT A10 Seed Biology and Seed Technology	PO9, PO10	BOT A5 A8 A9		
	BOT A11 Plant Health Technology	PO9, PO10	BOT A5 A4 A8		

8.	BOT A12 Medicinal Plants and Phytochemistry	PO9, PO10	BOT A4 A5 A7 A8		
	BOT A13 Bioinformatics and Computational Biology	PO9, PO10	BOT A5 A8 A9		
	BOT A14 Research Methodology	PO9, PO10	BOT A13		

- Pedagogy for student engagement is predominantly lectures. However, other pedagogies enhancing better student engagement to be recommended for each course. The list includes active learning/ course projects/ problem or project based learning/ case studies/self-study like seminar, term paper or MOOC

- Every course needs to include assessment for higher order thinking skills (Applying/ Analyzing/ Evaluating/ Creating). However, this column may contain alternate assessment methods that help formative assessment (i.e. assessment for learning).

IIA. Model Program Structures for the Under-Graduate Programs in Universities and Colleges in Karnataka Bachelor of Science (Basic/ Hons.) (Botany as Major)

Sem.	Discipline Core (DSC) (L+T+P)	Discipline Elective (DSE) / Open Elective (OE)	Ability Enhancement Compulsory Courses (AECC), Languages (L+T+P)		Skill Enhancement Courses (SEC)		Total Credits
					Skill based (L+T+P)	Value based (L+T+P)	
I	Discipline A 1(6) **Microbial Diversity and Technology** Discipline B 1(5)	**OE-1 (3)**	**L1-1 (3), L2-1(3) (3+1+0 each)**		SEC-1: Digital Fluency (2) (1+0+2)	Health and Wellness/ Social & Emotional Learning (2) (1+0+2)	24
II	Discipline A 2(5) **Diversity of non flowering plants** Discipline B 2(6)	**OE-2 (3)**	**L1-2(3), L2-2 (3) (3+1+0 each)**	Environmental Studies (2)		Sports/NCC/NSS etc. (2) (1+0+2)	24
Exit option with Certificate (48 credits)							
III	Discipline A 3(6) **Plant Anatomy and Developmental Biology** Discipline B 3(5)	**OE-3 (3)**	**L1-3 (3), L2-3(3) (3+1+0 each)**	Constitution of India (2)	SEC-2: Artificial Intelligence (2)(1+0+2)		24
IV	Discipline A 4(5) **Ecology and conservation biology** Discipline B 4(6)	**OE-4 (3)**	**L1-4 (3), L2-4(3) (3+1+0 each)**		SEC-3: Cyber Security (2) (1+0+2)	Sports/NCC/NSS etc. (2) (1+0+2)	24
Exit option with Diploma (96 credits)							
Choose any one Discipline as Major, the other as the Minor							
V	Discipline A 5(5) **Plant Taxonomy and resource botany** Discipline A 6(5) **Cell biology and Genetics** Discipline B 5(5)	DSE A-1 (3) **Algal and Fungal Biotechnology**			SEC-3: (2) (2+0+2)	Ethics & Self Aware-ness (2) (1+0+2)	20
VI	Discipline A 7(5) **Plant Physiology and biochemistry** Discipline A 8(5) **Plant Biotechnology** Discipline B 6(5)	DSE A-2 (3) **Herbal Technology**			SEC-4: Professional/ Societal Communication (2)		20
Exit option with Bachelor of Science, B. Sc. Basic Degree (136 credits)							
VII	Discipline A-9(5) **Molecular Biology** Discipline A-10(5) **Seed biology and seed Technology** Discipline A-11(4) **Plant Health Technology.**	DSE A-3 (3) **Plant Propagation and Tissue Culture (3)**					20
VIII	Discipline A-12(4) **Medicinal Plants and Phytochemistry** Discipline A-13(4) **Bioinformatics and Computational Biology** Discipline A-14(3) **Research Methodology**	DSE A-4 (3) **Landscaping, Gardening and Green House Technology**					20
Award of Bachelor of Bachelor of Science Honours, B.Sc. (Hons) degree in a discipline etc. (176 credits)							

DISCIPLINE CORE PAPERS (DSC)

Sl. No.	Semester Details	Subject	Paper No
1	Semester I	Microbial Diversity and Technology	**A-1**
2	Semester II	Diversity of Non Flowering Plants	**A-2**
3	Semester III	Plant Anatomy and Development Biology	**A-3**
4	Semester IV	Ecology and Conservation Biology	**A-4**
5	Semester V	Plant taxonomy and Resource Botany	**A-5**
		Genetics and Cell Biology	**A-6**
6	Semester VI	Plant Physiology and Biochemistry	**A-7**
		Plant Biotechnology	**A-8**
7	Semester VII	Molecular Biology	**A-9**
		Seed Biology and Seed Technology	**A-10**
		Plant Health Technology	**A-11**
8	Semester VIII	Medicinal Plants and Phytochemistry	**A-12**
		Bioinformatics and Computational Biology	**A-13**
		Research Methodology	**A-14**

CORESPECIFIC ELECTIVE PAPERS (DSE)

Sl No.	Semester Details	Subject: Botany	Credits	Paper No
1	Semester V	**DSE 1:** Algal and Fungal Biotechnology	03	E-1
2	Semester VI	**DSE 2:** Herbal Technology	03	E-2
3	Semester VII	**DSE 3:** Plant Propagation and Tissue Culture	03	E-3
4	Semester VIII	**DSE 4:** Landscaping, Gardening and Green House Technology	03	E-4

BOTANY COURSE OUTCOMES (COs):

At the end of the course the student should be able to:

(Write 3-7 course outcomes. Course outcomes are statements of observable student actions that serve as evidence of knowledge, skills and values acquired in this course)

Semester I (A-1): Microbial Diversity and Technology

1. Understand the fascinating diversity, evolution, and significance of microorganisms.
2. Comprehend the systematic position, structure, physiology and life cycles ofmicrobes and their impact on humans and environment.
3. Gain laboratory skills such as microscopy, microbial cultures, staining, identification, preservation of microbes for their applications in research and industry.

Semester II (A-2): Diversity of Non- Flowering Plants

1. Understand the diversity and affinities among Algae, Bryophytes, Pteridophytes and Gymnosperms.
2. Understand the morphology, anatomy, reproduction and life cycle across Algae, Bryophytes, Pteridophytes and Gymnosperms, and their ecological and evolutionary significance.
3. Obtain laboratory skills/explore non-flowering plants for their commercial applications.

Semester III (A-3): Plant Anatomy and Developmental Biology

1. Observation of variations that exist in internal structure of various parts of a plant and as well as among different plant groups in support for the evolutionary concept.
2. Skill development for the proper description of internal structure using botanical terms, their identification and further classification.
3. Understanding the basic concepts in plant morphogenesis, embryology and organ development.

Semester IV (A-4): Ecology & Conservation Biology

1. Understanding the fundamental concepts in ecology, environmental science and phyto geography.
2. Concept development in conservation, global ecological crisis, Sustainable development and pros and cons of human intervention.
3. Enable the student to appreciate bio diversity and the importance of various conservation strategies, laws and regulatory authorities and global issues related to climate change and sustainable development.

Semester V (A-5): Plant Taxonomy &Resource Botany

1. Ability to identify, classify and describe the plants in scientific terms. Identification of plants using dichotomous keys.
2. Recognition, processing and utilization of economically important plants.
3. Skill development in processing of biomass and plant products as source of food, healthcare, energy and natural products.

Semester V (A-6): Cell Biology & Genetics

1. Identify the basic principles and current trends in classical genetics and Cell biology.
2. Recognize the historical process of the evolution of molecular genetics from classical genetics.
3. Develop theoretical background on molecular genetics to provide a strong support for the student for future research and employability.

Semester VI (A-7): Plant Physiology & Biochemistry

1. Preliminary understanding of the basic functions and intermediary metabolism in a plant body.
2. Awareness on the interdisciplinary nature of botany, chemistry and physics by studying the principles of plant life, growth and reproduction.
3. Recognizing the wonderful mechanism of transport and the Interrelationships existing between metabolic pathways thereby gaining and idea about the importance of plants in the dynamicity of nature.

Semester VI (A-8): Plant Biotechnology

1. Learning of knowledge & skill in plant tissue culture, plant molecular biology and transgenic.
2. Application of plant biotechnology in plant genomics, phylogenetic studies and metabolic engineering.
3. Understanding of new molecular techniques in cell and metabolic manipulations.

Semester VII (A-9): **Molecular Biology**

1. Understanding the mechanism and concepts of life process at molecular level through central dogma concept.
2. Skill acquiring in the basic molecular biology techniques & characterization of micro- molecules.
3. Acquiring the emerging technology skills in plant genetic engineering & proteomics.

Semester VII (A-10): **Seed Biology & Seed Technology**

1. Understanding the seed structure and related functions, seed health and productivity.
2. Technology for assessing the seed pathology, purity, and preservation.
3. Learning the field and laboratory protocols of seed production, certification and quality.

Semester VII (A-11): Plant Health Technology

1. Understanding & learning common diseases & control measures of plant diseases.
2. Acquiring skills in plant disease diagnosis, control & management through IPM.
3. Learning of new skills in health clinic through biological methods.

Semester VIII (A-13): Medicinal Plants & Phytochemistry

1. Knowledge of Indian system of medicine with regard to medicinal plants.
2. Acquiring skills in identification, cultivation and preservation of medicinal plants.
3. Isolation, identification, characteristics of active principles in medicinal plants & drug formulations.

Semester VIII (A-14): Bioinformatics & Computational Biology

1. Learning of basic principles of application, ICT Technology in biological studies & research.
2. Acquiring skill to utilize the computational apps, active data basis and tools in analysis in genetics & proteomics.
3. Learning skills and software used for biological research & process understanding.

Semester VIII (A-15): Research Methodology

1. Understanding the working of science for further application in free, independent, individual needs and in designing scientific experimentation.
2. Acquire knowledge on the principles, components and applications of various scientific equipment in biology.
3. Foundation knowledge in the basic concepts, components and functions of informatics and the importance of statistical principles in biological research.

Job opportunities in Botany

Exit after ONE Year: Certificate Course

I Sem. - A1: Microbial Diversity and Technology

II Sem. – A2: Diversity and Conservation of Non- Flowering plants

Job opportunities in Botany
• *Preparation of algal, fungal microbial, bryophyte*, pteridophyte, and gymnosperm slides for educational institutions and other line departments (Entrepreneurship). • Providing algal, fungal microbial, bryophyte, pteridophyte, and gymnosperm materials for educational institutions and other line departments (Entrepreneurship). • Developing Nursery (Entrepreneurship). • Nursery supervisor/manager • Mushroom cultivation (Entrepreneurship). • Cyanobaterial, algal and microbial culture (Entrepreneurship). • Fermentation industries. Dairy farming industries. Dairy products industries. Spice Industries (Lichens) • Quarantine dept., Quality control/analyst, packaging, Lab. assistant

Job opportunities in Botany

Exit After **TWO** Year: **Diploma Course**

I Semester-A3: Plant Anatomy and Developmental Biology

IV Semester-A4: Ecology and Conservation Biology

Job opportunities in Botany
In Addition to one year certificate • Preparation of Anatomy embryology and Ecological slides for educational institutions and other line departments (Entrepreneurship). • Providing Anatomy embryology and Ecological materials for educational institutions and other line departments (Entrepreneurship). • Lab technician • Garden / nursery supervisor • Developing his/her own nursery (Entrepreneurship). • Forest guard, Wild life watch guard. • Forest nursery (Entrepreneurship).

Job opportunities in Botany

Exit After **THREE** Year: **Degree Course**

V Semester-A5: Plant Taxonomy and Resource Botany

V Semester-A6: Genetics and Cell Biology

VISemester-A7: Plant Physiology and Biochemistry

VI Semester-A8: Plant Biotechnology

Job opportunities in Botany
In Addition to two year diploma • Supplying the angiosperm plants and cytological slides to the educational institutions and other line departments (Entrepreneurship). • Advisor for Health department • Marketing NTFPs species (Entrepreneurship). • RFO/ forest officers • Biochemical Laboratory (Soil, Water, Air testing etc). (Entrepreneurship). • Adviser to grow advanced crop (Biotech crop). • Farmer friendly liaison officer. • Advisor for crop improvement programme.

Job opportunities in Botany

Exit After FOUR Year: Degree Course (Honors)

VII Semester-A9: Molecular Biology

VII Semester-A10: Seed Biology and Seed Technology

VII Semester-A11: Plant Health Technology

VIII Semester-A12: Medicinal Plants and Phytochemistry

VIII Semester-A13: Bioinformatics & Computational Biology

VIII Semester-A14: Research Methodology

Jobs opportunities in Botany
In Addition to three year degree
• Assisting for Ayurvedic doctors. • Medicinal plants Marketing (Entrepreneurship). • R & D Botany, Biotechnology, Ayurvedic and Pharmaceutical Lab. • Laboratory on checking food adulteration (Entrepreneurship). • Soil and water assessment laboratory (Entrepreneurship). • Biological material analysis Laboratory (Entrepreneurship). • Teacher in primary and High Schools. • Prepare for joining Research institution for Ph.D. programmes. • Wild life photographer • Separation and Analyzing phytochemical compounds. • Seed technician. • Plant health manager

SUGGESTED DISCIPLINE SPECIFIC ELECTIVE PAPERS (DSE): UG - BOTANY

Srl No	Subject
1.	Aquatic Botany
2.	Bio-analytical techniques.
3.	Stress Biology
4.	Introduction to plant breeding
5.	Biostatistics
6.	Biofuels & Technology
7.	Horticulture post-harvest practices
8.	Reproductive biology of Angiosperms.
9.	Agroforestry
10.	Food Science
11.	Plant Microbe interaction
12.	IPR
13.	Good laboratory practices
14.	Forensic Botany
15.	Botanical garden, landscaping & Greenhouse technology
16.	Herbal Technology
17.	Plant tissue culture
18.	Genetic Engineering in plants and biosafety
19.	Fermentation Technology
20.	Palynology
21.	Organic Farming
22.	Plant Genomics and proteomics
23	Mushroom Cultivation
24	Global Climate Change
25	Dendrology and Arboriculture

I B.Sc., I- Semester DSC-1

Microbial Diversity and Technology

Number of Theory Credits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours / semester
4	56	2	56

Content of Theory Course 1	56 Hrs
Unit –1	15
Chapter No. 1: Microbial diversity-Introduction to microbial diversity; Methods of estimation; Hierarchical organization and positions of microbes in the living world. Whittaker's five-kingdom system and Carl Richard Woese's three-domain system. Distribution of microbes in soil, air, food and water. Significance of microbial diversity in nature	5
Chapter No. 2 History and developments of microbiology-Microbiologists and their contributions **(**Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Dmitri Iwanowski, Sergius Winogradsky and M W Beijerinck and Paul Ehrlich**)**	5
Chapter No. 3 Microscopy-Working principle and applications of light, dark field, phase contrast and electron microscopes (SEM and TEM). Microbiological stains (acidic, basic and special) and Principles of staining. Simple, Gram's and differential staining.	5

Unit – 2	15
Chapter No. 4. Culture media for Microbes-Natural and synthetic media, Routine media -basal media, enriched media, selective media, indicator media, transport media, and storage media.	5
Chapter No. 5. Sterilization methods -Principle of disinfection, antiseptic, tyndallisation and Pasteurization, **Sterilization-**Sterilization by dry heat, moist heat, UV light, ionization radiation, filtration. Chemical methods of sterilization-phenolic compounds, anionic and cationic detergents.	5
Chapter No. 6. Microbial Growth-Microbial growth and measurement. Nutritional types of Microbes- autotrophs and heterotrophs, phototrophs and chemotrophs; lithotrophs and organotrophs.	5
Unit – 3	11
Chapter No. 7 Microbial cultures and preservation-Microbial cultures. Pure culture and axenic cultures, subculturing, Preservation methods-overlaying cultures with mineral oils, lyophilisation. Microbial culture collections and their importance. A brief account on ITCC, MTCC and ATCC.	5
Chapter No. 8. Viruses- General structure and classification of Viruses; ICTV system of classification. Structure and multiplication of TMV, SARS-COV-2, and Bacteriophage (T2). Cultivation of viruses. Vaccines and types.	4
Chapter No. 9. Viroids- general characteristics and structure of Potato Spindle Tuber Viroid (PSTVd); Prions - general characters and Prion diseases**.** Economic importance of viruses.	2

Unit – 4	15
Chapter No. 10. Bacteria- General characteristics and classification. Archaebacteria and Eubacteria. Ultrastructure of Bacteria; Bacterial growth and nutrition. Reproduction in bacteria- asexual and sexual methods. Study of *Rhizobium* and its applications. A brief account of Actinomycetes and Cyanobacteria. Mycoplasmas and Phytoplasmas- Generalcharacteristics and diseases. Economic importance of Bacteria.	5
Chapter No. 11. Fungi-General characteristics and classification. Thallus organization and nutrition in fungi. Reproduction in fungi (asexual and sexual). Heterothallism and parasexuality. Type study of *Phytophthora, Rhizopus, Neurospora, Puccinia, Penicillium and Trichoderma***.** Economic importance of Fungi.	6
Chapter No. 12. Lichens – Structure and reproduction. **VAM Fungi** and their significance. **Plant diseases**-Late Blight of Potato, Black stem rust of wheat; Downy Mildew of Bajra, Grain smut of Sorghum, Sandal Spike, Citrus Canker, Root Knot Disease of Mulberry.	4

Text Books

1. Ananthnarayan R and Panikar JCK. 1986. Text book of Microbiology. Orient Longman ltd. New Delhi.
2. Arora DR. 2004. Textbook of Microbiology, CBS, NewDelhi.
3. William CG.1989. Understanding microbes. A laboratory text book for Microbiology. W.H. Freeman and Company. New York.
4. Dubey RC and Maheshwari DK. 2007. A textbook of Microbiology, S. Chand and Company, NewDelhi.
5. Dubey RC and Maheshwari DK. 2002. A Text book of Microbiology, S.C.Chand and Company, Ltd. Ramnagar, New Delhi.
6. Sharma R. 2006. Text book of Microbiology. Mittal Publications. New Delhi. 305pp.
7. Sharma PD. 1999. Microbiology and Plant Pathology. Rastogi publications. Meerut, India.
8. Vasanthkumari R. 2007. A textbook of Microbiology, BI Publications Pvt. Ltd., New Delhi.

References

1. Alexepoulos CJ and Mims CW. 1989. Introductory Mycology, Wiley Eastern Ltd., NewDelhi.
2. Allas RM. 1988. Microbiology: Fundamentals and Applications, Macmillan publishing co. New York.
3. Brook TD, Smith DW and Madigan MT. 1984. Biology of Microorganisms, 4th ed. Eaglewood Cliffts. N.J.Prentice- Hall. New Delhi.
4. Burnell JH and Trinci APJ. 1979. Fungal walls and hyphal growth, Cambridge UniversityPress. Cambridge.
5. Jayaraman J. 1985. Laboratory Manual of Biochemistry, Wiley Eastern Limited. New Delhi.
6. Ketchum PA. 1988. Microbiology, concepts and applications. John Wiley and Sons. New York.
7. Michel J, Pelczar Jr.EC and Krieg CR. 2005. Microbiology, Mc.Graw-Hill, NewDelhi.
8. Powar CB and Daginawala. 1991. General Microbiology, Vol – I and Vol – II Himalaya publishing house,Bombay.
9. Reddy S and Ram. 2007. Microbial Physiology. Scientific Publishers, Jodhpur, 385pp.
10. Sullia SB and Shantharam S. 1998. General Microbiology. Oxford and IBH publishing Co.Pvt.Ltd. New Delhi.
11. Schlegel HG. 1986. General Microbiology. Cambridge. University Press. London, 587pp.
12. Roger S, Ingrahan Y, Wheelis JL, Mark L and Page PR. 1990. Microbial World 5th edition. Prentice-Hall India, Pvt. Ltd. New Delhi.
13. Sullia SB. and Shantharam S. 2005. General Microbiology, Oxford and IBH, NewDelhi.

I B.Sc., I- Semester DSC-1

MICROBIAL DIVERSITY AND TECHNOLOGY

PRACTICALS **Lectures: 56 Hours**

(4 Hours/week)

Practical 1: Safety measures in microbiology laboratory and study of equipment/appliances used for microbiological studies (Microscopes, Hot air oven, Autoclave/Pressure Cooker, Inoculation needles/loop, Petri plates, Incubator, LAF, Colony counter, Haemo cytometer, Micrometer etc.).

Practical 2: Enumeration of soil/food /seed microorganisms by serial dilution technique.

Practical 3: Preparation of culture media (NA/PDA) sterilization, inoculation, incubation of *E coli / B. subtilis/* Fungi and study of cultural characteristics.

Practical 4: Determination of cell count by using Haemocytometer and determination of microbial cell dimension by using Micrometer.

Practical 5: Simple staining of bacteria (Crystal violet /Nigrosine blue) / Gram's staining of bacteria.

Practical 6: Isolation and study of morphology of *Rhizobium* from root nodules of legumes

Practical 7: Preparation of spawn and cultivation of paddy straw (Oyster) mushroom.

Practical 8: Study of vegetative structures and reproductive structures - *Albugo, Phytophthora, Rhizopus, Saccharomyces, Puccinia, Agaricus, Lycoperdon, Penicillium,(Depending on local availability)*

Practical 9: Preparation of agar slants, inoculation, incubation, pure culturing and preservation of microbes by oil overlaying.

Practical 10: Study of late blight of Potato, Downy mildew of Bajra, Citrus canker, Tobacco mosaic disease, Sandal spike disease.

Practical 11: Study of well-known microbiologists and their contributions through charts and photographs (As mentioned in theory).

Practical-12: Visit to water purification units/Composting/ microbiology labs/dairy and farms to understand role of microbes in day today life.

(**Note:** Botanical study tour to a floristic rich area for 1-2 days and submission of study report is compulsory)

SCHEME OF BOTANY THEORY EXAMINATION
I SEMESTER
MICROBIAL DIVERSITY AND TECHNOLOGY

Time: 2.5 Hours **Max Marks-** 60

Instructions: Draw neat labelled diagrams wherever necessary

I. Define/Explain any Four of the following: 2X4=8 Marks

1.
2.
3.
4.
5.
6.

II. Answer any Four of the following: 5X4=20 Marks

7.
8.
9.
10.
11.
12.

III. Answer any Four of the following: 8X4=32 Marks

13.
14.
15.
16.
17.
18.

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BLUE PRINT OF BOTANY THEORY EXAMINATION

I SEMESTER-BLUE PRINT

MICROBIAL DIVERSITY AND TECHNOLOGY

Time: 2.5 Hours **Max Marks- 60**

Weightage of Marks				
Units	**2 marks**	**5 marks**	**8 marks**	**Total Mks.**
I	2X2=4	5X2=10	8X1=08	22
II	2X1=2	5X1=05	8X2=16	23
III	2X2=4	5X1=05	8X1=08	17
IV	2X1=2	5X2=10	8X2=16	28
	12 Marks	**30Marks**	**48 Marks**	**90 Marks**

I SEMESTER: PAPER A-1

SCHEME OF PRACTICAL QUESTION PAPER

MICROBIAL DIVERSITY AND TECHNOLOGY

Time: 3 Hours **Max Marks**- 25

I. Write critical notes on A, B & C **3X2=6 Marks**

A and B- Microbial Instruments (As mentioned in the syllabus)
C- Microbiologists (As mentioned in the Syllabus)
(Identification- 1 mark, Application/Contribution- 1Mark)

II. Bacterial staining D -Simple / Gram's staining **5 Marks**

(Preparation- 3 Marks Flow chart- 2 Marks)

III. Prepare a temporary stained slide E of the given material and leave the preparation for evaluation. **5 Marks**

(Rhizobium, Rhizopus, Saccharomyces, Penicillium)
(Identification- 1 Mark, Mounting- 2 Marks, Diagram with reasons- 2 Marks)

IV. Identify the Specimens F & G **2X3=6 Marks**

(F- Albugo, Phytophthora, Agaricus, Lycoperdon)
(G - Plant Diseases (As Mentioned in the Syllabus)
(Identification with Diagram - 2 Marks, Reason – 1Mark

V. Identify the Permanent Slide J **3 Marks**

(Fungi/Pathology)
(Identification & Diagram- 2 Marks, reasons- 1 Marks)

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I SEMESTER: PAPER A-1

PRACTICAL QUESTION PAPER

MICROBIAL DIVERSITY AND TECHNOLOGY

Time: 3 Hours **Max Marks**- 25

I.	Write critical notes on **A, B** & **C**	**6 Marks**
II.	Bacterial staining **D -**Simple / Gram's staining	**5 Marks**
III.	Prepare a temporary stained slide **E** of the given material and leave the preparation for evaluation.	**5 Marks**
IV.	Identify the Specimens **F & G**	**2X3=6 Marks**
V.	Identify the Permanent Slide **J**	**3 Marks**

NOTE: Duly valued, Certified practical record & Submissions/ Assignments/ Tour or field visit reports are compulsorily to be submitted by the student.

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B.Sc. BOTANY: Open Elective Course (OE-1.1)

Semester I

OE-1.1: PLANTS AND HUMAN WELFARE

Course Outcome:

On completion of this course, the students will be able to

1. To make the students familiar with economic importance of diverse plants that offer resources to human life.
2. To make the students known about the plants used as-food, medicinal value and also plant source of different economic value.
3. To generate interest amongst the students on plants importance in day today life, conservation, ecosystem and sustainability.

Number of Theory Credits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours / semester
3	39	0	00

Content of Theory Course OE-1.1: PLANTS AND HUMAN WELFARE	39 Hrs
Unit I	13
Origin of Cultivated Plants. Concept of Centres of Origin, their importance with reference to Vavilov's work. Examples of major plant introductions. Crop domestication and loss of genetic diversity (Only conventional plant breeding methods). Importance of plant bio- diversity and conservation. **Cereals**: Wheat and Rice (origin, evolution, morphology, post-harvest processing & uses).Green revolution. Brief account of millets and their nutritional importance. **Legumes:** General account (including chief pulses grown in Karnataka- red gram, green gram, chick pea, soybean). Importance to man and ecosystem.	
Unit II	13
Cash crops: Morphology, new varieties and processing of sugarcane, products and by-products of sugarcane industry. Natural Rubber –cultivation, tapping and processing. **Spices:** Listing of important spices, their family and parts used, economic importance with special reference to Karnataka. Study of fennel, clove, black pepper and cardamom. **Fruits:** Mango, grapes and Citrus (Origin, morphology, cultivation ,processing and uses) **Beverages:** Tea, Coffee (morphology, processing&uses)	.
Unit III	13
Oils and fats: General description, classification, extraction, their uses and health implications; groundnut, coconut, sunflower and mustered (Botanical name, family & uses). Non edible oil yielding trees and importance as biofuel. Neem oil and applications.	

Essential Oils: General account. Extraction methods of sandal wood oil, rosa oil and eucalyptus oil. Economic importance as medicine, perfumes and insect repellents. **Drug-yielding plants:** Therapeutic and habit-forming drugs with special reference to Cinchona, Digitalis, Aloe vera and Cannabis. **Fibers:** Classification based on the origin of fibers; Cotton and jute (origin morphology, processing and uses).	

Text Books and References

1. Kochhar, S.L. (2012). Economic Botany in Tropics. MacMillan & Co. New Delhi.
2. Wickens, G.E. (2001). Economic Botany: Principles & Practices. The Netherlands: Kluwer Academic Publishers. Netherland.
3. Chrispeels, M.J. and Sadava, D.E. (1994) Plants, Genes and Agriculture. Jones & Bartlett - Publishers. Lincoln, United Kingdom

Pedagogy:

Lectures, Practicals, Field and laboratory visits, Participatory Learning, Seminars, Assignments, specimen submission etc

B.Sc. BOTANY: Open Elective Course (OE-1.2)

Semester I
OE 1.2: BOTANY FOR THE BEGINNERS

Course Outcome:

On completion of this course, the students will be able to

1. To make the students familiar with importance of Botany: plants as natural resources.
2. To make the students known about the plants used as-food, medicinal value and economic value for sustainable development.
3. To generate interest amongst the students to know the importance of plants in day today life, ecosystem restoration.

Number of Theory Credits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours / semester
3	39	0	00

Content of Theory OE 1.2: BOTANY FOR THE BEGINNERS	39 hrs
UNIT I: Living World	**13 hrs**.
Origin of Cultivated Plants. Concept of Centres of Origin, their importance with reference to Vavilov's work. Examples of major plant introductions. Crop domestication and loss of genetic diversity (Only conventional plant breeding methods). Importance of plant bio- diversity and conservation. Concept of Living and Non Living: Viruses, Bacteria, Fungi, Plants and Animals; Five kingdom Classification- Classification of plants- Eichler's system – general characters of groups- An introduction to the Life cycle of plants. Cell Structure-Prokaryote and eukaryote	
UNIT II: Morphology of Angiosperms, Origin and Evolution of Life	**13 hrs**
Typical angiosperm plant: Functions of each organ viz. Root, Stem, leaves, inflorescence, flowers, fruit and seed. Flower: Basic structure - essential and non essential whorls. Definition, Ancient Concepts and Modern Concepts. Origin of Life – Geological Time scale – Variation in Hydrosphere, Lithosphere, Atmosphere and Biosphere from Pre Cambrian to Coenozoic era. Darwin's Natural Selection theory and Modern evidences at molecular and organismic level in support of Darwin's theroy	
UNIT III: Interaction between plants and animals	**13 hrs**
General concept on Interaction between plants, microbes and animals. Ecological Significance of Plants – Solar energy fixing Producers, Nitrogen fixation, biofertilisers, biopesticides, Symbiotic relationships-Mutualism, Commensalism, Protoco-operation, Parasitism.	

Plants and Animals for pollination and seed/fruit dispersal- Pollination- Entomophily, Chiropterophily, Myrmecophily Seed Dispersal: Zoochory, Specific case studies on examples for co evolution- Dodo and Calvaria, Butterflies and plants; Wasps and Ficus, mimicking for pollinators. Medicinal uses of plants – traditional knowledge and scientific knowledge – a brief account	

Text Books and References

1. Agarwal, S. K. (2009), Foundation Course in Biology, Ane Books Pvt. Ltd., New Delhi.
2. Datta, A C Class Book of Botany. New Delhi.
3. Mamatha Rao, Microbes and Non flowering plants-impacts and applications, Ane Books, Pvt Ltd, New Delhi.
4. Pandey, B. P. 2001.College Botany, Vol. I: Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. S. Chand & Company Ltd, New Delhi.
5. Prithipal Singh (2007), An introduction to Biodiversity. Ane Books India, New Delhi
6. Raven, P.H; Johnson, G.B; Losos, J.B; Singer, S.R (2005), Biology, seventh edition, Tata McGraw Hill, New Delhi
7. Robert A Wallace. Biology: The world of life. Harper Collins Publishers

Pedagogy:

Lectures, Practicals, Field and laboratory visits, Participatory Learning, Seminars, Assignments, specimen submission etc

B.Sc. BOTANY: Open Elective Course (OE-1.3)

Semester I

OE 1.3: MUSHROOM CULTIVATION

Course Outcome:

On completion of this course, the students will be able to

1. To make the students familiar with mushroom cultivation for commercial exploitation.
2. To make the students known about the *Agaricus* (mushroom) used as-food, medicine and economic value for sustainable development.
3. To generate interest amongst the students to know the importance of mushroom in day today life.

Number of Theory Credits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours / semester
3	39	0	00

Content of Theory Course OE 1.3: MUSHROOM CULTIVATION	39 hrs
UNIT-I . Mycology and Mushroom Biology	**13 hrs**.
Five kingdom classification of organisms. Kingdom fungi. General characters of form, function, reproduction and relationship with other organisms. Importance of fungi in human welfare. Morphology (range of form, macro-morphology, micro-morphology), life cycle of a typical mushroom and biological function. Edible, non-edible and poisonous species. Domestication of mushroom. Importance of mushroom in human nutrition, sustainable livelihood, ecosystem function and quality of the environment.	
UNIT II. Applied Mushroom Biology	**13 hrs**
Mushroom cultivation and production. Lab scale, pilot plant and large scale cultivation of commercial species. Crop cycle- spawn, substrate, substrate processing, spawning, spawn run, cropping, harvesting, environment requirement, post harvest practices, shelf life, preservation, storage, transport and marketing. Value-added products of mushroom. Constraints and environment management. Economics of mushroom cultivation. Designs of mushroom facility. Economics of mushroom cultivation and marketing.	
UNIT IV. Mushroom Biotechnology.	**13 hrs**
Concept. Preparation of flavours, appetizers, neutraceuticals, dietary supplements and cosmetics. Mushroom bioremediation. Cleaning of polluted sites. Utilization of mushroom mycelium or enzymes in recycling biological materials. Mycofiltration and applications of the process. Mycorrhiza applications. Biopulping, biobleaching and biotransformations. Biodetergents.	

References.

1. Harandar Singh 1991. Mushrooms: the art of Cultivation. Sterling Publishers.
2. Kaul, T.N.2001. Biology and conservation of Mushrooms. Oxford and IBH Publishing Company. New Delhi.
3.Tripathi, M. Mushroom Cultivation. Oxford and IBH Publishing Company. New Delhi.
4. Suman B.C. and Sharma V P.2007. Mushroom Cultivation in India. Eastern Book Corporation. New Delhi.
5. Singh R. and U.C.Singh 2005. Modern Mushroom Cultivation. Agrobios. New Delhi.

Pedagogy:

Lectures, Practicals, Field and laboratory visits, Participatory Learning, Seminars, Assignments, specimen submission etc

OPEN ELECTIVE
SCHEME OF BOTANY THEORY EXAMINATION I SEMESTER
MODEL QUESTION PAPER

Time: 2.5 Hours **Max Marks**- 60

Instructions: Draw neat labelled diagrams wherever necessary

I. Define/Explain any Four of the following 2X4=8 Marks

1.
2.
3.
4.
5.
6.

II. Answer any Four of the following 5X4=20 Marks

7.
8.
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11.
12.

III. Answer any Four of the following 8X4=32 Marks

13.
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18.

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OPEN ELECTIVE
BLUE PRINT OF BOTANY THEORY EXAMINATION I SEMESTER

Time: 2.5 Hours **Max Marks- 60**

Weightage of Marks				
Units	**2 marks**	**5 marks**	**8 marks**	**Total Mks.**
I	**2X2=4**	**5X2=10**	**8X2=16**	**30**
II	**2X2=4**	**5X2=10**	**8X2=16**	**30**
III	**2X2=4**	**5X2=10**	**8X2=16**	**30**
	12 Marks	**30Marks**	**48 Marks**	**90 Marks**

I B.Sc., II- Semester DSC-2

Diversity of Non- Flowering Plants

Number of Theory Credits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours/semester
4	56	2	56

Content of Theory Course 2	56Hrs
Unit –1	15
Chapter No. 1 Algae –Introduction and historical development in algology. General characteristics and classification of algae, Diversity- habitat, thallus organization, pigments, reserve food, flagella types, life-cycle and alternation of generation in Algae. Distribution of Algae.	5
Chapter No. 2 Morphology and reproduction and life-cycles of Nostoc, *Oedogonium, Chara, Sargassum and Batrachospermum*. Diatoms and their importance. Blue-green algae-A general account. Algal blooms and toxins.	5
Chapter No. 3 Algal cultivation- Cultivation of microalgae-*Spirulina* and *Dunaliella;* Algal cultivation methods in India. Algal products- Food and Nutraceuticals, Feed stocks, food colorants; fertilizers, aquaculture feed; therapeutics and cosmetics; medicines; dietary fibres from algae and uses.	5

Unit – 2	15
Chapter No. 4. Bryophytes – General characteristics and classification of Bryophytes, Diversity-habitat, thallus structure, Gametophytes and sporophytes.	5
Chapter No. 5 Distribution, morphology, anatomy, reproduction and life-cycles of *Riccia, Anthoceros*, and *Funaria.* Ecological and economic importance of Bryophytes. Fossil Bryophytes.	5
Chapter No. 6. . Pteridophytes- General characteristics and classification; Structure of sporophytes and life-cycles. Distribution, morphology, anatomy, reproduction and life-cycles in *Selaginella*, *Equisetum*, *Pteris* and *Salvinia*.	5
Unit – 3	15
Chapter No. 7 A brief account of heterospory and seed habit. Stelar evolution in Pteridophytes. Affinities and evolutionary significance of Pteridophytes. Ecological and economic importance.	5
Chapter No. 8. Gymnosperms- General characteristics. Distribution and classification of Gymnosperms. Study of the habitat, distribution, habit, anatomy, reproduction and life-cycles in Cycas, Pinus and Gnetum.	5
Chapter No. 9. Affinities and evolutionary significance of Gymnosperms. Economic importance of Gymnosperms - food, timber, industrial uses and medicines.	5

Unit – 4	11
Chapter No. 10. Origin and evolution of Plants: Origin and evolution of plants through Geological Time scale.	2
Chapter No. 11. Paleobotany- Paleobotanical records, plant fossils, Preservation of plant fossils - impressions, compressions, petrification's, moulds and casts, pith casts. Radiocarbon dating.	5
Chapter No. 12. Fossil taxa- *Rhynia, Lepidodendron, Lepidocarpon,Lyginopteris and Cycadeoidea*. Exploration of fossil fuels. Birbal Sahni Institute of Paleosciences.	4

Text Books

1) Chopra, G.L. A text book of Algae. Rastogi & Co., Meerut, Co., New Delhi, Depot.Allahabad.
2) Johri, Lata anf Tyagi, 2012, A Text Book of, Vedam e Books, New Delhi.
3) Sharma, O.P. 1990. Text Book of Pteridophyta. McMillan India Ltd. New Delhi.
4) Sharma, O.P. 1992. Text Book of Thallophytes. McGraw Hill Publishing Co. New Delhi.
5) Sharma, O.P., 2017, Algae Singh-Pande-Jain 2004-05. A Text Book of Botany.Rastogi Publication, Meerut.

References

1. Sambamurty, A.V.S.S.. A Text Book of Algae. I.K. International Private Ltd., New Delhi.
2. Agashe, S.N. 1995. Paleobotany. Plants of the past, their evolution, paleoenvironment and Allied plants. Hutchinson & Co., Ltd., London.
3. Anderson R.A. 2005, Algal cultural Techniques, Elsievier, London.
4. Publication, Application in exploration of fossil fuels. Oxford & IBH., New Delhi.

5. Eams, A.J., (1974) Morphology of vascular plants - Lower groups. Tata Mc Grew- Hill Publishing Co. New Delhi, Freeman & Co., New York.
6. Fritze, R.E. 1977. Structure and reproduction of Algae. Cambridge University Press.
7. Goffinet B and Shaw A.J. 2009, Bryophyte Biology, 2nd ed. Cambridge Unversity Press, Cambridge.Gymnosperms.
8. Srivastava, H N, 2003. Algae Pradeep Publication, Jalandhar, India.
9. Kakkar, R.K. and B.R.Kakkar (1995) The Gymnosperms (Fossils and Living) Central Publishing House, Allahabad.
10. Kumar H. D., 1999, Introductory Phycology, Affiliated East-West Press, Delhi.
11. Lee, R.E., 2008, Phycology, Cambridge Unversity Press, Cambridge. 4th edition.McGraw Hill Publishing Co., New Delhi.
12. Parihar, N.S. 1970. An Introduction to Embryophyta. Vol. I. Bryophyta. Central Book, Allhabad.
13. Parihar, N.S. (1976) An Introduction to Pteridophytes, Central Book Depot, Allhabad.
14. Parihar, N.S. 1977. The Morphology of Pteridophytes. Central Book Depot., Allahabad.Press, Cambridge.
15. Rashid, A. 1998. An Introduction to Pteridophyta. II ed., Vikas Publishing House, New Delhi.
16. Smith, G.M. 1971. Cryptogamic Botany. Vol. II. Bryophytes & Pteridophytes. Tata Tata McGraw Hill Publishing, New Delhi.
17. Smith, G.M. 1971. Cryptogamic Botny. Vol.I Algae & Fungi. Tata McGraw Hill Publishing. New Delhi.
18. Sporne, K.R. 1965. The Morphology of Gymnosperms. Hutchinson & Co., Ltd., London.
19. Stewart, W.M. 1983. Paleobotany and the Evolution of Plants, Cambridge University Cambridge.
20. Sundarajan, S. 1997. College Botany Vol. I. S Chand & Co. Ltd., New Delhi.
21. Vanderpoorten, A. and Goffinet, B. 2009, Introduction to Bryophytes, Cambridge Unversity Press, Cambridge.
22. Vashista, B.R. 1978. Bryophytes. S Chand & Co. Ltd., New Delhi.

I B.Sc., II- Semester DSC-2

Diversity of Non- Flowering Plants

PRACTICALS **Lectures: 56 Hours**

(4 Hours/week)

Practical-1: Study of morphology, classification, reproduction and lifecycle of

Nostoc.

Practical-2: Study of morphology, classification, reproduction and life-cycle of

*Oedogonium & Chara,*Sargassum, *Batrachospermum/ Polysiphonia*.

Practical-3: Study of morphology, classification, reproduction and life-cycle of

Riccia/Marchantia &Anthoceros.

Practical-4: Study of morphology, classification, anatomy, reproduction and life-cycle of

Selaginella and Equisetum.

Practical -5: Study of morphology, classification, anatomy, reproduction and life-cycle of

Pteris, Azolla..

Practical -6: Study of morphology, classification, anatomy and reproduction

in *Cycas*.

Practical -7: Study of morphology, classification & anatomy, reproduction in

Pinus.

Practical -8: Study of morphology, classification & anatomy, reproduction in

Gnetum.

Practical -9: Study of imporratnt blue green algae causing water blooms in

the lakes.

Practical -10: Study of different methods of cultivation of ferns in a nursery.

Practical -11: Preparation of natural media and cultivation of *Azolla* in artificial ponds.

Practical -12: Media preparation and cultivation of *Spirulina*.

Practical -13: Study different algal products and fossils impressions and slides/Photographs.

Practical-14: Visit to algal cultivation units/lakes with algal blooms/Fern house/ Nurseries/Geology museum/lab to study plant fossils.

(Note: Botanical study tour to a floristic rich area for 1-2 days and submission of study report is compulsory)

SCHEME OF BOTANY THEORY EXAMINATION
II SEMESTER
MODEL QUESTION PAPER
DIVERSITY OF NON FLOWERING PLANTS

Time: 2.5 Hours **Max Marks-** 60

Instructions: Draw neat labelled diagrams wherever necessary

I. Define/Explain any Four of the following: 2X4=8 Marks

1.
2.
3.
4.
5.
6.

II. Answer any Four of the following: 5X4=20 Marks

7.
8.
9.
10.
11.
12.

III. Answer any Four of the following: 8X4=32 Marks

13.
14.
15.
16.
17.
18.

***

BLUE PRINT OF BOTANY THEORY EXAMINATION II SEMESTER

DIVERSITY OF NON FLOWERING PLANTS

Time: 2.5 Hours **Max Marks-** 60

Weightage of Marks				
Units	**2 marks**	**5 marks**	**8 marks**	**Total Mks.**
I	2X2=4	5X2=10	8X1=08	22
II	2X1=2	5X2=10	8X2=16	28
III	2X1=2	5X1=05	8X2=16	23
IV	2X2=4	5X1=05	8X1=08	17
	12 Marks	**30Marks**	**48 Marks**	**90 Marks**

II SEMESTER

SCHEME OF PRACTICAL QUESTION PAPER

DIVERSITY OF NON- FLOWERING PLANTS

Time: 3 Hours **Max Marks**- 25

I. Prepare a temporary stained slide of the given material A and leave the preparation for evaluation `5 Marks

Algae (Nostoc, Oedogonium, Chara, Batrachospermum / Polysiphonia)

(Preparation - 2 Mark, Diagram-1 Marks, Identification with Reasons- 2 Marks)

II. Identify the given specimens B & C 2X3=6 Marks

B- Bryophytes (Marchantia and Anthoceros)
C- Pteridophytes (Selaginella, Equisetum, Pteris , Azolla,)

(Identification- 1 Mark, Diagram with reasons- 2 Marks)

III. Identify the Permanent Slides D, E, F & G 4X2=8 Marks

(One each from Algae, Bryophyte, Pteridophyte and Gymnosperms)

(Identification- 1 Mark, Diagram with Reasons-1 Marks)

IV. Comment on H & I 2X3=6 Marks

H- Gymnosperm
I – Fossils

(Identification- 1 Mark, Diagram with Reasons- 2 Marks)

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II SEMESTER

PRACTICAL QUESTION PAPER

DIVERSITY OF NON- FLOWERING PLANTS

Time: 3 Hours **Max Marks**- 25

I. Prepare a temporary stained slide of the given material **A** and leave the preparation for evaluation

5 Marks

II. Identify the given specimens **B &C** **2X3=6 Marks**

III. Identify the Permanent Slides **D, E, F & G** **4X2=8 Marks**

IV. Comment on **H & I** **2X3=6 Marks**

NOTE: Duly valued, Certified practical record & Submissions/ Assignments/ Tour or field visit reports are compulsorily to be submitted by the student.

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Open Elective Course (OE-2.1)
I B.Sc., Semester II

PLANT PROPAGATION, NURSERY MANAGEMENT AND GARDENING

Paper Outcome:

On completion of this course, the students will be able to

1. To gain knowledge of gardening, cultivation, multiplication, raising of seedlings of garden plants.
2. To get knowledge of new and modern techniques of plant propagation.
3. To develop interest in nature and plant life.

Number of Theory Credits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours / semester
3	39	0	00

Unit I :Nursery and Vegetative propagation	13
Definition, objectives and scope and general practices and building up of infrastructure for nursery, planning and seasonal activities. Planting - direct seeding and transplants, Soil free/soilless/ synthetic growth mediums for pots and nursery. Air-layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium and planting of cuttings. Hardening of plants .Green house, mist chamber, shed root, shade house and glass house.	
Unit II :Gardening	13
Definition, objectives and scope. Different types of gardening - landscape and home/terrace gardening, parks and its components. Plant materials and design. Computer applications in landscaping, Gardening operations: soil laying, manuring, watering, management of pests and diseases and harvesting.	
Unit III: Seed, Sowing/raising of seeds and seedlings	13
Structure and types - Seed dormancy; causes and methods of breaking dormancy. Seed storage: Seed banks, factors affecting seed viability, genetic erosion Seed production technology. Seed testing and certification. Transplanting of seedlings - Study of cultivation of different vegetables and flowering plants: cabbage, brinjal, lady's finger, tomatoes, carrots, bougainvillea, roses, geranium, ferns, petunia, orchids etc. Storage and marketing procedures. Developing and maintence of different types of lawns. Bonsai technique.	

Text Books and References

1. Agrawal, P.K. (1993). Hand Book of Seed Technology. Dept. of Agriculture and Cooperation, National Seed Corporation Ltd. New Delhi.
2. Bose T.K., Mukherjee, D. (1972). Gardening in India. Oxford & IBH Publishing Co. New Delhi.
3. Jules, J. (1979). Horticultural Science, 3rd edition. W.H. Freeman and Co. San Francisco, California.
4. Kumar, N. (1997). Introduction to Horticulture. Rajalakshmi Publications. Nagercoil, Tamil Nadu.
5. Musser E., Andres. (2005). Fundamentals of Horticulture. McGraw Hill Book Co. New Delhi
6. Sandhu, M.K. (1989). Plant Propagation. Walle Eastern Ltd. Bangalore.

Pedagogy:

Lectures, Practicals, Field and laboratory visits, Participatory Learning, Seminars, Assignments, specimen submission etc

Open Elective Course (OE-2.2)

I B.Sc., Semester II

BIO-FUELS

Course Outcome:

On completion of this course, the students will be able to

1. To make the students familiar with Bio-fuel plant species cultivation for commercial exploitation.
2. To make the students known about the Bio-fuel used in automobile industries and solving fuel problems in feature.
3. To generate interest amongst the students to know the importance of Bio-fuel in day today life and economic wellbeing.

Number of Theory Credits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours / semester
3	39	0	00

UNIT-I	**10 hrs**.
Introduction, definition, scope and Importance of Bio-fuel with respect to climate change and environmental issues. Public awareness. Biofuels scenario in India and world. History of Biofuels. Advantages and disadvantages of biofuels. Developmental generation of biofuels: first, second, third and fourth generation of biofuels and present status.	
UNIT II	**16 hrs**
Biofuel feed stocks: Agricultural waste, farm waste, forestry waste, organic wastes from the residential, institutional and industrial waste and its importance.(Biomass-plant, animal and microbial based waste). Algal biofuel. Biodiesel species: *Pongamia pinnata, Simarouba gluca, Jatropha curcas, Azardirachta india, Madhuca indica* and *Callophyllum innophyllum* . Seed harvesting, processing, oil extraction, and characterization.	
UNIT III	**13 hrs**
Introduction to biodiesel, bioethanol, biogas and bio hydrogen. Production technology of biofuels (Biodiesel, ehanol and biogas). Quality analysis of biodiesel, bioethanol and biogas and its comparison with national and international standards. Biofuel sustainability; Biofuel Policy in Karnataka and India. Biofuel production statistics. Fuel against food security concepts.	

Text Books and References

1) The Biodiesel Handbook (2005). Jurgen Krahl, Jon Harlan Van Gerpen.AOCS Press.
2) Bioenergy and Biofuels (2017).Ozcan Konur. CRC Press, Taylor & Franci's group.
3) https://mnre.gov.in/biofuels

Pedagogy:

Lectures, Practicals, Field and laboratory visits, Participatory Learning, Seminars, Assignments, specimen submission etc

Open Elective Course (OE-2.3)

I B.Sc., Semester II

BIOFERTILISERS

Course Outcome:

On completion of this course, the students will be able to

1. To make the students familiar with bio-fertilizer plant species cultivation for commercial exploitation.
2. To make the students known about the bio-fertilizer used in agriculture forming and industries and solving problems erupted by synthetic fertilizer.
3. To generate interest amongst the students to know the importance of bio-fertilizer in day today agricultural practices and economic wellbeing.

Number of Theory Credits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours / semester
3	39	0	00

Content of Theory Course 2.3: BIOFERTILISERS	39 hrs
UNIT-I . General account, isolation and mass multiplication	**13 hrs**.
General account about the microbes used as biofertilizer – Rhizobium – isolation, identification, mass multiplication, carrier based inoculants, Actinorrhizal symbiosis. *Azospirillum:* isolation and mass multiplication – carrier based inoculants, associative effect of different microorganisms. *Azotobacter*: classification, characteristics – crop response to *Azotobacter* inoculum, maintenance and mass multiplication	
UNIT II. Association of Cyanobacteria and Fungi	**13hrs**
Cyanobacteria (blue green algae), *Azolla* and *Anabaena Azollae* association, nitrogen fixation, factors affecting growth, blue green algae and *Azolla* in rice cultivation Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth and yield – colonization of VAM –its influence on growth and yield of crop plants	
UNIT III. Applications of Cyanobacteria and Fungi	**13 hrs**
Organic farming – Green manuring and organic fertilizers, Recycling of biodegradable municipal, agricultural and Industrial wastes – bio-compost making methods, types and method of vermin-composting – field Application.	

Suggested Readings

1. Dubey, R.C., 2005 A Text book of Biotechnology S. Chand & Co, New Delhi.
2. Kumaresan, V. 2005, Biotechnology, Saras Publications, New Delhi.
3. John Jothi Prakash, E. 2004. Outlines of Plant Biotechnology. Emkay Publication, New Delhi.
4. Sathe, T.V. 2004 Vermiculture and Organic Farming. Daya Publishers. New Delhi.
5. Subha Rao, N.S. 2000, Soil Microbiology, Oxford & IBH Publishers, New Delhi.
6. Vayas, S.C, Vayas, S. and Modi, H.A. 1998 Bio-fertilizers and organic Farming Akta Prakashan, Nadiad

PEDAGOGY:

Lectures, Practicals, Field and laboratory visits, Participatory Learning, Seminars, Assignments, specimen submission etc

OPEN ELECTIVE
SCHEME OF BOTANY THEORY EXAMINATION II SEMESTER
MODEL QUESTION PAPER

Time: 2.5 Hours **Max Marks**- 60

Instructions: Draw neat labelled diagrams wherever necessary

I. Define/Explain any Four of the following 2X4=8 Marks

1.
2.
3.
4.
5.
6.

II. Answer any Four of the following 5X4=20 Marks

7.
8.
9.
10.
11.
12.

III. Answer any Four of the following 8X4=32 Marks

13.
14.
15.
16.
17.
18.

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OPEN ELECTIVE
BLUE PRINT OF BOTANY THEORY EXAMINATION II SEMESTER

Time: 2.5 Hours **Max Marks- 60**

Weightage of Marks				
Units	**2 marks**	**5 marks**	**8 marks**	**Total Mks.**
I	**2X2=4**	**5X2=10**	**8X2=16**	**30**
II	**2X2=4**	**5X2=10**	**8X2=16**	**30**
III	**2X2=4**	**5X2=10**	**8X2=16**	**30**
	12 Marks	**30Marks**	**48 Marks**	**90 Marks**

JSS COLLEGE OF ARTS, COMMERCE & SCIENCE

(An Autonomous College of University of Mysore)

Re-accredited by NAAC with 'A' grade

OOTY ROAD, MYSORE-570 025, KARNATAKA

SYLLABUS 2021-22

B. Voc. (Software Development)

B.Voc. (SD) Scheme:

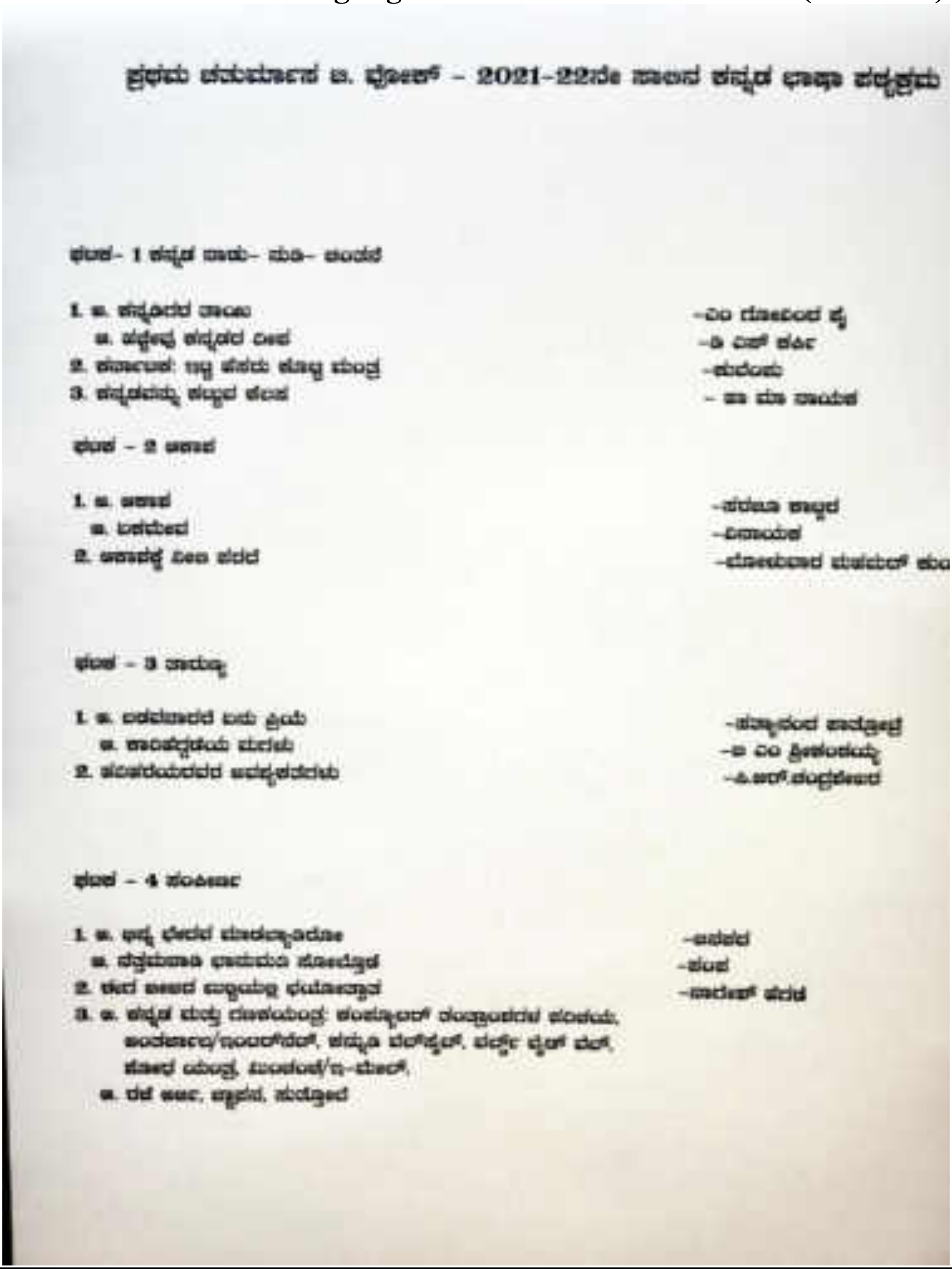
Year	Sem	Course Code	Title	L:T:P	Theory Hours	Tutorial Hours	Practical Hours	Total Hours	Total Credits
1 Year	Sem 1	SDA 020	Communication Language Kannada	3:0:0	45	0	0	45	3
		SDA 510	Basic Mathematics	3:0:0	45	0	0	45	3
		SDA 520	C Programming	2:0:1	30	0	15	45	3
		SDA 530	Digital Electronics	2:0:1	30	0	15	45	3
	Sem 2	SDB 510	Discrete Mathematics	3:0:0	45	0	0	45	3
		SDB 540	Communication Language English	3:0:0	45	0	0	45	3
		SDB 520	Algorithms & Data Structure	2:0:1	30	0	15	45	3
		SDB 550	Microcontroller & Embedded System	2:0:1	30	0	15	45	3
									24
2 Year		SDC 510	Advanced calculus	3:0:0	45	0	0	45	3
		SDC 520	Differential equation	3:0:0	45	0	0	45	3
		SDC 530	Software Architecture and SDLC & Process	2:0:1	30	0	15	45	3
		SDC 550	Indian Constitution	3:0:0	45	0	0	45	3
	Sem 4	SDD 510	Numerical Analysis & Statistics	3:0:0	45	0	0	45	3
		SDD 520	Operation Research	3:0:0	45	0	0	45	3
		SDD 530	Software Modeling & Software Quality Assurance	2:0:1	30	0	15	45	3
		SDD560	Environmental Studies	3:0:0	45	0	0	45	3
									24
3 Year	Sem 5	SDE 510	Project Management	2:0:2	30	0	30	60	4
		SDE 520	Configuration Management	3:0:1	45	0	15	60	4
		SDE 530	Human Computer Interaction	3:0:1	45	0	15	60	4
	Sem 6	SDF 510	Operating System	3:0:1	45	0	15	60	4
		SDF 550	Database Design	3:0:1	45	0	15	60	4
		SDF 520	CN & Security Fundamentals	3:0:1	45	0	15	60	4
									24
4 Year	Sem 7	G .1	Business English	2:0:1	30	0	15	45	3
		G - 2	Time Management Skills	2:0:1	30	0	15	45	3
									06
	Sem 8	G-3	Presentation Skills	2:0:1	30	0	15	45	3
		G-4	Teamwork Skills	2:0:1	30	0	15	45	3
									06

Scheme of Assessment:

SEMESTER I

General Education Content **180 hours**

1. Communication Language Kannada Credits: 3 (45 hours)



ಹೊಸರಾಷ್ಟ್ರೀಯ ಶಿಕ್ಷಣನೀತಿ : 2021-22

ಕನ್ನಡ ಭಾಷಾ ಮಾದರಿ ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ

(1,2,3 ಮತ್ತು 4ನೇ ಚತುರ್ಮಾಸಗಳು)

ಅವಧಿ : 3ಗಂಟೆಗಳು

ಗರಿಷ್ಠ ಅಂಕಗಳು : 60

1. ಒಂದು ಪ್ರಶ್ನೆಗೆ ಉತ್ತರಿಸಿ 1x10=10

(ಘಟಕ -೧ ರಿಂದ ಎರಡು ಪ್ರಶ್ನೆಗಳನ್ನು ಕೇಳಲಾಗುತ್ತದೆ)

2. ಒಂದು ಪ್ರಶ್ನೆಗೆ ಉತ್ತರಿಸಿ 1x10=10

(ಘಟಕ -೨ ರಿಂದ ಎರಡು ಪ್ರಶ್ನೆಗಳನ್ನು ಕೇಳಲಾಗುತ್ತದೆ)

3. ಒಂದು ಪ್ರಶ್ನೆಗೆ ಉತ್ತರಿಸಿ 1x10=10

(ಘಟಕ -೩ ರಿಂದ ಎರಡು ಪ್ರಶ್ನೆಗಳನ್ನು ಕೇಳಲಾಗುತ್ತದೆ

4. ಒಂದು ಪ್ರಶ್ನೆಗೆ ಉತ್ತರಿಸಿ 1x10=10

(ಘಟಕ -೪ ರಿಂದ ಎರಡು ಪ್ರಶ್ನೆಗಳನ್ನು ಕೇಳಲಾಗುತ್ತದೆ)

5. ಎರಡು ಪ್ರಶ್ನೆಗಳಿಗೆ ಉತ್ತರಿಸಿ 2x5=10

(ಘಟಕ ೧,೨,೩ ಮತ್ತು ೪ ರಿಂದ [illegible] ವಾಕ್ಯಗಳನ್ನು ಕೇಳಲಾಗುತ್ತದೆ.
[illegible] ಪ್ರಶ್ನೆಗಳನ್ನು ಕೇಳಲಾಗುತ್ತದೆ)

6. ಒಂದು ವಿಷಯ ಕುರಿತು ಬರೆಯಿರಿ 1x5=5

([illegible] ಪ್ರಶ್ನೆ ಕೇಳಲಾಗುತ್ತದೆ)

7. ಒಂದು ವಾಕ್ಯದಲ್ಲಿ ಉತ್ತರಿಸಿ 1x5=5

([illegible] ಪ್ರಶ್ನೆಗಳನ್ನು ಕೇಳಲಾಗುತ್ತದೆ)

2. Basic Mathematics

(45 Hrs @ 3 Hrs per week, 3 credits)

Course Outcome:

After completion of the course, the students are able to:

CO1. Learn in depth Polynomials
CO2. Write down the details of Cardon's Method
CO3. Identify the details of Pair of straight lines
CO4. Deliberate in details with examples Circle
CO5. Specify in details with examples Radian Measure
CO6. Learn in depth Complex Numbers

Unit 1: Algebra 1 **15 Hours**

Theory of Equations: Polynomials – Relations between the roots and coefficients –Symmetric functions –Synthetic division-Descartes' rule of signs –Cubic equations- Cardon's method.

Unit 2: Analytical Geometry –I **15 Hours**

Two dimensional coordinate geometry – straight line (Revision), Pair of straight lines –standard results and simple problems.
Circle: equations of circles, Tangent and normal, radical axis and radical centers.
Conic : Parabola – Ellipse- Hyperbola (Equations in standard form and problems)

Unit 3: Trigonometry **15 Hours**

Radian measure-Trigonometric ratios –Trigonometric functions of compound angle, multiple angles and half angles-Inverse trigonometric functions-complex numbers.

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Books for Reference:

1. Algebra –Natarajan
2. Algebra – Hardy and wright
3. Algebra –Shanthi Narayan
4. Algebra -Manicavachagam Pillay.
5. Elements of Analytical Solid geometry – Shanti Narayan
6. Elements of Analytical Solid geometry –S.L.Loney
7. Differential Calculus –Shanthi Narayan
8. Triogonometry –S.L.Loney

Scheme of Teaching and Examination:

Teaching: 45 Hours of Teaching at the rate of 3 Hrs per week

Scheme of Examination:

Component	Syllabus	Weight age	Period of continuous assessment
C1	first 50 % of the syllabus	15%	First half of the semester
C2	Remaining 50%	15%	Second half of the semester
C3	Semester - end examination	70%	After completing one full semester

Question paper pattern:

Title of the paper: **Basic Mathematics**

Section A:

Q1: Six questions of 2 marks each – Five questions to be answered. $5 \times 2 = 10$

Section B: Answer any Four questions from each main. Each full question carries 20 marks.

$4 \times 15 = 60$

Q2: Five sub questions of 5 marks each from unit 1
Q3: Five sub questions of 5 marks each from unit 2
Q4: Five sub questions of 5 marks each from unit 3

3. C PROGRAMMING

Credits 3 (45 Hours)

(2 Hours of Theory + 2 Hour of Practical per Week)

Course Outcome:

After completion of the course, the students are able to:

CO1. Specify in details with examples Problem Design
CO2. Learn in details with examples Algorithms
CO3. Deliberate the details of Data Definition Structure
CO4. Learn the details of Control Structures
CO5. Learn the details of Functions
CO6. Identify in details with examples Abstract Data Types

Unit 1 — 15 Hours

Problem Solving Technique: Problem definition, Problem analysis, Problem Design, Algorithms, Flow charts, Coding, Debugging, Program documentation, Program maintenance and Basic programming construct.

Data Definition Structure: Types, constants, variables, keywords and identifiers.

Operators and Expressions: Arithmetic, Relational, Logical, operator precedence rules; input and output statement and Assignment statement.

Unit 2 — 15 Hours

Control Structures: Sequential, Selection (one way, two way), looping (while, do while, for), combinations.

Functions: Definition and passing (function depth look), Prototypes: parameter definition and passing (scope: local and global variables).

Data Structures: One and Two dimensional arrays.

Abstract data types: Records (Structure definition statement); Strings: Use of main operations, string functions (concatenates string copy and compare etc).

Books for References:

- Programming with ANSI C by: E. Balagurusamy
- Let us C - Yashwanth kanetkar
- Computer concepts and C programming by - P. B. Kotur

Practical

(1Hour per week X 15 Weeks = 15 Hours)

Experiments are based on topics mention in the Paper designed by concerned Faculty

4. ELECTRONICS

Credits 3 (45 Hours)

(2 Hours of Theory + 2 Hour of Practical per Week)

Course Outcome:
After completion of the course, the students are able to:

CO1. Learn in detail with application, logic gates

CO2. Learn the classification and characteristics of combinational digital circuits

CO3. Deliberate the classification and characteristics of sequential digital circuits CO4. Learn in details with application, flip flop

Unit 1 **15 Hours**

Representation of Information: Number system, integer and floating point representation, character codes (ASCII, EBCDIC)

Number Systems: Introduction to decimal, binary and hexadecimal number systems. Inter-conversion of decimal, binary and hex numbers

Binary Arithmetic and codes: Addition, multiplication and division in binary systems. Subtraction in binary systems –one's and two's complement methods. Subtraction of binary numbers by one`s and two`s complement methods. Concept of signed and unsigned numbers

Alphanumeric codes- ASCII and EBCDIC, concept of parity, error detection and correction.

Logic Gates: Logic values and variables, positive and negative logic, AND, OR, NOT, NAND, NOR, AND, XOR gates, symbols and truth table. Definition of universal gates, NAND & NOR gates as universal gates.

Boolean Algebra: Laws of Boolean algebra. Principle of duality. DeMorgan's theorems. Simplification of Boolean expressions. Boolean expression for logic circuits and vice versa. . SOP and POS notations. Canonical Expressions. Conversion from SOP to POS form and vice versa. Reduction of Boolean expressions (three/ four variables with don't care conditions) using Karnaugh maps

Unit 2 **15 Hours**

Combinational Circuits: Half Adder, Full Adder, Half subtractor, Full subtractor, Encoders (Decimal to BCD) and decoders (BCD to Decimal), 4 X 1 Multiplexer and 1 X 4 demultiplexer - symbol and truth table

Sequential Circuits: RS flip flop, D flip flop. JK flip flop. Race around condition & T flip-flops. Shift registers –SISO, SIPO, PISO, PIPO registers. Brief explanation with Block diagrams. Counter - Synchronous and Asynchronous - Binary ripple counter and modulo counter.

Semiconductor Memories: Idea of different types of Semiconductor memories (RAM, ROM, PROM, EPROM, EEPROM), process of data storage and retrieval, organization of memory, concept of PLA and PAL.

Basic Building Blocks: ALU: arithmetic and logic unit operations, organization of control units, memory: types and organization, peripheral devices: I/O devices (video terminals and printers) and

controllers, storage devices (tapes and disks), Programmed and interrupt control mechanism, I/O controllers, and bus bandwidths

Books for References:

- Digital Electronic – Introduction to Theory & Practice by Gothmann.
- Modern Digital Electronic (3rd Ed.) by Jain.
- Digital Principles & applications (6th Ed.) by Leech, Malvino and Saha.
- Digital Electronic by Thomas Floyd.
- The 8086 / 8088 Family Design, Programming & Interfacing by John Uffenbeck.
- 8086 Microprocessors Programming & Interfacing by Duglos V Hall.
- Intel Microprocessors Architecture, Programming & Interfacing (6th Ed.) by Barry B Bery.

Practical

(1 Hour per week X 15 Weeks = 15 Hours)

Experiments are based on topics mention in the Paper designed by concerned Faculty

SEMESTER II

General Education Content 180 hours

1. Communicative Language English

Credits: 3 (45 hours)

(3 Hours of Theory per week)

Course Outcome:

After completion of the course, the students are able to:

CO1. Deliberate in details with examples Voice
CO2. Specify in details with examples Articles
CO3. Learn in depth Speech
CO4. Deliberate the details of Writing Skills
CO5. Learn in depth Speaking Skills

Module – 1 Grammar

		Marks	Hrs/ Week
1.	Subject and Verb Agreement	5	6
2.	Voice	5	5
3.	Articles	5	3
4.	Speech	5	6
5.	Question tag	5	5
6.	Framing of Questions	5	3+2=05

Module – 2 Writing Skills

1.	Letter Writing Letter of Application/Letter of Grievances/Resume Preparation	10	4
2.	Comprehension	10	3
3.	Essay Writing	10	3

Module – 3 Speaking Skills

1.	Greeting		
2.	Requesting		
3.	Enquiring		
4.	Explaining	10	03+2=05
5.	Reporting		
6.	Permission		
7.	Thanking		
		70	**45**

2. DISCRETE MATHEMATICS

Credits 3 (45 Hours)

(3 Hours of Theory per Week)

Course Outcome:

After completion of the course, the students are able to:

CO1. Understand the details of Matrices and Determinants
CO2. Learn the details of Hamilton Theorem
CO3. Understand in details with examples Graph Theory
CO4. Understand the details of Calculus
CO5. Identify in details with examples Definite and Indefinite Integrals

Unit 1: Matrices and Determinants **15 Hours**

Algebra of Matrices and determinants –Elementary row operations- Rank of a matrix –Linear dependence of row and column vectors- System of Homogeneous linear equations-System of non homogeneous linear equations-Characteristic equations –Eigen values and Eigen vectors-Cayley – Hamilton theorem-Inverse of a matrix.

Unit 2: Basics of graph theory **15 Hours**

Definition-paths-matrix representation of graphs –planar graphs-non planar graphs-coloring of graphs-chromatic number of graphs-Independent number.

Unit 3: Calculus **15 Hours**

Limits–Derivatives-Rules of differentiation-problems-differentiation of implicit Parametric and inverse functions-logarithmic differentiation and derivatives of second order Indefinite and definite integrals-simple problems.

Scheme of Teaching and Examination:

Teaching: 45 Hours of Teaching at the rate of 3 Hrs per week

Scheme of Examination:

Component	Syllabus	Weight age	Period of continuous assessment
C1	First 50 % of the syllabus	15%	First half of the semester
C2	Remaining 50%	15%	Second half of the semester
C3	Semester - end examination	70%	After completing one full semester

Question paper pattern: Title of the paper: **Mathematics II**

Section A:

Q1 Six questions of 2 mark each - Five questions to be answered. $5 \times 2 = 10$

Section B: Answer any Four questions from each main. Each full question carries 15 marks.

$4 \times 15 = 60$

Q2: Five sub questions of 5 marks each from unit 1
Q3: Five sub questions of 5 marks each from unit 2
Q4: Five sub questions of 5 marks each from unit 3

3. ALGORITHMS AND DATA STRUCTURES

Credits 3 (45 Hours)

(2 Hours of Theory + 2 Hour of Practical per Week)

Course Outcome:

After completion of the course, the students are able to:

CO1. Deliberate in details with examples Algorithms and Data Structures
CO2. Learn in depth Arrays
CO3. Learn in details with examples Binary Search Trees
CO4. Deliberate the characteristics of Heaps
CO5. Specify the characteristics of Sorting Algorithms
CO6. Learn the details of Shortest Path

Unit 1: **15 Hours**

Algorithms and Data Structures: Asymptotic and Algorithm Analysis, Properties of data, Asymptotic Analysis, Algorithm Analysis.

Abstract Lists and Implementations: Linked lists and arrays, Stacks, Queues, De-queues.

Abstract Sorted Lists and Implementations: General trees, binary (including binary and complete trees), N-array trees and tree traversals, Abstract Sorted Lists, Binary search trees, Balanced search trees, AVL trees, B-Trees.

Unit 2: **15 Hours**

Abstract Priority Queues: Heaps.

Abstract Sets/Maps: Chained Hash Tables, Linear Probing, Double Hashing.

Sorting Algorithms: Insertion and bubble sort, Heap, merge, and quick sort, Bucket and radix sort.

Graph and Direct Acyclic Graph Algorithms: Topological sort, Minimum spanning trees and shortest path.

Reference:

1. T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, Introduction to Algorithms, 2nd Ed., Prentice-Hall of India, 2006.
2. Robert L. Kruse and A.J. Ryba, Data Structures and Program Design in C++, Prentice Hall, Inc., NJ, 1998.

Practical

(1 Hour per week X 15 Weeks = 15 Hours)

Experiments are based on topics mention in the Paper designed by concerned Faculty

4. INTRODUCTION TO MICROCONTROLLERS AND EMBEDDED SYSTEMS

(2 Hours of Theory + 2 Hour of Practical per Week)

Course Outcome:

After completion of the course, the students are able to:

CO1. Understand architecture of 8051 microcontroller
CO2. Write down the the instruction set and simple programs of 8051 microcontroller
CO3. Learn the details of 8051 microcontrollers
CO4. Specify the characteristics of embedded system

Unit 1: Microcontrollers (15 Hours)

Microcontroller 8051 - Introduction, block diagram of microprocessor, block diagram of microcontroller, comparison between microprocessor & microcontroller, Architecture of 8051 and pin out diagram of 8051. **Addressing modes -** Data moves, Types of addressing modes - register addressing, immediate addressing, direct addressing, indirect addressing mode. **Instructions set -** Data transfer instructions, arithmetic instructions, jump and call instructions. **PIC microcontroller** - Core feature and over view of series.

Unit 2: Embedded Systems (15 Hours)

Introduction to Embedded Systems - Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

Hardware Side - introduction, The Core Level, Representing Information, Understanding Numbers, Addresses, Instructions, Registers. An Instruction Set View, Embedded Systems-A Register View, Register View of a Microprocessor

The Hardware Side: Storage Elements and Finite-State Machines - Theoretical model.

Text Books:

- Microcontroller – K J Ayala.
- Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill.

Books for References:

- Microcontroller – Mazadi.

Practical

(1 Hour per week X 15 Weeks = 15 Hours)

Experiments are based on topics mention in the Paper designed by concerned Faculty

SEMESTER III

1. ADVANCED CALCULUS
Credits 3 (45 Hours)

(3 Hours of Theory per Week)

Course Outcome:

After completion of the course, the students are able to:

CO1. Learn in depth Sequences

CO2. Specify the details of Series

CO3. Understand in details with examples Rolle's Theorem

CO4. Deliberate in details with examples Taylor's Theorem

CO5. Identify the details of Partial derivatives

Unit 1: Sequences and Series **15 Hours**

Sequences- Bounded and monotonic sequences-convergent, divergent and oscillatory sequences- standard results and simple problems.

Infinite series-nth partial sum- geometric series-convergence of $\sum \frac{1}{n^p}$ - comparison test and ratio test-simple problems-alternating series.

Unit 2: Calculus **15 Hours**

Mean value theorems-Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorems (Statements and Geometrical interpretations)-Taylor's theorem –Maclaurin's expansion (Statement) and problems.

Unit 3: Partial derivatives **15 Hours**

Limit and continuity of functions of two and three variables. Partial differentiation. Change of variables. Partial derivation and differentiability of real-valued functions of two and three variables. Euler's theorem on homogeneous functions. Taylor's theorem for functions of two and three variables. Jacobians.

Books for Reference:

1. A First Course in Real Analysis – Asharani Singhal.
2. Real Analysis – S.C .Malik .
3. Principles of Mathematical Analysis –Shanthinarayan
4. Calculus ,Volume -1 and Volume -2

Scheme of Teaching and Examination:

Teaching: 45 Hours of Teaching at the rate of 3 Hrs per week

Scheme of Examination:

Component	**Syllabus**	**Weightage**	**Period of continuous assessment**
C1	first 50 % of the syllabus	15%	First half of the semester
C2	Remaining 50%	15%	Second half of the semester
C3	Semester - end examination	70%	After completing one full semester

Question paper pattern:

Title of the paper: Paper 1: **ADVANCED CALCULUS**

Section A:

Q1: Six questions of two marks each .Five questions to be answered $5 \times 2 = 10$

Section B: Answer any Four questions from each main. Each main carries 20 marks

3 X 20 = 60

Q2: Five sub questions of 5 marks each from unit 1
Q3: Five sub questions of 5 marks each from unit 2
Q4: Five sub questions of 5 marks each from unit 3

2: DIFFERENTIAL EQUATIONS IV

Credits 3 (45 Hours)

(3 Hours of Theory per Week)

Course Outcome:

After completion of the course, the students are able to:

CO1. Specify in details with examples linear differential equations

CO2. Write down in details with examples nonlinear differential equations

CO3. Understand in details with examples Homogeneous linear differential equations

CO4. Learn the details of Non homogeneous linear differential equations CO5. Specify the details of Partial differential equations

Unit 1: Linear and nonlinear differential equations 15 Hours

Elimination of arbitrary constant-solutions of linear differential equations - separation of variables –Homogeneous equations-exact equations- equations of the form $\frac{dy}{dx} + Py = Q$-Integrating factor. Equations solvable for x, y, p. Clairaut's form and singular solutions. .

Unit 2: Homogeneous and non homogeneous linear differential equations 15 Hours

Homogeneous Linear differential equations with constant coefficients.-non homogeneous linear differential equations –inverse differential operators-Cauchy's homogeneous linear differential equations- Second order linear differential equations-variation of parameters and exact equations.

Unit 3: Partial differential equations 15 Hours

Total differential equations-simultaneous equations- partial differential equations-Lagranges form of linear partial differential equations-charpit's method.

Books for Reference :

1. A short course in differential equations –Rainville and Bedient
2. Advanced Engineering Mathematics – Kreyszig
3. Higher Engineering Mathematics – Grewal
4. Laplace Transform –Murry R Speigel
5. Applications of Differential equations –Martin Brown

Scheme of Teaching and Examination

Teaching: 45 Hours of Teaching at the rate of 3 Hrs per week

Scheme of Examination:

Component	**Syllabus**	**Weightage**	**Period of continuous assessment**
C1	First 50 % of the syllabus	15%	First half of the semester
C2	Remaining 50%	15%	Second half of the semester
C3	Semester - end examination	70%	After completing one full semester

Question paper pattern:

Title of the paper: *Paper 2:* **DIFFERENTIAL EQUATIONS**

Section A:

Q1: Six questions of two marks each .Five questions to be answered $5 \times 2 = 10$

Section B: Answer any Four questions from each main. Each main carries 20 marks

3 X 20 = 60

Q2: Five sub questions of 5 marks each from unit 1
Q3: Five sub questions of 5 marks each from unit 2
Q4: Five sub questions of 5 marks each from unit 3

3. Software Architecture and SDLC & Processes

Credits 3 (45 Hours)

(2 Hours of Theory and 1Hour of Practical's)

Course Outcome:

After completion of the course, the students are able to:

CO1. Specify in depth Software Process
CO2. Deliberate in details with examples SDLC
CO3. Learn in depth Data Modeling
CO4. Understand the details of UML and ER Models
CO5. Specify the details of Loose Coupling

Unit 1: **15 Hours**

SDLC & Processes: Software Process, Software Development Life Cycle, Object-Oriented Concepts: connections between design and implementation, Software Testing, Object-Oriented Architecture and Design, Requirements analysis, Safety Critical Software.

Unit 2: **15 Hours**

Software Architecture: Introduction to enterprise software architecture, the role of middleware, Cloud computing =SaaS + Utility Computing, Data Modeling, UML and E-R models. XML, Schemas, XML Schemas, Data Processing. Strategies for data processing, Introduction to XQuery. JSON and JAXB, Domain-Driven Architecture. Domain-driven, design (DDD), Object-relational mapping (ORM), Service-oriented Architecture (SOA), Standardized service contract, Loose coupling, Service abstraction, Service-oriented Architecture (SOA).

Practical

(1 Hour per week X 15 Weeks = 15 Hours)

Experiments are based on topics mention in the Paper designed by concerned Faculty

4. Indian Constitution

Credits 3 (45 Hours)

(3 Hours of Theory)

Course Outcome:

After completion of the course, the students are able to:

CO1. Learn the details of Features of Indian Constitution
CO2. Understand the details of Fundamentals Rights
CO3. Identify the details of Role of Prime Minister
CO4. Learn the details of Power and Functions of Lok Sabha
CO5. Specify the details of Power and Functions of Chief Minister

UNIT I **08 hrs**

a) Preamble of the Indian Constitution
b) Salient features of Indian Constitution

UNIT II **10 hrs**

a) Fundamental Rights
b) Fundamental Duties
c) Directive principles of State Policy

UNIT III **14 hrs**

a) President – Election Method, Powers and Functions
b) The Role of the Prime Minister
c) The Parliament – Structure, Power and Functions(Lok Sabha and Rajya Sabha)
d) Supreme Court – Organization and Jurisdiction

UNIT IV **13 hrs**

a) The Role of Governor in the Administration of State
b) Powers and Functions of the Chief Minister
c) Composition , Powers and Functions of both the Houses of State Legislature
d) High Court – Organization and Jurisdiction

SEMESTER IV

General Education Content 180 hours

PAPER 1: NUMERICAL ANALYSIS

Credits 3 (45 Hours)

(3 Hours of Theory per Week)

Course Outcome:

After completion of the course, the students are able to:

CO1. Understand the details of Bisection Method

CO2. Identify in details with examples Range Kutta IV Order Method

CO3. Learn the details of Finite differences

CO4. Understand in depth Numerical Integration

CO5. Identify in details with examples Linear programming

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Unit 1: Numerical Methods 15 Hours

Numerical solutions of algebraic equations-Bisection method -Newton Raphson method, Regula Falsi method -iteration method-Euler method, Range kutta IV order methods

Unit 2: Finite differences 15 Hours

Finite differences-Interpolation-Newton Gregory forward interpolation formula-Lagrange's interpolation formula-Finding first and second derivatives using interpolation formula.

.

Unit 3: Numerical integration 15 Hours

General quadrature formula- Trapezoidal rule, Simpson's $1/3^{rd}$ and $3/8^{th}$ rule Weddle's rule.

Books for reference:

1. Numerical methods: S.S.Sastry.
2. Probability and statistics for engineers and Scientists – Ronald E .Walpole and Raymond H Mayers .
3. Mathematical Statistics - John Freund (Prentice Hall India PVT .Ltd)

Scheme of Teaching and Examination

Teaching: 45 Hours of Teaching at the rate of 3 Hrs per week

Scheme of Examination:

Component	**syllabus**	**Weightage**	**Period of continuous assessment**
C1	first 50 % of the syllabus	15%	First half of the semester
C2	Remaining 50%	15%	Second half of the semester
C3	Semester – end examination	70%	After completing one full semester

Question paper pattern:

Title of the paper: **Numerical Techniques and Statistics**

Section A:

Q1: Six questions of two marks each .Five questions to be answered $5 \times 2 = 10$

Section B: Answer any Four questions from each main. Each main carries 20 marks

3 X 20 = 60

Q2: Five sub questions of 5 marks each from unit 1
Q3: Five sub questions of 5 marks each from unit 2
Q4: Five sub questions of 5 marks each from unit 3

PAPER 2: OPERATION RESEARCH

Credits 3 (45 Hours)

(3 Hours of Theory per Week)

Course Outcome:

After completion of the course, the students are able to:

CO1. Understand the details of Different phases of operation research

CO2. Deliberate in depth Simplex method

CO3. Identify in depth Duality theorems

CO4. Understand the details of Sequencing problems

CO5. Learn in depth Transportation model problems

CO6. Understand the details of Assignment problems

Unit 1: **15 Hours**

Definition of the term Operation Research -Different phases of operation research Advantages and limitations of O.R. Linear programming –Requirements for a linear programming problem , Examples on the Applications of linear programming problem, Formulation of a linear programming , Standardization , Solving LPP by Graphical Method ,Simplex Method (up to two variables)

Unit 2: **15 Hours**

Big M method revised simplex method, Dual simplex method, Duality theorems.

Sequencing problems: Processing 'n' jobs through two machines –Travelling salesman problems as an application of sequencing.

Unit 3: **15 Hours**

Transportation Model problems – Formulating, Solution –North West Corner Rule, Least Cost method, Row Minima method, Column minima method and Vogel's approximation.

Assignment problem: formulating, method of finding initial basic feasible solution to Assignment problem using Hungarian method.

Books for reference:

1. 'Operation Research ' by Kanthiswarup ,Guptha ,Manmohan –Sultan chand and sons Educational publishers ,New Delhi ,1996
2. ' Operation Research ' by H .A .Taha Prentice Hall of india Ltd 1998
3. 'Operation research ' ,by S .D Sharma Kedarnath Ramnath and co (publishers)1997

Scheme of Teaching and Examination

Teaching: 45 Hours of Teaching at the rate of 3 Hrs per week

Scheme of Examination:

Component	**Syllabus**	**Weightage**	**Period of continuous assessment**
C1	first 50 % of the syllabus	15%	First half of the semester
C2	Remaining 50%	15%	Second half of the semester
C3	Semester - end examination	70%	After completing one full semester

Question paper pattern:

Title of the paper: **Operation Research**

Section A:

Q1: Six questions of two marks each .Five questions to be answered $5 \times 2 = 10$

Section B: Answer any Four questions from each main. Each main carries 20 marks

3 X 20 = 60

Q2: Five sub questions of 5 marks each from unit 1
Q3: Five sub questions of 5 marks each from unit 2
Q4: Five sub questions of 5 marks each from unit 3

3. Software Modeling and Software Quality Assurance

Credits 3 (45 Hours)

(2 Hours of Theory and 2 Hour of Practical's)

Course Outcome:

After completion of the course, the students are able to:

CO1. Deliberate in details with examples Classes and Relationships
CO2. Specify the details of State diagrams
CO3. Identify in details with examples Events
CO4. Deliberate in details with examples Software quality assurance
CO5. Understand the details of Software quality assurance

Unit 1: **15 Hours**

Software Modeling: What is Modeling?, Classes, Relationships, Common Mechanisms, Diagrams, Class Diagrams, Advanced Relationships, Instances, Object Diagrams, Use Cases, Interaction/Activity Diagrams, Events, State Machines, Time, Space, State Diagrams and Events.

Unit 2: **15 Hours**

Software Quality Assurance: Software Quality, Quality Assurance, Testing Concepts and Issues, Testing Activities, Testing Techniques. Other Techniques, Defect Prevention/Process Improvement, Inspection, Refactoring; CRC, Software Reliability Engineering, Quality Models and Measurements.

Practical

(1 Hour per week X 15 Weeks = 15 Hours)

Experiments are based on topics mention in the Paper designed by concerned Faculty

Paper 4: Environmental Studies

(One-Semester Compulsory Core Module for B.Voc Programmes)

(3 hrs Theory/Week)

3 Credits (45 Hrs)

Course Outcome:

After completion of the course, the students are able to:

CO1. Deliberate the details of Components of environment
CO2. Specify the details of Ecology and Ecosystems
CO3. Identify in details with examples Natural resources
CO4. Learn the details of Biodiversity
CO5. Specify in details with examples Environmental pollution
CO6. Identify the details of Environmental issues and policies

Unit i: Environment and natural systems 4 hrs

- Introduction to Environment and Environmental Studies
- Definition and Components of Environment, Relationship between the different components of Environment
- Man and Environment relationship
- Impact of technology on Environment, Environmental Degradation
- Multidisciplinary nature of the Environment studies
- its scope and importance in the present day Education System

UNIT 2: Ecology and Ecosystems: 5 hrs

- Introduction: Ecology- Objectives and Classification
- Concept of an ecosystem- structure and functions of ecosystem
- Components of ecosystem- Producers, Consumers, Decomposers
- Bio-Geo- Chemical Cycles- Hydrologic Cycle, Carbon cycle, Energy Flow in Ecosystem, Food Chains, Food webs ,Ecological Pyramids
- Major Ecosystems: Forest Ecosystem, Grassland Ecosystem, Desert Ecosystem, Aquatic Ecosystem, Estuarine Ecosystem**.**

Unit 3: Natural Resources 6 hrs

Renewable and Non-renewable resources, exploitation and conservation,

a. Water resources: Surface and Ground water sources, Indian and Global scenario.
b. Land as a resource, land use change and land degradation
c. Forest resources: Definition and Classification of Forests
   Ecological and Economic importance and benefits of forest, Indian scenario,
   Deforestation: causes and effects, case studies remedial measures
d. Food resources: Sources of food, Global and Indian food demand scenario,

Limits of food production, Environmental effects of Agriculture

e. Energy resources: Renewable and non renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

f. Mineral resources: Definition and Classification of minerals, mining issues case studies.

e. Role of individual in conservation of natural resources.

Unit 4: Biodiversity and its Conservation 7 hrs

- Biodiversity : Definition, Levels of biological diversity : genetic, species and ecosystem diversity
- Bio geographic zones of India
- Hot spots of biodiversity
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational values
- Biodiversity patterns
- India as a mega-biodiversity nation
- Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions.
- Endangered and endemic species of India
- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT 5: Environmental pollution: 6 hrs

- Types of Environmental Pollution:
- Water Pollution: Introduction – Water Quality Standards, Sources of Water Pollution: Industrial Agricultural, Municipal; Classification of water pollutants, Effects of water pollutants, Eutrophication.
- b) Marine pollution: Causes, effects and control.
- c) Air Pollution: Composition of air, Structure of atmosphere, Ambient Air Quality Standards, Classification of air pollutants, Sources of common air pollutants like PM, SO2, NOX, Natural & Anthropogenic Sources, Effects of common air pollutants
- d) Soil Pollution: causes, effects and control.
- e) Noise Pollution: Introduction, Sound and Noise, Noise measurements, Causes and Effects
- f) Thermal Pollution: Causes, effects and control.
- g) Nuclear hazards and human health risks.
- Solid waste management: Control measures of urban and industrial waste.
- Role of individual in the prevention of pollution, Pollution case studies.

UNIT 6: Sustainable development and Environmental issues and Policies. 7 hrs

- Sustainable development: Meaning, changes in resource utilization.
- Water conservation: watershed management and Rain water harvesting.
- Environmental issues: Climate change, global warming, acid rain, ozone layer depletion.
- Disaster management: floods, drought, earthquake, cyclones and landslides.
- Wasteland reclamation.

- Environment Protection Act: Air, Water, Wildlife (Prevention and Control of Pollution)
- Forest Conservation Act.
- Issues involved in enforcement of environmental legislation.
- Environment: rights and duties**.**

Unit 7: Human Population and the Environment 5 hrs

- Population growth, Explosion, demographic variation among nations.
- Family welfare Program.
- Environment, human health and welfare; infectious and lifestyle diseases in contemporary world.
- Value Education: Environmental ethics.
- HIV/AIDS
- Women and Child welfare.
- Role of information technology in Environment and human health

Unit 8: Field visit 5 hrs

- Field work Visit to an area to document environmental assets :river/ forest/ grassland/ hill/ mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.
- Visit to the solid waste treatment plant and water treatment plant.
- Video: The one degree • (Equal to 5 lectures)

Reference Books:

1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha Second edition, 2013 Publisher: Universities Press (India) Private Ltd, Hyderabad.
2. Basics of Environmental Studies by Prof Dr N S Varandani , 2013 Publisher: LAP -Lambert Academic Publishing , Germany
3. Environmental Studies by Anindita Basak , 2009 Publisher: Drling Kindersley(India)Pvt. Ltd Pearson
4. Textbook of Environmental Studies by Deeksha Dave & S S Kateva , Cengage Publishers.
5. Environmental Sciences by Daniel B Botkin & Edward A Keller Publisher: John Wiley & Sons.
6. Environmental Studies by R. Rajagopalan, Oxford University Press
7. Environmental Studies by Benny Joseph, TMH publishers
8. Environmental Studies by Dr. Suresh K Dhameja, 2007 Published by: S K Kataria & Sons New Delhi
9. Basics of Environmental Studies by U K Khare, 2011 Published by Tata McGraw Hill.
10. Environmental Studies by N.Arumugam & V.Kumaresan, saras publication.

SEMESTER V

Paper 1: Project Management

Credits 2 (30 Hours)

(2 Hour of Theory + 2 Hour of Practical per Week)

Course Outcome:

After completion of the course, the students are able to:

CO1. Understand in depth Project plan

CO2. Identify the details of User controlled scheduling

CO3. Deliberate the details of Adding tasks

CO4. Understand in details with examples Adding work resources

CO5. Learn the details of Calendar

Unit 1: **15 Hours**

Creating a Project Plan.
User-Controlled Scheduling
Adding Tasks
Resolving Common Scheduling Issues

Unit 2: **15 Hours**

Adding Work Resources
Adding Material and Cost Resources
Defining a Calendar
Viewing and Tracking Project Information Gantt Charts

Practical's

Credits 2 (30 Hours)

Experiments are based on topics mention in the Paper designed by concerned Faculty

Paper 2: Configuration Management

Credits 3 (45 Hours)

(3 Hour of Theory + 2 Hour of Practical per Week)

Course Outcome:

After completion of the course, the students are able to:

CO1. Specify in depth Configuration management

CO2. Understand the details of Configuration management planning

CO3. Deliberate the details of Configuration control

CO4. Learn in details with examples Configuration status accounting

CO5. Identify the details of Configuration audits

Unit 1: **15 Hours**

DEFINING CONFIGURATION MANAGEMENT: CM principles and standards, the recent growth of CM

CM PLANNING: Program phasing and milestones, Creating the CM organization, Defining CM system requirements, CM job classifications

CONFIGURATION IDENTIFICATION: First tasks of CM, Configurations & Baselines, Requirements traceability, Item identification and numbering

Unit 2: **15 Hours**

ENGINEERING RELEASE: Control of technical data, the document control process, Development vs. formal release

CONFIGURATION CONTROL: Defining a closed-loop process, Change classifications, Review boards and CCBs, Processing changes and RDWs

INTRODUCTION TO SOFTWARE CONFIGURATION MANAGEMENT: Specific software CM tasks, SEI evaluation criteria

Unit 3: **15 Hours**

CONFIGURATION STATUS ACCOUNTING: Defining CSA tasks and tailoring, Status accounting elements, Understanding the impact

CM PLANS: CMP preparation techniques, Software CMPs, Assessments and Plans

General procedures and work flow

CONFIGURATION AUDITS: Internal and informal audits, developing the audit plan, The Functional and Physical Audits

Practical's

Credits 1 (15 Hours)

Experiments are based on topics mention in the Paper designed by concerned Faculty

Paper 3: Human Computer Interaction

Credits 3 (45 Hours)

(3 Hours of Theory + 2 Hour of Practical per Week)

Course Outcome:

After completion of the course, the students are able to:

CO1. Learn the details of Introduction of human computer interface
CO2. Understand the details of Human consideration in screen design
CO3. Identify in details with examples Windows
CO4. Deliberate in depth Multimedia and coloring
CO5. Specify in details with examples Hypermedia

Unit 1: 20 Hours

Introduction-Importance-Human-Computer interface-characteristics of graphics interface-Direct manipulation graphical system - web user interface-popularity-characteristic & principles. User interface design process- obstacles-usability-human characteristics in design - Human interaction speed-business functions-requirement analysis-Direct-Indirect methods-basic business functions-Design standards-system timings - Human consideration in screen design - structures of menus - functions of menus-contents of menu-formatting -phrasing the menu - selecting menu choice-navigating menus-graphical menus.

Unit 2: 13 Hours

Windows: Characteristics-components-presentation styles-types-managements-organizations-operations-web systems-device-based controls: characteristics-Screen -based controls: operate control - text boxes-selection control-combination control-custom control-presentation control.

Unit 3: 12 Hours

Text for web pages - effective feedback-guidance & assistance-Internationalization-accesssibility-Icons-Image-Multimedia - coloring.

Windows layout-test: prototypes - kinds of tests - retest - Information search - visualization - Hypermedia - www - Software tools.

Practical's

Credits 1 (15 Hours)

Experiments are based on topics mention in the Paper designed by concerned Faculty

SEMESTER VI

Paper 1: Operating System

Credits 4 (60 Hours)

(3 Hours of Theory + 2 Hour of Practical per Week)

Course Outcome:
After completion of the course, the students are able to:

CO1. Identify the Characteristics of operating system
CO2. Deliberate in depth Scheduling algorithms
CO3. Learn in depth Semaphores
CO4. Specify the details of Message passing
CO5. Understand the details of Deadlock
CO6. Identify in details with examples File organisation

Unit 1: **15 Hours**

Overview of operating systems, functionalities and types of OS.
User Operating, System Interface, Command Interpreter and Graphical User Interface.
System Calls – Types of System Calls.
The concept of a process - operations on processes, process states, concurrent processes, process control block.
UNIX process control and management, signals and pipes.
Operating system organisation, OS kernel FLIH.
Processor scheduling, scheduling algorithms and Scheduling Criteria.

Unit 2: **15 Hours**

Mutual exclusion, process co-operation, producer and consumer processes.
Semaphores: definition, init, wait, signal operations.
Use of semaphores to implement mutex, process synchronisation etc., implementation of semaphores.
Critical regions, Conditional Critical Regions, Monitors, Ada Tasks.
Interprocess Communication (IPC), Message Passing, Direct and Indirect.

Unit 3: **15 Hours**

Deadlock – Deadlock Characterization, Methods of handling deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery from deadlock. Memory organisation and management, storage allocation.
Virtual memory concepts, paging and segmentation, address mapping.
Virtual storage management, page replacement strategies.
File organisation: blocking and buffering, file descriptor, directory structure, File and Directory structures, blocks and fragments, directory tree, inodes, file descriptors, UNIX file structure.

Practical's

Credits 1 (15 Hours)

Experiments are based on topics mention in the Paper designed by concerned Faculty

Paper 2: Database Design

Credits 4 (60 Hours)

(3 Hours of Theory + 2 Hour of Practical per Week)

Course Outcome:

After completion of the course, the students are able to:

CO1. Understand the details of Database terminology and information types

CO2. Specify in depth Database planning and designing

CO3. Learn the details of Cloud computing

CO4. Specify the details of Sets and normalization

CO5. Specify in depth Report writing

CO6. Understand in details with examples Customer service management

Unit 1 **15 Hours**

Database Basics, Introduction to Devise Digital Storage, Database Terminology & Database Information Types, Microsoft Excel versus Microsoft Access, Database Planning, Database Objects – Creating Fields and Tables, Planning and Designing a Database

Unit 2 **15 Hours**

Introduction to Cloud Computing, Database Relationships, Designing for the Business Case, Introduction to Data Security & Data Archives, Managing the Database, Database Relationship Development, Introduction to Visual Data Analytics, Introduction to Sets & Normalization, Database Extractions

Unit 3 **15 Hours**

Database Queries and Basic SQL, Emergence of Social Media Databases, Database Distribution, Report Writing, Introduction to Customer Service Management, Computing Databases, Database Inputs, Form Development

Practical's

Credits 1 (15 Hours)

Experiments are based on topics mention in the Paper designed by concerned Faculty

Paper 3: Computer Networks & Security Fundamentals

Credits 4 (60 Hours)

(3 Hours of Theory + 2 Hour of Practical per Week)

Course Outcome:

After completion of the course, the students are able to:

CO1. Deliberate the details of OSI model
CO2. Learn the details of Switches
CO3. Understand the details of Protocols and services
CO4. Identify in depth Security
CO5. Learn in depth Encryption
CO6. Specify the details of E-mail and server protection

Unit 1 **15 Hours**

COMPUTER NETWORKS: Network Infrastructure - Internet, intranet, and extranet.
Understand the OSI model. TCP/IP, Local area networks (LANs), Wide area networks (WANs). Network topologies and access methods. Network Hardware - switches. Connecting devices – Bridges, Repeaters and Hubs.

Unit 2 **15 Hours**

Internetworking device – Router, Gateway and Media types. Error detection and correction – Parity Check, CRC Checksum and Hamming Code. Protocols and Services. Understand IPv4 & IPv6. Addressing names resolution & networking services. SECURITY: Understanding Security Layers Principles, Physical, Wireless, Internet & Operating System Security.

Unit 3 **15 Hours**

Cryptography – Symmetric Key Cryptography and Public Key Cryptography. User authentication, permissions, password, audit policies, encryption, malware, Network Security & dedicated firewalls. Network Access Protection (NAP), network isolation. Protocol security, client, e-mail & server protection.

Practical's

Credits 1 (15 Hours)

Experiments are based on topics mention in the Paper designed by concerned Faculty

Model Curriculum

JUNIOR SOFTWARE DEVELOPER

JUNIOR SOFTWARE DEVELOPER

SECTOR: **IT-ITeS**
SUB-SECTOR: **IT Services**
OCCUPATION: **Application Development**
REFERENCE ID: **SSC/Q0508, version 1.0** NSQF
LEVEL: **4**

Format: ModCur_2015_1_0

Model Curriculum for Junior Software Developer

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Junior Software Developer

CURRICULUM / SYLLABUS

This program is aimed at training candidates for the job of **Junior Software Developer** in the **IT-ITeS** Sector/Industry and aims at building the following key competencies in the learner.

Program Name	**Junior Software Developer**		
Qualification Pack Name & Reference ID.	Junior Software Developer SSC/Q0508, version 1.0		
Version No.	1.0	**Version Update Date**	31/12/2015
Pre-requisites to Training	10th Standard		
Training Outcomes	**After completing this programme, participants will be able to:** • assist in performing software construction and software testing entry-level tasks in the IT Services industry • manage work to meet requirements • maintain a healthy, safe and secure working environment		

The Course encompasses all six National Occupational Standards (NOS) of **Junior Software Developer SSC/Q0508** Qualification Pack issued by **IT-ITeS Sector Skills Council NASSCOM**.

Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
1	Basics of IT	05:00	15:00	Candidates will be able to: Demonstrate basic computer and internet literacy including operating a computer, describing its major components and how they work, using Windows and Linux OS, operating a browser, searching the internet, managing mails and using social internet media.	SSC/N0506	Refer to Unique Equipment Required section

2	Problem Solving and Program Design	30:00	60:00	Candidates will be able to: 1. Demonstrate aptitude for analysing information and making logical conclusions. 2. Demonstrate knowledge of the foundational mathematical concepts in computing.	SSC/N0506	Refer to Unique Equipment Required section
3	Basic Algorithms and Application Development	30:00	60:00	Candidates will be able to: • Design algorithms to solve problems and convert them into code using the appropriate programming language constructs. • Read and execute a test case and record the outcome in the appropriate template. Communicate effectively with appropriate people w.r.t. assigned roles in simple English – both oral and written.	SSC/N0506	Refer to Unique Equipment Required section
4	Self and work Management	30:00	70:00	Candidates will be able to: • Establish and agree work requirements with appropriate people . Keep immediate work area clean and tidy • Utilize time effectively • Use resources correctly and efficiently • Treat confidential information correctly • Work in line with organization's policies and procedures • Work within the limits of job role • Obtain guidance from appropriate people, where necessary Ensure work meets the agreed requirements	SSC/N9001	Refer to Unique Equipment Required section

Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
4	Self and work Management	30:00	70:00	Candidates will be able to: • Establish and agree work requirements with appropriate people • Keep immediate work area clean and tidy • Utilize time effectively • Use resources correctly and efficiently • Treat confidential information correctly • Work in line with organization's policies and procedures • Work within the limits of job role • Obtain guidance from appropriate people, where necessary • Ensure work meets the agreed requirements	SSC/N9001	Refer to Unique Equipment Required section
5	Team Work and Communication	12:00	38:00	Candidates will be able to: • Obtain guidance from appropriate people to agree the analysis to be performed on the data • Obtain advice and guidance from appropriate people on issues with data analysis outside their area of competence or • Review the results of their analysis with appropriate people • Undertake modifications to your analysis based on inputs from appropriate people • Communicate with colleagues clearly, concisely and accurately • Work with colleagues to integrate their work effectively with them • Pass on essential information to	SSC/N9002	Refer to Unique Equipment Required Section

				colleagues in line with organizational requirements • Work i`n ways that show respect for colleagues • Carry out commitments they have made to colleagues • Let colleagues know in good time if they cannot carry out your commitments, explaining the reasons • Identify any problems they have working with colleagues and take the initiative to solve these problems • Follow the organization's policies and procedures for working with colleagues		
6	Managing Health and Safety	12:00	38:00	Candidates will be able to: • Comply with organization's current health, safety and security policies and procedures • Report any identified breaches in health, safety, and security policies and procedures to the designated person • Identify and correct any hazards that can deal with safely, competently and within the limits of authority • Report any hazards that one is not competent to deal with to the relevant person in line with organizational procedures and warn other people who may be affected • Follow their organization's emergency procedures promptly, calmly, and efficiently • Identify and recommend opportunities for improving health, safety, and security to the designated person Complete any health and safety records legibly and accurately		

Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
7	Data and Information Management	15:00	35:00 `	Candidates will be able to: • Establish and agree with appropriate people the data/information they need to provide, the formats in which you need to provide it, and when they need to provide it • Obtain the data/information from reliable sources • Check that the data/information is accurate, complete and up-to-date • Obtain advice or guidance from appropriate people where there are problems with the data/information • Carry out rule-based analysis of the data/information, if required • Insert the data/information into the agreed formats • Check the accuracy of work, involving colleagues where required • Report any unresolved anomalies in the data/information to appropriate people. Provide complete, accurate and up-to-date • data/information to the appropriate people in the required formats on time	SSC/N9004	Refer to Unique Equipment Required Section

Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
8	Learning and Self Development	05:00	20:00	Candidates will be able to: • Obtain advice and guidance from appropriate people to develop your knowledge, skills and competence • Identify accurately the knowledge and skills they need for your job role • Identify accurately their current level of knowledge, skills and competence and any learning and development needs • Agree with appropriate people a plan of learning and development activities to address their learning needs • Undertake learning and development activities in line with their plan • Apply new knowledge and skills in the workplace, under supervision • Obtain feedback from appropriate people on their knowledge and skills and how effectively you apply them • Review their knowledge, skills and competence regularly and take appropriate action	SSC/N9005	Refer to Unique Equipment Required Section
	Total Duration:	**114:00**	**286:00**	**Unique Equipment Required:** Training room should be fully furnished with the following equipment / tools / accessories. Additional / specific resources, wherever applicable (e.g. Hardware, software) are indicated in the main text corresponding to relevant learning outcome.		

Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
				For Domain NOS, For NOS SSC/N0506 – HTML, C++ / Java, IDE General: • Comfortable seats with adequate lighting, controlled temperature and acoustics for training and learning • White Board, Markers and Eraser • Projector with screen • Flip chart with markers • Faculty's PC/Laptop with latest configuration and internet connection • Supporting software / applications for projecting audio, video, recording, • Presentation Tools to support learning activities: • Intranet • Email • IMs • Learning management system e.g. Moodle, Blackboard to enable blended learning • Microphone / voice system for lecture and class activities • Handy Camera • Stationery kit – Staples, Glue, Chart Paper, Sketch Pens, Paint Box, Scale, A4 Sheets ⌟ For IT Lab sessions: Computer Lab with 1:1 PC : trainee ratio and having internet connection, MS Office / Open office, Browser, Outlook / Any other Email Client and chat tools. • Assessment and Test Tools for day to day online Tests and Assessments • For team discussions: Adequate seating arrangement in full / half circle format for one or more teams as per planned team composition. Reading Resources: Access to relevant sample documents and learning forums to enable self-study before and after each training session.		

Grand Total Course Duration: **400 Hours 0 Minutes**

*(This Syllabus/Curriculum has been approved by **IT-ITeS Sector Skills Council NASSCOM**.)*

Notes from IT-ITeS Sector Skills Council NASSCOM

1. This document outlines the broad scope of coverage. This should be linked with OBF and training delivery plan. OBF (Outcome based framework) reflects the pedagogy used to ensure an expected outcome. Training delivery plan focuses on the sequence of delivery.
2. Though many NOSs have some seemingly common outcomes, notably core/generic, professional and technical skills, it is imperative to understand the contextual difference between them. For example, writing skills required to document program structure and code (in SSC/N0506) are different from the writing skills required to prepare a time plan (in SSC/N9001). Training providers are advised to,
    a. Embed such skills development in the learning pedagogy for each expected outcome
    b. Prepare a detailed session plan for training delivery with focus on sequence and duration of training
    c. Run a diagnostic test to assess prior learning of students and help trainers / students identify the need for gap training, optimal duration and suitable training methodology. Accordingly, more introductory level sessions may be included in guided or self-paced mode of learning. E.g. adding some sessions on Functional English or Use of Internet and MS Office.

Annexure1: Assessment Criteria

Assessment Criteria for Junior Software Developer	
Job Role	**Junior Software Developer**
Qualification Pack	**SSC/Q0508**
Sector Skill Council	**IT-ITeS**

Sr. No.	Guidelines for Assessment
1	Criteria for assessment for each Qualification Pack (QP) will be created by the Sector Skill Council (SSC). Each performance criteria (PC) will be assigned Theory and Skill/Practical marks proportional to its importance in NOS.
2	The assessment will be conducted online through assessment providers authorised by SSC.
3	Format of questions will include a variety of styles suitable to the PC being tested such as multiple choice questions, fill in the blanks, situational judgment test, simulation and programming test.
4	To pass a QP, a trainee should pass each individual NOS. Standard passing criteria for each NOS is 70%.
5	For latest details on the assessment criteria, please visit www.sscnasscom.com.

				MARKS ALLOCATION	
ASSESSMENT OUTCOME (NOS CODE DESCRIPTION)	**Assessment criteria** (PC)	**Total Marks**	**Out Of**	**Theory**	**Skills Practical**
1.SSC/N0506 (Deal remotely with customer queries - Domestic)	PC1. greet customers and verify details, following your organization's procedures	**120**	12.5	2.5	10
	PC2. read carefully, summarize, and obtain **customer** confirmation of, your understanding of queries		12.5	2.5	10
	PC3. express your concern for any difficulties caused and your commitment to resolving queries		15	0	15
	PC4. record and categorize queries accurately using your organization's query management tool		5	0	5
	PC5. refer queries outside your area of competence or authority promptly to appropriate		2.5	0	2.5

	people				
	PC6. access your organization's knowledge base for solutions to queries, where available		2.5	0	2.5
	PC7. resolve queries within your area of competence or authority in line with organizational guidelines and service level agreements (SLAs)		15	0	15
	PC8. obtain advice and guidance from appropriate people, where necessary		2.5	0	2.5
	PC9. obtain confirmation from **c**ustomers that queries have been resolved to satisfaction		10	0	10

	PC10. record the resolution of queries accurately using your organization's query management tool		35	15	20
	PC11. comply with relevant standards, policies, procedures and guidelines when dealing remotely with customer queries		7.5	0	7.5
		NOS Total	**120**	**20**	**100**
2.SSC/N9001 (Manage your work to meet requirements)	PC1. establish and agree your work requirements with appropriate people		10	5	5
	PC2. keep your immediate work area clean and tidy		5	0	5
	PC3. utilize your time effectively		5	5	0
	PC4. use resources correctly and efficiently		5	2.5	2.5
	PC5. treat confidential information correctly	**40**	5	0	5
	PC6. work in line with your organization's policies and procedures		2.5	0	2.5
	PC7. work within the limits of your job role		2.5	0	2.5
	PC8. obtain guidance from appropriate people, where necessary		2.5	0	2.5
	PC9. ensure your work meets the agreed requirements		2.5	0	2.5
		NOS Total	**40**	**12.5**	**27.5**
3.SSC/N9003 (Maintain a healthy, safe and secure workin g environment)	PC1. comply with your organization's current health, safety and security policies and procedures	**40**	10	5	5

	PC2. report any identified breaches in health, safety, and security policies and procedures to the designated person		5	0	5
	PC3. identify and correct any hazards that you can deal with safely, competently and within the limits of your authority		10	5	5
	PC4. report any hazards that you are not competent to deal with to the relevant person in line with organizational procedures and warn other people who may be affected		5	0	5
	PC5. follow your organization's emergency procedures promptly, calmly, and efficiently		5	0	5
	PC6. identify and recommend opportunities for improving health, safety, and security to the designated person		2.5	0	2.5
	PC7. complete any health and safety records legibly and accurately		2.5	0	2.5
		NOS Total	**40**	**10**	**30**

Annexure2: Trainer Prerequisites for Job role: Junior Software Developer mapped to Qualification Pack: SSC/Q0508

Sr. No.	Area	Details
1	**Job Description**	To deliver accredited training service, mapping to the curriculum detailed above, in accordance with the Qualification Pack SSC/Q0508.
2	**Personal Attributes**	Aptitude for conducting training, and pre/ post work to ensure competent, employable candidates at the end of the training. Strong communication skills, interpersonal skills, ability to work as part of a team; a passion for quality and for developing others; well-organised and focused, eager to learn and keep oneself updated with the latest in this field.
3	**Minimum Educational Qualifications**	Minimum 12th Standard; Preferred Master's degree in any discipline

4a	**Domain Certification**	Minimum accepted score in SSC Assessment is 90% per NOS being taught in QP SSC/Q0508. Additional certification in customer orientation, dealing with difficult customers, written communication etc. will be an added advantage.
4b	**Platform Certification**	Recommended that the Trainer is certified for the Job Role: "Trainer" mapped to the Qualification Pack: "SSC/Q1402". Minimum accepted score is 70% per NOS.
5	**Experience**	Field experience: Minimum 2 years' experience in the same domain Training experience: 1 year preferred


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for the
MODEL CURRICULUM
Complying to National Occupational Standards of
Job Role/ Qualification Pack: 'Junior Software Developer' QP No. 'SSC/Q0908 NSQF Level 4'
Date of Issuance: December 31st, 2015
Valid up to*: December 31st, 2018
* Valid up to the next review date of the Qualification Pack
Authorised Signatory
Lakshmy Narayan
(Chairman, IT-ITeS Sector Skills Council NASSCOM)

Model Curriculum

WEB DEVELOPER

WEB DEVELOPER

SECTOR:	**IT-ITeS**
SUB -SECTOR:	**IT Services**
OCCUPATION:	**Application Development**
REFERENCE ID:	**SSC/Q0503, version 1.0**
NSQF LEVEL:	**5**

Format: ModCur_2015_1_0

Model Curriculum for Web Developer SSC/Q0503

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Web Developer

CURRICULUM / SYLLABUS

This program is aimed at training candidates for the job of **Web Developer** in the **IT-ITeS** Sector/Industry and aims at building the following key competencies in the learner.

Program Name	**Web Developer**		
Qualification Pack Name & Reference ID.	Web Developer SSC/Q0503, version 1.0		
Version No.	1.0	**Version Update Date**	31/12/2015
Pre-requisites to Training	Graduate degree/ diploma in web design/ media design or any other related field		
Training Outcomes	**After completing this programme, participants will be able to:** • Contribute to the design of software products and applications • Develop media content and graphic designs for software products and Applications • Manage their work to meet requirements • Work effectively with colleagues • Maintain a healthy, safe and secure working environment • Provide data/information in standard formats • Develop their knowledge, skills and competence		

The Course encompasses all seven National Occupational Standards (NOS) of **Web Developer SSC/Q0503** Qualification Pack issued by **IT-ITeS Sector Skills Council NASSCOM**.

Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
1	Programming for the Web	20:00	30:00	Candidates will be able to: Design basic programming structures to implement functionality in line with requirements defined in BRS/URS, SRS and HLD	SSC/N0501	Refer to Unique Equipment Required Section

2	Analysis and Design of Web based Applications	20:00	30:00	Candidates will be able to: ┘ Check their understanding of the Business Requirements Specification (BRS)/User	SSC/N0501	Refer to Unique Equipment Required Section

Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
				Requirements Specification (URS) with appropriate people • Check their understanding of the Software Requirements Specification (SRS) with appropriate people • Check their understanding of High Level Design (HLD) with appropriate people • Review their designs with appropriate people • Analyse inputs from appropriate people to identify, resolve and record design defects and inform future designs • Document their designs using standard templates and tools • Comply with their organization's policies, procedures and guidelines when contributing to the design of software products and applications		

3	Media Content and Graphics Design	20:00	80:00	Candidates will be able to: • Check their understanding of the Business Requirements Specification (BRS), Software Requirements Specification (SRS), High Level Design (HLD) and Low Level Design (LLD) with appropriate people • Access reusable components, media and graphical packages and tools from their organization's knowledge base	SSC/N0503	Refer to Unique Equipment Required Section

				• Convert requirements into media content and graphic designs, leveraging reusable components where available • Review media content and graphic designs with appropriate people and analyze their feedback • Record any defects and corrective actions taken to inform future work • Rework media content and graphic designs, incorporating feedback • Submit media content timely and graphic designs for approval by appropriate people • Update their organization's knowledge base with their experiences of the media content and graphic designs developed • Comply with their organization's policies, procedures and guidelines when developing media content and graphic designs for software products and applications		
4	Self and work Management	12:00	38:00	Candidates will be able to: • Establish and agree their work requirements with appropriate people • Keep their immediate work area clean and tidy • utilize their time	SSC/N9001	Refer to Unique Equipment Required Section

				effectively		

Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
				• Use resources correctly and efficiently • Treat confidential information correctly • Work in line with organization's policies and procedures • Work within the limits of their job role • Obtain guidance from appropriate people, where necessary • Ensure their work meets the agreed requirements		

5	Team Work and Communication	12:00	38:00	Candidates will be able to: • Communicate with colleagues clearly, concisely and accurately • Work with colleagues to integrate their work effectively with them • Pass on essential information to colleagues in line with organizational requirements • Work in ways that show respect for colleagues • carry out commitments they have made to colleagues • Let colleagues know in good time if they cannot carry out their commitments, explaining the reasons • Identify any problems they have working with colleagues and take the initiative to solve these problems • Follow the organization's policies and procedures for working with colleagues	SSC/N9002	Refer to Unique Equipment Required Section

Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
6	Managing and Health Safety	05:00	20:00	Candidates will be able to: • Comply with their organization's current health, safety and security policies and procedures • Report any identified breaches in health, safety, and security policies and procedures to the designated person • Identify and correct any hazards that they can deal with safely, competently and within the limits of their authority • Report any hazards that they are not competent to deal with to the relevant person in line with organizational procedures and warn other people who may be affected • Follow their organization's emergency procedures promptly, calmly, and efficiently • Identify and recommend opportunities for improving health, safety, and security to the designated person • Complete any health and safety	SSC/ N 9003	

7	Data and Information Management	15:00	35:00	Candidates will be able to: ❑ Establish and agree with appropriate people the data/information they need to provide, the formats in which they need to provide it, and when they need to provide it • Obtain the data/information from reliable sources • Check that the data/information is accurate, complete and up-to-date • Obtain advice or guidance from appropriate people where there are problems with the data/information • Carry out rule-based analysis of the data/information, if required • Insert the data/information into the agreed formats • Check the accuracy of their work, involving colleagues where required • Report any unresolved anomalies in the data/information to appropriate people Provide complete, accurate and up-to-date data/information to the appropriate people in the required formats on time	SSC/N9004	Refer to Unique Equipment Required Section

8	Learning and Self Development	5:00	20:00	Candidates will be able to: • Obtain advice and guidance from appropriate people to develop their knowledge, skills and competence • Identify accurately the knowledge and skills they need for their job role • Identify accurately their current level of knowledge, skills and	SSC/N9005	Refer to Unique Equipment Required Section
				competence and any learning and development needs • Agree with appropriate people a plan of learning and development activities to address their learning needs • Undertake learning and development activities in line with their plan • Apply their new knowledge and skills in the workplace, under supervision • Obtain feedback from appropriate people on their knowledge and skills and how effectively they apply them • Review their knowledge, skills and competence regularly and take appropriate action		

	Total Duration:	**109:00**	**291:00**	**Unique Equipment Required**: Training room should be fully furnished with the following equipment / tools / accessories. Additional / specific resources, wherever applicable (e.g. Hardware, software) are indicated in the main text corresponding to relevant learning outcome. For Domain NOSs: • NOS SSC/N0501: HTML5, Javascript, CSS, SQL, Web Builder, Word Press, Joomla and modelling tools such as Visio, UML • NOS SSC/N0503: HTML5, CSS, Flash, Photoshop, Windows media player, Eclipse, XAMPP General: • Comfortable seats with adequate lighting, controlled temperature and acoustics for training and learning

Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
				• White Board, Markers and Eraser • Projector with screen • Flip chart with markers • Faculty's PC/Laptop with latest configuration and internet connection • Supporting software / applications for projecting audio, video, recording, • Presentation Tools to support learning activities: ○ Intranet ○ Email ○ IMs ○ Learning management system e.g. Moodle, Blackboard to enable blended learning • Microphone / voice system for lecture and class activities ⌟ Handy Camera • Stationery kit – Staples, Glue, Chart Paper, Sketch Pens, Paint Box, Scale, A4 Sheets • For IT Lab sessions: Computer Lab with 1:1 PC:trainee ratio and having internet connection, MS Office / Open office, Browser, Outlook/ other Email Clients • Assessment and Test Tools for day to day online Tests and Assessments • For team discussions: Adequate seating arrangement in full / half circle format for one or more teams as per planned team composition. • Reading Resources: Access to relevant sample documents and learning forums to enable self-study before and after each training session.		

Grand Total Course Duration: **400 Hours 0 Minutes**

*(This Syllabus/Curriculum has been approved by **IT-ITeS Sector Skills Council NASSCOM**.)* **Notes from IT-ITeS Sector Skills Council**

1. This document outlines the broad scope of coverage. This should be linked with OBF and training delivery plan. OBF (Outcome based framework) reflects the pedagogy used to ensure an expected outcome. Training delivery plan focuses on the sequence of delivery.

2. Though many NOSs have some seemingly common outcomes, notably core/generic, professional and technical skills, it is imperative to understand the contextual difference between them. For example, writing skills required write design specifications (in SSC/N0501) are different from the writing skills required to prepare a time plan (in SSC/N9001). Training providers are advised to,
    a. Embed such skills development in the learning pedagogy for each expected outcome
    b. Prepare a detailed session plan for training delivery with focus on sequence and duration of training
    c. Run a diagnostic test to assess prior learning of students and help trainers / students identify the need for gap training, optimal duration, and suitable training methodology. Accordingly, more introductory level sessions may be included in guided or self-paced mode of learning. E.g. adding some sessions on Functional English or Use of Internet and MS Office.

Annexure 1: Assessment Criteria

Assessment Criteria for Web Developer	
Job Role	**Web Developer**
Qualification Pack	**SSC/Q0503**
Sector Skill Council	**IT-ITeS**

Sr. No.	Guidelines for Assessment
1	Criteria for assessment for each Qualification Pack (QP) will be created by the Sector Skill Council (SSC). Each performance criteria (PC) will be assigned Theory and Skill/Practical marks proportional to its importance in NOS.
2	The assessment will be conducted online through assessment providers authorised by SSC.
3	Format of questions will include a variety of styles suitable to the PC being tested such as multiple choice questions, fill in the blanks, situational judgment test, simulation and programming test.
4	To pass a QP, a trainee should pass each individual NOS. Standard passing criteria for each NOS is 70%.
5	For latest details on the assessment criteria, please visit www.sscnasscom.com.

				MARKS ALLOCATION	
ASSESSMENT OUTCOME (NOS CODE AND DESCRIPTION)	**ASSESSMENT CRITERIA** (PC)	**TOTAL MARKS**	**OUT OF**	**THEORY**	**SKILLS PRACTICAL**
1. SSC/N0501 (Contribute to the design of software products and applications)	PC1. check their understanding of the Business Requirements Specification (BRS)/User Requirements Specification (URS) with appropriate people	**100**	10	10	0
	PC2. check their understanding of the Software Requirements Specification (SRS) with appropriate people		10	10	0
	PC3. check their understanding of High Level Design (HLD) with appropriate people		10	10	0
	PC4. design basic programming structures to implement functionality in line with requirements defined in BRS/URS, SRS and HLD		30	0	30
	PC5. review their designs with appropriate people		5	5	0
	PC6. analyze inputs from appropriate people to identify, resolve and record design defects and inform future designs		15	5	10

	PC7. document their designs using standard templates and tools		10	0	10
	PC8. comply with their organization's policies, procedures and guidelines when contributing to the design of software products and applications		10	0	10
		Total	100	40	60
2. SSC/N0503 (Develop media content and graphic designs for software products and Applications)	PC1. check their understanding of the Business Requirements Specification (BRS), Software Requirements Specification (SRS), High Level Design (HLD) and Low Level Design (LLD) with appropriate people	**100**	10	10	0
	PC2. access reusable components, media and graphical packages and tools from their organization's knowledge base		10	0	10
	PC3. convert requirements into media content and graphic designs, leveraging reusable components where available		20	0	20
	PC4. review media content and graphic designs with appropriate people and analyze their feedback		10	5	5
	PC5. record any defects and corrective actions taken to inform future work		10	0	10
	PC6. rework media content and graphic designs, incorporating feedback		10	5	5
	PC7. submit media content and graphic designs for approval by appropriate people		10	0	10
	PC8. update their organization's knowledge base with their experiences of the media content and graphic designs developed		10	0	10
	PC9. comply with their organization's policies, procedures and guidelines when developing media content and graphic designs for software products and applications		10	0	10
		Total	100	20	80
3.SSC/N9001 (Manage their work to meet requirements)	PC1. establish and agree their work requirements with appropriate people	**100**	7.5	0	7.5
	PC2. keep their immediate work area clean and tidy		15	7.5	7.5
	PC3. utilize their time effectively		15	7.5	7.5
	PC4. use resources correctly and efficiently		15	7.5	7.5

	PC5. treat confidential information correctly		7.5	0	7.5
	PC6. work in line with their organization's policies and procedures		15	0	15
	PC7. work within the limits of their job role		7.5	0	7.5
	PC8. obtain guidance from appropriate people, where necessary		7.5	0	7.5
	PC9. ensure their work meets the agreed requirements		10	0	10
		Total	100	22.5	77.5
4.SSC/N9002 (Work effectively with colleagues)	PC1. communicate with colleagues clearly, concisely and accurately	**100**	20	0	20
	PC2. work with colleagues to integrate their work effectively with theirs		10	0	10
	PC3. pass on essential information to colleagues in line with organizational requirements		10	10	0
	PC4. work in ways that show respect for colleagues		20	0	20
	PC5. carry out commitments you have made to colleagues		10	0	10
	PC6. let colleagues know in good time if you cannot carry out their commitments, explaining the reasons		10	10	0
	PC7. identify any problems you have working with colleagues and take the initiative to solve these problems		10	0	10
	PC8. follow the organization's policies and procedures for working with colleagues		10	0	10
		Total	100	20	80
5.SSC/N9003 (Maintain a healthy, safe and secure working environment)	PC1. comply with their organization's current health, safety and security policies and procedures	**100**	20	10	10
	PC2. report any identified breaches in health, safety, and security policies and procedures to the designated person		10	0	10
	PC3. identify and correct any hazards that you can deal with safely, competently and within the limits of their authority		20	10	10
	PC4. report any hazards that you are not competent to deal with to the relevant person in line with organizational procedures and warn other people who may be affected		10	0	10

	PC5. follow their organization's emergency procedures promptly, calmly, and efficiently		20	10	10
	PC6. identify and recommend opportunities for improving health, safety, and security to the designated person		10	0	10
	PC7. complete any health and safety records legibly and accurately		10	0	10
		Total	100	30	70
6.SSC/N9004 (Provide data/information in standard formats)	PC1. establish and agree with appropriate people the data/information you need to provide, the formats in which you need to provide it, and when you need to provide it	**100**	15	15	0
	PC2. obtain the data/information from reliable sources		15	0	15
	PC3. check that the data/information is accurate, complete and up-to-date		15	5	10
	PC4. obtain advice or guidance from appropriate people where there are problems with the data/information		5	5	0
	PC5. carry out rule-based analysis of the data/information, if required		20	0	20
	PC6. insert the data/information into the agreed formats		10	0	10
	PC7. check the accuracy of their work, involving colleagues where required		10	0	10
	PC8. report any unresolved anomalies in the data/information to appropriate people		5	5	0
	PC9. provide complete, accurate and up-to-date data/information to the appropriate people in the required formats on time		5	0	5
		Total	100	30	70
7.SSC/N9005 (Develop their knowledge, skills and competence)	PC1. obtain advice and guidance from appropriate people to develop their knowledge, skills and competence	**100**	20	7	13
	PC2. identify accurately the knowledge and skills you need for their job role		14	7	7
	PC3. identify accurately their current level of knowledge, skills and competence and any learning and development needs		14	0	14
	PC4. agree with appropriate people a plan of learning and development activities to address their learning needs		7	0	7
	PC5. undertake learning and development		12	0	12

	activities in line with their plan				
	PC6. apply their new knowledge and skills in the workplace, under supervision		12	0	12
	PC7. obtain feedback from appropriate people on their knowledge and skills and how effectively you apply them		7	0	7
	PC8. review their knowledge, skills and competence regularly and take appropriate action		14	7	7
		Total	100	21	79

Annexure 2: Trainer Prerequisites for Job role: Web Developer mapped to Qualification Pack: SSC/Q0503

Sr. No.	Area	Details
1	**Job Description**	To deliver accredited training service, mapping to the curriculum detailed above, in accordance with the Qualification Pack SSC/Q0503.
2	**Personal Attributes**	Aptitude for conducting training, and pre/ post work to ensure competent, employable candidates at the end of the training. Strong communication skills, interpersonal skills, ability to work as part of a team; a passion for quality and for developing others; well-organised and focused, eager to learn and keep oneself updated with the latest in this field.
3	**Minimum Educational Qualifications**	Minimum Graduate degree/ diploma in web design/ media design or any other related field; Preferred Master's Degree in Media Design
4a	**Domain Certification**	Minimum accepted score in SSC Assessment is 90% per NOS being taught in QP SSC/Q0503. Certification in relevant software competencies: Software Development Certifications in C++, Embedded, C#, C, Java etc., is an added advantage.
4b	**Platform Certification**	Recommended that the Trainer is certified for the Job Role: "Trainer" mapped to the Qualification Pack: "SSC/1402". Minimum accepted score is 70%.
5	**Experience**	Field experience: Minimum 2 years' experience in the same domain Training experience: 1 year preferred

Certificate

CURRICULUM COMPLIANCE TO QUALIFICATION PACK – NATIONAL OCCUPATIONAL STANDARDS

is hereby issued by the

IT-ITES SECTOR SKILLS COUNCIL NASSCOM

for the

MODEL CURRICULUM

Complying to National Occupational Standards of
Job Role/ Qualification Pack: 'Web Developer' QP No. 'SSC/Q0103 NSQF Level 5'

Date of issuance: December 31st, 2015

Valid up to*: December 31st, 2018

* Valid up to the next review date of the Qualification Pack

Authorised Signatory
Lakshmi Narayan
(Chairman, IT-ITeS Sector Skills Council NASSCOM)

4E-Vandana Building (4th Floor)
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Phone: 91-11- 4151 9230/60
Fax: 91-11- 4151 9240
Email: ssc@nasscom.in

Model Curriculum

Software Developer

SECTOR: IT-ITES

OCCUPATION: SUB-SECTOR: IT SERVICES DATA SCIENTISTS

REF. ID: SSC/Q0401, VERSION 1.0
NSQF LEVEL: 7

IT - ITeS SSC NASSCOM

Skill India

N·S·D·C National Skill Development Corporation

Transforming the skill landscape

Certificate

CURRICULUM COMPLIANCE TO QUALIFICATION PACK – NATIONAL OCCUPATIONAL STANDARDS

is hereby issued by the

IT-ITES SECTOR SKILLS COUNCIL NASSCOM

for the

MODEL CURRICULUM

Complying to National Occupational Standards of
Job Role/ Qualification Pack: '**Software Developer**' QP No. '**SSC/Q0901 NSQF Level 7**'

Date of Issuance: December 31st, 2015

Valid up to*: December 31st, 2018

* Valid up to the next review date of the Qualification Pack

Authorised Signatory
Lakshmi Narayan
(Chairman, IT-ITeS Sector Skills Council NASSCOM)

TABLE OF CONTENTS

Software Developer

CURRICULUM / SYLLABUS

This program is aimed at training candidates for the job of **Software Developer** in the **IT-ITeS** Sector/Industry and aims at building the following key competencies in the learner.

Program Name	**Software Developer**		
Qualification Pack Name & Reference ID.	Software Developer SSC/Q0501, version 1.0		
Version No.	1.0	**Version Update Date**	31/12/2015
Pre-requisites to Training	BSc (Stat, Math, Physics, Chemistry, Geology) or BE/ BTech		
Training Outcomes	**After completing this programme, participants will be able to:** • Contribute to the design of software products and applications • Develop software code to specification • Manage their work to meet requirements • Work effectively with colleagues • Maintain a healthy, safe and secure working environment • Provide data/information in standard formats • Develop their knowledge, skills and competence		

The Course encompasses all seven National Occupational Standards (NOS) of Software Developer SSC/Q0501 Qualification Pack issued by IT-ITeS Sector Skills Council NASSCOM.

Sr. No.	Module	Key Learning Outcomes	Equipment Required
1	**Programming and Algorithms** **Theory Duration** (hh:mm) 20:00 **Practical Duration** (hh:mm) 30:00 **Corresponding NOS Code** SSC/N0501	Candidates will be able to: • Design basic programming structures to implement functionality in line with requirements defined in BRS/URS, SRS and HLD	Refer to Unique Equipment Required Section
2	**Analysis and Design of Software Applications** **Theory Duration** (hh:mm) 20:00 **Practical Duration** (hh:mm) 30:00 **Corresponding NOS Code** SSC/N0501	Candidates will be able to: • Check their understanding of the Business Requirements Specification (BRS)/User Requirements Specification (URS) with appropriate people • Check their understanding of the Software Requirements Specification (SRS) with appropriate people • Check their understanding of High Level Design (HLD) with appropriate people • Review their designs with appropriate people • Analyse inputs from appropriate people to identify, resolve and record design defects and inform future designs • Document designs using standard templates and tools • Comply with organization's policies, procedures and guidelines when contributing to the design of software products and applications	Refer to Unique Equipment Required Section

3	**Application Development** **Theory Duration** (hh:mm) 20:00 **Practical Duration** (hh:mm) 80:00 **Corresponding NOS Code** SSC/N0502	Candidates will be able to: • Check their understanding of the Business Requirements Specification (BRS), Software Requirements Specification (SRS), High Level Design (HLD) and Low Level Design (LLD) with appropriate people • Access reusable components, code generation tools and unit testing tools from their organization's knowledge base • Convert technical specifications into code to meet the requirements, leveraging reusable components, where available • Create appropriate unit test cases (UTCs) • Review codes and UTCs with appropriate people • Execute UTCs and document results • Rework the code and UTCs to fix identified defects	Refer to Unique Equipment Required Section

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		• Analyse inputs from appropriate people to inform future designs • Record corrective actions for identified defects to inform future designs • Submit tested code timely for approval by appropriate people • Update their organization's knowledge base with their experiences of the code developed • Comply with their organization's policies, procedures and guidelines when developing software code to specification	
4	**Self and work Management** **Theory Duration** (hh:mm) 12:00 **Practical Duration** (hh:mm) 38:00 **Corresponding NOS Code** SSC/N9001	Candidates will be able to: • Establish and agree their work requirements with appropriate people • Keep their immediate work area clean and tidy • utilize their time effectively • Use resources correctly and efficiently • Treat confidential information correctly • Work in line with organization's policies and procedures • Work within the limits of their job role • Obtain guidance from appropriate people, where necessary • Ensure their work meets the agreed requirements	Refer to Unique Equipment Required Section

5	**Team Work and Communication** **Theory Duration** (hh:mm) 12:00 **Practical Duration** (hh:mm) 38:00 **Corresponding NOS Code** SSC/N9002	Candidates will be able to: • Communicate with colleagues clearly, concisely and accurately • Work with colleagues to integrate their work effectively with them • Pass on essential information to colleagues in line with organizational requirements • Work in ways that show respect for colleagues • carry out commitments they have made to colleagues • Let colleagues know in good time if they cannot carry out their commitments, explaining the reasons • Identify any problems they have working with colleagues and take the initiative to solve these problems • Follow the organization's policies and procedures for working with colleagues	Refer to Unique Equipment Required Section
6	**Managing Health and Safety** **Theory Duration** (hh:mm) 05:00	Candidates will be able to: • Comply with their organization's current health, safety and security policies and procedures • Report any identified breaches in health, safety, and security policies and procedures to the designated person • Identify and correct any hazards that they can deal	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	Practical Duration (hh:mm) 20:00 **Corresponding NOS Code** SSC/ N 9003	with safely, competently and within the limits of their authority • Report any hazards that they are not competent to deal with to the relevant person in line with organizational procedures and warn other people who may be affected • Follow their organization's emergency procedures promptly, calmly, and efficiently • Identify and recommend opportunities for improving health, safety, and security to the designated person • Complete any health and safety	

7	**Data and Information Management** **Theory Duration** (hh:mm) 15:00 **Practical Duration** (hh:mm) 35:00 **Corresponding NOS Code** SSC/N9004	Candidates will be able to: • Establish and agree with appropriate people the data/information they need to provide, the formats in which they need to provide it, and when they need to provide it • Obtain the data/information from reliable sources • Check that the data/information is accurate, complete and up-to-date • Obtain advice or guidance from appropriate people where there are problems with the data/information • Carry out rule-based analysis of the data/information, if required • Insert the data/information into the agreed formats • Check the accuracy of their work, involving colleagues where required • Report any unresolved anomalies in the data/information to appropriate people • Provide complete, accurate and up-to-date data/information to the appropriate people in the required formats on time	Refer to Unique Equipment Required Section
8	**Learning and Self Development** **Theory Duration** (hh:mm) 05:00 **Practical Duration** (hh:mm) 20:00 **Corresponding NOS Code** **SSC/N9005**	Candidates will be able to: • Obtain advice and guidance from appropriate people to develop their knowledge, skills and competence • Identify accurately the knowledge and skills they need for their job role • Identify accurately their current level of knowledge, skills and competence and any learning and development needs • Agree with appropriate people a plan of learning and development activities to address their learning needs • Undertake learning and development activities in line with their plan • Apply their new knowledge and skills in the workplace, under supervision • Obtain feedback from appropriate people on their	Refer to Unique Equipment Required Section
Sr. No.	**Module**	**Key Learning Outcomes**	**Equipment Required**
		knowledge and skills and how effectively they apply them • Review their knowledge, skills and competence regularly and take appropriate action	

	Total Duration **Theory Duration** **109:00** **Practical Duration** **291:00**	**Unique Equipment Required:** Training room should be fully furnished with the following equipment / tools / accessories. Additional / specific resources, wherever applicable (e.g. Hardware, software) are indicated in the main text corresponding to relevant learning outcome. **For Domain NOSs:** • For NOS SSC/N0501: C/C++, UML tools such as Rational suite • For NOS SSC/N0502: JDK / Eclipse General: • Comfortable seats with adequate lighting, controlled temperature and acoustics for training and learning • White Board, Markers and Eraser • Projector with screen • Flip chart with markers • Faculty's PC/Laptop with latest configuration and internet connection • Supporting software / applications for projecting audio, video, recording, • **Presentation Tools to support learning activities:** o Intranet o Email o IMs o Learning management system e.g. Moodle, Blackboard to enable blended learning • Microphone / voice system for lecture and class activities • Handy Camera • Stationery kit – Staples, Glue, Chart Paper, Sketch Pens, Paint Box, Scale, A4 Sheets • For IT Lab sessions: Computer Lab with 1:1 PC: trainee ratio and having internet connection, MS Office / Open office, Browser, Outlook/ other Email Clients • Assessment and Test Tools for day to day online Tests and Assessments • For team discussions: Adequate seating arrangement in full / half circle format for one or more teams as per planned team composition. • Reading Resources: Access to relevant sample documents and learning forums to enable self-study before and after each training session.

Grand Total Course Duration: 400 Hours 0 Minutes
(This Syllabus/Curriculum has been approved by IT-ITeS Sector Skills Council NASSCOM.)

Notes from IT-ITeS Sector Skills Council

1. This document outlines the broad scope of coverage. This should be linked with OBF and training delivery plan.OBF (Outcome based framework) reflects the pedagogy used to ensure an expected outcome. Training delivery plan focuses on the sequence of delivery.

2. Though many NOSs have some seemingly common outcomes, notably core/generic, professional and technical skills, it is imperative to understand the contextual difference between them. For example, writing skills required to communicate results of testing (in SSC/N0501) are different from the writing skills required to prepare a time plan (in SSC/N9001). Training providers are advised to,

a. Embed such skills development in the learning pedagogy for each expected outcome
b. Prepare a detailed session plan for training delivery with focus on sequence and duration of training
c. Run a diagnostic test to assess prior learning of students and help trainers / students identify the need for gap training, optimal duration, and suitable training methodology. Accordingly, more introductory level sessions may be included in guided or self-paced mode of learning. E.g. adding some sessions on Functional English or Use of Internet and MS Office.

Trainer Prerequisites for Job role: Software Developer mapped to Qualification Pack: SSC/Q0501

Sr. No.	Area	Details
1	**Job Description**	To deliver accredited training service, mapping to the curriculum detailed above, in accordance with the Qualification Pack SSC/Q0501.
2	**Personal Attributes**	Aptitude for conducting training, and pre/ post work to ensure competent, employable candidates at the end of the training. Strong communication skills, interpersonal skills, ability to work as part of a team; a passion for quality and for developing others; well-organised and focused, eager to learn and keep oneself updated with the latest in this field.
3	**Minimum Educational Qualifications**	Minimum Bachelor's Degree in Computer Science or any related field; Preferred Master's Degree in Computer Science
4a	**Domain Certification**	Minimum accepted score in SSC Assessment is 90% per NOS being taught in QP SSC/Q0501. Certification in relevant software competencies: Software Development Certifications in C++, Embedded, C#, C, Java etc., is an added advantage.
4b	**Platform Certification**	Recommended that the Trainer is certified for the Job Role: "Trainer" mapped to the Qualification Pack: "SSC/Q1402". Minimum accepted score is 70%.
5	**Experience**	Field experience: Minimum 2 years' experience in the same domain Training experience: 1 year preferred

Annexure: Assessment Criteria

Assessment Criteria for Software Developer	
Job Role	Software Developer
Qualification Pack	SSC/Q0501
Sector Skill Council	IT-ITeS

Sr. No.	Guidelines for Assessment
1	Criteria for assessment for each Qualification Pack (QP) will be created by the Sector Skill Council (SSC). Each performance criteria (PC) will be assigned Theory and Skill/Practical marks proportional to its importance in NOS.
2	The assessment will be conducted online through assessment providers authorised by SSC.
3	Format of questions will include a variety of styles suitable to the PC being tested such as multiple choice questions, fill in the blanks, situational judgment test, simulation and programming test.
4	To pass a QP, a trainee should pass each individual NOS. Standard passing criteria for each NOS is 70%.
5	For latest details on the assessment criteria, please visit www.sscnasscom.com.

				MARKS ALLOCATION	
ASSESSMENT OUTCOME (NOS CODE AND DESCRIPTION)	ASSESSMENT CRITERIA (PC)	TOTAL MARKS	OUT OF	THEORY	SKILLS PRACTICAL
1.SSC/N0501 (CONTRIBUTE TO THE DESIGN OF SOFTWARE PRODUCTS AND APPLICATIONS)	PC1. check their understanding of the Business Requirements Specification (BRS)/User Requirements Specification (URS) with appropriate people	**100**	10	10	0
	PC2. check their understanding of the Software Requirements Specification (SRS) with appropriate people		10	10	0
	PC3. check their understanding of High Level Design (HLD) with appropriate people		10	10	0
	PC4. design basic programming structures to implement functionality in line with requirements defined in BRS/URS, SRS and HLD		30	0	30
	PC5. review their designs with appropriate people		5	5	0
	PC6. analyze inputs from appropriate people to identify, resolve and record design defects and inform future designs		15	0	15
	PC7. document their designs using standard templates and tools		10	0	10
	PC8. comply with their organization's policies, procedures and guidelines when contributing to the design of software products and applications		10	0	10
		Total	100	35	65
2.SSC/N0502 (DEVELOP SOFTWARE CODE TO SPECIFICATION)	PC1. check their understanding of the Business Requirements Specification (BRS), Software Requirements Specification (SRS), High Level Design (HLD) and Low Level Design (LLD) with appropriate people	**100**	5	5	0
	PC2. access reusable components, code generation tools and unit testing tools from their organization's knowledge base		5	0	5
	PC3. convert technical specifications into code to meet the requirements, leveraging reusable components, where available		30	0	30
	PC4. create appropriate unit test cases (UTCs)		10	0	10
	PC5. review codes and UTCs with appropriate people		5	5	0
	PC6. execute UTCs and document results		5	0	5
	PC7. rework the code and UTCs to fix identified defects		10	0	10

	PC8. analyze inputs from appropriate people to inform future designs		5	5	0
	PC9. record corrective actions for identified defects to inform future designs		10	0	10
			5	5	0

				MARKS ALLOCATION	
ASSESSMENT OUTCOME (NOS CODE AND DESCRIPTION)	ASSESSMENT CRITERIA (PC)	TOTAL MARKS	OUT OF	THEORY	SKILLS PRACTICAL
	PC10. submit tested code for approval by appropriate people				
	PC11. update their organization's knowledge base with their experiences of the code developed		5	0	5
	PC12. comply with their organization's policies, procedures and guidelines when developing software code to specification		5	0	5
		Total	100	20	80
3.NOS/N9001 (MANAGE THEIR WORK TO MEET REQUIREMENTS)	PC1. establish and agree their work requirements with appropriate people	**100**	6.25	0	6.25
	PC2. keep their immediate work area clean and tidy		12.5	6.25	6.25
	PC3. utilize their time effectively		12.5	6.25	6.25
	PC4. use **resources** correctly and efficiently		18.75	6.25	12.5
	PC5. treat confidential information correctly		6.25	0	6.25
	PC6. work in line with their organization's policies and procedures		12.5	0	12.5
	PC7. work within the limits of their job role		6.25	0	6.25
	PC8. obtain guidance from appropriate people, where necessary		6.25	0	6.25
	PC9. ensure their work meets the agreed requirements		18.75	6.25	12.5
		Total	**100**	**25**	**75**
4.SSC/N9002 (WORK EFFECTIVELY WITH COLLEAGUES)	PC1. communicate with colleagues clearly, concisely and accurately	**100**	20	0	20
	PC2. work with colleagues to integrate their work effectively with theirs		10	0	10
	PC3. pass on essential information to colleagues in line with organizational requirements		10	10	0
	PC4. work in ways that show respect for colleagues		20	0	20
	PC5. carry out commitments you have made to colleagues		10	0	10

	PC6. let colleagues know in good time if you cannot carry out their commitments, explaining the reasons		10	10	0
	PC7. identify any problems you have working with colleagues and take the initiative to solve these problems		10	0	10
	PC8. follow the organization's policies and procedures for working with colleagues		10	0	10
		Total	**100**	**20**	**80**
5.SSC/N9003 (MAINTAIN A	PC1. comply with their organization's current health, safety and security policies and procedures	**100**	20	10	10

				MARKS ALLOCATION	
ASSESSMENT OUTCOME (NOS CODE AND DESCRIPTION)	ASSESSMENT CRITERIA (PC)	TOTAL MARKS	OUT OF	THEORY	SKILLS PRACTICAL
HEALTHY, SAFE AND SECURE WORKING ENVIRONMENT)	PC2. report any identified breaches in health, safety, and security policies and procedures to the designated person		10	0	10
	PC3. identify and correct any hazards that you can deal with safely, competently and within the limits of their authority		20	10	10
	PC4. report any hazards that you are not competent to deal with to the relevant person in line with organizational procedures and warn other people who may be affected		10	0	10
	PC5. follow their organization's emergency procedures promptly, calmly, and efficiently		20	10	10
	PC6. identify and recommend opportunities for improving health, safety, and security to the designated person		10	0	10
	PC7. complete any health and safety records legibly and accurately		10	0	10
		Total	**100**	**30**	**70**
6.SSC/N9004 (PROVIDE DATA/INFORMATION IN STANDARD FORMATS)	PC1. establish and agree with appropriate people the data/information you need to provide, the formats in which you need to provide it, and when you need to provide it	**100**	12.5	12.5	0
	PC2. obtain the data/information from reliable sources		12.5	0	12.5
	PC3. check that the data/information is accurate, complete and up-to-date		12.5	6.25	6.25
	PC4. obtain advice or guidance from appropriate people where there are problems with the data/information		6.25	0	6.25

	PC5. carry out rule-based analysis of the data/information, if required		25	0	25
	PC6. insert the data/information into the agreed formats		12.5	0	12.5
	PC7. check the accuracy of their work, involving colleagues where required		6.25	0	6.25
	PC8. report any unresolved anomalies in the data/information to appropriate people		6.25	6.25	0
	PC9. provide complete, accurate and up-todate data/information to the appropriate people in the required formats on time		6.25	0	6.25
		Total	**100**	**25**	**75**
7.SSC/N9005 (DEVELOP THEIR KNOWLEDGE, SKILLS AND COMPETENCE)	PC1. obtain advice and guidance from appropriate people to develop their knowledge, skills and competence	**100**	10	0	10
	PC2. identify accurately the knowledge and skills you need for their job role		10	0	10
	PC3. identify accurately their current level of		20	10	10
				MARKS ALLOCATION	
ASSESSMENT OUTCOME (NOS CODE AND DESCRIPTION)	ASSESSMENT CRITERIA (PC)	TOTAL MARKS	OUT OF	THEORY	SKILLS PRACTICAL
	knowledge, skills and competence and any learning and development needs				
	PC4. agree with appropriate people a plan of learning and development activities to address their learning needs		10	0	10
	PC5. undertake learning and development activities in line with their plan		20	10	10
	PC6. apply their new knowledge and skills in the workplace, under supervision		10	0	10
	PC7. obtain feedback from appropriate people on their knowledge and skills and how effectively you apply them		10	0	10
	PC8. review their knowledge, skills and competence regularly and take appropriate action		10	0	10
		Total	**100**	**20**	**80**

IT-ITeS Sector Skill Council
4E-Vandana Building (4th Floor) 11, Tolstoy Marg, New Delhi-110001

Model Curriculum

User Interface (UI) Developer

User Interface (UI) Developer

SECTOR: **IT-ITeS**
SUB-SECTOR: **IT Services**
OCCUPATION: **Application Development**
REFERENCE ID: **SSC/Q0502**
NSQF LEVEL: **7**

Format: ModCur_2015_1_0

Table of Contents

User Interface (UI) Developer

Curriculum / Syllabus

This program is aimed at training candidates for the job of a **User Interface (UI) Developer** in the **IT-ITeS** Sector/Industry and aims at building the following key competencies amongst the learner.

Program Name	**User Interface (UI) Developer**		
Qualification Pack Name & Reference ID.	User Interface (UI) Developer SSC/Q0502		
Version No.	1.0	**Version Update Date**	31/01/2015
Pre-requisites to Training	Bachelor's Degree in Science/Technology/Computers or any graduate course		
Training Outcomes	**After completing this programme, participants will be able to:** • Contribute to the design of software products and applications • Develop software code to specification • Develop media content and graphic designs for software products and applications • Manage your work to meet requirements • Work effectively with colleagues • Maintain a healthy, safe and secure working environment • Provide data/information in standard formats • Develop your knowledge, skills and competence		

This course encompasses all Eight National Occupational Standards (NOS) of **User Interface (UI) Developer** Qualification Pack issued by **IT-ITeS Sector Skills Council NASSCOM**.

Sl. NO	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
1.	Contribute to the design of software products and applications	17:00	33:00	Candidates will be able to: • check your understanding of the Business Requirements Specification (BRS)/User Requirements Specification (URS) with appropriate people • check your understanding of the Software Requirements Specification (SRS) with appropriate people • check your understanding of High Level Design (HLD) with appropriate people • design basic programming structures to implement functionality in line with requirements defined in BRS/URS, SRS and HLD • review your designs with appropriate people analyze inputs from appropriate people to identify, resolve and record design defects and inform future designs document your designs using standard templates and tools • comply with your organization's policies, procedures and guidelines when contributing to the design of software products and applications.	SSC/N0501	Refer to Unique Equipment Required
2.	Develop software code to specification	20:00	80:00	Candidates will be able to: • check your understanding of the Business Requirements Specification (BRS), Software Requirements Specification (SRS), High Level Design (HLD) and Low Level Design (LLD) with appropriate people • access reusable components, code generation tools and unit testing tools from your organization's knowledge base • convert technical specifications into code to meet the requirements, leveraging reusable components, where available • create appropriate unit test cases (UTCs) • review codes and UTCs with appropriate		

				people • execute UTCs and document results • rework the code and UTCs to fix identified defects • analyze inputs from appropriate people to inform future designs • record corrective actions for identified defects to inform future designs • submit tested code for approval by appropriate people • update your organization's knowledge base with your experiences of the code developed comply with your organization's policies, procedures and guidelines when developing software code to specification		
3.	Develop media content and graphic designs for software products and applications	12:00	38:00	Candidates will be able to: • check your understanding of the Business Requirements Specification (BRS), Software Requirements Specification (SRS), High Level Design (HLD) and Low Level Design (LLD) with appropriate people • access reusable components, media and graphical packages and tools from your organization's knowledge base • convert requirements into media content and graphic designs, leveraging reusable components where available • review media content and graphic designs with appropriate people and analyze their feedback • record any defects and corrective actions taken to inform future work • rework media content and graphic designs, incorporating feedback • submit media content and graphic designs for approval by appropriate people • update your organization's knowledge base with your experiences of the media content and graphic designs developed • comply with your organization's policies, procedures and guidelines when developing media content and graphic designs for software products and applications	SSC/N0503	

Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
4.	Manage your work to meet requirements	12:00	38:00	Candidates will be able to: • establish and agree your work requirements with appropriate people • keep your immediate work area clean and tidy • utilize your time effectively • use resources correctly and efficiently • treat confidential information correctly • work in line with your organization's policies and procedures • work within the limits of your job role • obtain guidance from appropriate people, where necessary ensure your work meets the agreed requirements	SSC/N9001	
5.	Work effectively with colleagues	10:00	40:00	Candidates will be able to: • communicate with colleagues clearly, concisely and accurately • work with colleagues to integrate your work effectively with theirs • pass on essential information to colleagues in line with organizational requirements • work in ways that show respect for colleagues • carry out commitments you have made to colleagues • let colleagues know in good time if you cannot carry out your commitments, explaining the reasons • identify any problems you have working with colleagues and take the initiative to solve these problems • follow the organization's policies and procedures for working with colleagues	SSC/N9002	

Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
6.	Maintain a healthy, safe and secure working environment	7:00	18:00	Candidates will be able to: • comply with your organization's current health, safety and security policies and procedures • report any identified breaches in health, safety, and security policies and procedures to the designated person • identify and correct any hazards that you can deal with safely, competently and within the limits of your authority • report any hazards that you are not competent to deal with to the relevant person in line with organizational procedures and warn other people who may be affected • follow your organization's emergency procedures promptly, calmly, and efficiently • identify and recommend opportunities for improving health, safety, and security to the designated person	SSC/N9003	
7.	Provide data/information in standard formats	12:00	38:00	Candidates will be able to: • establish and agree with appropriate people the data/information you need to provide, the formats in which you need to provide it, and when you need to provide it • obtain the data/information from reliable sources • check that the data/information is accurate, complete and up-to-date • obtain advice or guidance from appropriate people where there are problems with the data/information • carry out rule-based analysis of the data/information, if required • insert the data/information into the agreed formats • check the accuracy of your work, involving colleagues where required • report any unresolved anomalies in the data/information to appropriate people provide complete, accurate and upto-date data/information to the appropriate people in the required formats on time	SSC/N9004	

Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
8.	Develop your knowledge, skills and competence	5:00	20:00	Candidates will be able to: • obtain advice and guidance from appropriate people to develop your knowledge, skills and competence • identify accurately the knowledge and skills you need for your job role • identify accurately your current level of knowledge, skills and competence and any learning and development needs • agree with appropriate people a plan of learning and development activities to address your learning needs • undertake learning and development activities in line with your plan • apply your new knowledge and skills in the workplace, under supervision • obtain feedback from appropriate people on your knowledge and skills and how effectively you apply them	SSC/N9005	

Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
	Total Duration:	**95:00**	**305:00**	**Unique Equipment Required:** Training room should be fully furnished with the following equipment / tools / accessories. Additional / specific resources, wherever applicable (e.g. Hardware, software) are indicated in the main text corresponding to relevant learning outcome. **Domain NOS requirements** • Visio, UML, freeminds, mockingbird • HTML 5, CSS, Java Script and SQL • IDEs such as Web Builder, Word Press, Joomla ⌟ Wordpress, psdGraphics etc. • HTML, CSS, Flash, Photoshop, Windows media player, Eclipse, XAMPP **Common requirements** • Comfortable seats with adequate lighting, controlled temperature and acoustics for training and learning • White Board, Markers and Eraser • Projector with screen • Flip chart with markers • Faculty's PC/Laptop with latest configuration and internet connection • Supporting software / applications for projecting audio, video, recording, • Presentation Tools to support learning activities: ○ Intranet ○ Email ○ IMs ○ Learning management system e.g. Moodle, Blackboard to enable blended learning • Microphone / voice system for lecture and class activities ⌟ Handy Camera • Stationery kit – Staples, Glue, Chart Paper, Sketch Pens, Paint Box, Scale, A4 Sheets • For IT Lab sessions: Computer Lab with 1:1 PC:trainee ratio and having internet connection, MS Office / Open office, Browser, Outlook / Any other Email Client and chat tools. • Assessment and Test Tools for day to day online Tests and Assessments • For team discussions: Adequate seating arrangement in full / half circle format for one or more teams as per planned team composition.		

Grand Total Course Duration: **400 Hours 0 Minutes**

*(This syllabus/ curriculum has been approved **IT-ITeS Sector Skills Council NASSCOM**.)*

Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
				❑ Reading Resources: Access to relevant sample documents and learning forums to enable self-study before and after each training session.		

Notes from IT-ITeS Sector Skills Council NASSCOM

1. This document outlines the broad scope of coverage. This should be linked with OBF and training delivery plan. OBF (Outcome based framework) reflects the pedagogy used to ensure an expected outcome. Training delivery plan focuses on the sequence of delivery.
2. Though many NOSs have some seemingly common outcomes, notably core/generic, professional and technical skills, it is imperative to understand the contextual difference between them. Training providers are advised to,
   a. Embed such skills development in the learning pedagogy for each expected outcome
   b. Prepare a detailed session plan for training delivery with focus on sequence and duration of training
3. Run a diagnostic test to assess prior learning of students and help trainers / students identify the need for gap training and suitable training methodology. Accordingly, more introductory level sessions may be included in guided or self-paced mode of learning. E.g. adding some sessions on Functional English or Use of Internet and MS Office.

Annexure1: Assessment Criteria

Assessment Criteria for <QP Name>	
Job Role	**User Interface (UI) Developer**
Qualification Pack	**SSC/Q0502**
Sector Skill Council	**IT-ITeS**

Sr. No.	**Guidelines for Assessment**
1	Criteria for assessment for each Qualification Pack (QP) will be created by the Sector Skill Council (SSC). Each performance criteria (PC) will be assigned Theory and Skill/Practical marks proportional to its importance in NOS.
2	The assessment will be conducted online through assessment providers authorised by SSC.
3	Format of questions will include a variety of styles suitable to the PC being tested such as multiple choice questions, fill in the blanks, situational judgment test, simulation and programming test.
4	To pass a QP, a trainee should pass each individual NOS. Standard passing criteria for each NOS is 70%.
5	For latest details on the assessment criteria, please visit www.sscnasscom.com.

Assessable Outcomes	**Assessment criteria for the outcome**	**Total Mark**	**Out of**	**Theory**	**Skills Practical**
1. SSC/N0501 (Contribute to the design of software products and applications)	PC1. check your understanding of the Business Requirements Specification (BRS)/User Requirements Specification (URS) with appropriate people	**100**	10	10	0
	PC2. check your understanding of the Software Requirements Specification (SRS) with appropriate people		10	10	0
	PC3. check your understanding of High Level Design (HLD) with appropriate people		10	10	0
	PC4. design basic programming structures to implement functionality in line with requirements defined in BRS/URS, SRS and HLD		30	0	30
	PC5. review your designs with appropriate people		5	5	0
	PC6. analyze inputs from appropriate people to identify, resolve and record design defects and inform future designs		15	0	15
	PC7. document your designs using standard templates and tools		10	0	10
	PC8. comply with your organization's policies, procedures and guidelines when contributing to the design of software products and applications		10	0	10
		Total	100	35	65
2. SSC/N0502 (Develop software code to specification)	PC1. check your understanding of the Business Requirements Specification (BRS), Software Requirements Specification (SRS), High Level Design (HLD) and Low Level Design (LLD) with appropriate people	**100**	5	5	0

	PC2. access reusable components, code generation tools and unit testing tools from your organization's knowledge base		10	0	10

Assessable Outcomes	Assessment criteria for the outcome	Total Mark	Out of	Theory	Skills Practical
	PC3. convert technical specifications into code to meet the requirements, leveraging reusable components, where available		10	0	10
	PC4. create appropriate unit test cases (UTCs)		10	0	10
	PC5. review codes and UTCs with appropriate people		5	5	0
	PC6. execute UTCs and document results		10	0	10
	PC7. rework the code and UTCs to fix identified defects		10	0	10
	PC8. analyze inputs from appropriate people to inform future designs		5	5	0
	PC9. record corrective actions for identified defects to inform future designs		10	0	10
	PC10. submit tested code for approval by appropriate people		5	5	0
	PC11. update your organization's knowledge base with your experiences of the code developed		10	0	10
	PC12. comply with your organization's policies, procedures and guidelines when developing software code to specification		10	0	10
		Total	100	20	80
3. SSC/N0503 m (Develop content graphic and for designs softwar products and Applications)	PC1. check your understanding of the Business Requirements Specification (BRS), Software Requirements Specification (SRS), High Level Design (HLD) and Low Level Design (LLD) with appropriate people	**100**	10	10	0
	PC2. access reusable components, media and graphical packages and tools from your organization's knowledge base		10	0	10
	PC3. convert requirements into media content and graphic designs, leveraging reusable components where available		25	0	25
	PC4. review media content and graphic designs with appropriate people and analyze their feedback		10	10	0
	PC5. record any defects and corrective actions taken to inform future work		10	0	10
	PC6. rework media content and graphic designs, incorporating feedback		10	0	10
	PC7. submit media content and graphic designs for approval by appropriate people		5	5	0
	PC8. update your organization's knowledge base with your experiences of the media content and graphic designs developed		10	0	10

	PC9. comply with your organization's policies, procedures and guidelines when developing media content and graphic designs for software products and applications		10	0	10
		Total	100	25	75
4.SSC/N9001 (Manage your work to meet requirements)	PC1. establish and agree your **work requirements** with **appropriate people**	**100**	6.25	0	6.25
	PC2. keep your immediate work area clean and tidy		12.5	6.25	6.25
	PC3. utilize your time effectively		12.5	6.25	6.25
	PC4. use **resources** correctly and efficiently		18.75	6.25	12.5

Assessable Outcomes	Assessment criteria for the outcome	Total Mark	Out of	Theory	Skills Practical
	PC5. treat confidential information correctly		6.25	0	6.25
	PC6. work in line with your organization's policies and procedures		12.5	0	12.5
	PC7. work within the limits of your job role		6.25	0	6.25
	PC8. obtain guidance from **appropriate people**, where necessary		6.25	0	6.25
	PC9. ensure your work meets the agreed requirements		18.75	6.25	12.5
		Total	**100**	**25**	**75**
5.SSC/N9002 (Work effectively with colleagues)	PC1. communicate with colleagues clearly, concisely and accurately	**100**	20	0	20
	PC2. work with colleagues to integrate your work effectively with theirs		10	0	10
	PC3. pass on essential information to colleagues in line with organizational requirements		10	10	0
	PC4. work in ways that show respect for colleagues		20	0	20
	PC5. carry out commitments you have made to colleagues		10	0	10
	PC6. let colleagues know in good time if you cannot carry out your commitments, explaining the reasons		10	10	0
	PC7. identify any problems you have working with colleagues and take the initiative to solve these problems		10	0	10
	PC8. follow the organization's policies and procedures for working with colleagues		10	0	10
		Total	**100**	**20**	**80**
6.SSC/N9003 (Maintain a healthy, safe and secure working environment)	PC1. comply with your organization's current health, safety and security policies and procedures	**100**	20	10	10
	PC2. report any identified breaches in health, safety, and security policies and procedures to the designated person		10	0	10

	PC3. identify and correct any hazards that you can deal with safely, competently and within the limits of your authority		20	10	10
	PC4. report any hazards that you are not competent to deal with to the relevant person in line with organizational procedures and warn other people who may be affected		10	0	10
	PC5. follow your organization's **emergency procedures** promptly, calmly, and efficiently		20	10	10
	PC6. identify and recommend opportunities for improving health, safety, and security to the designated person		10	0	10
	PC7. complete any health and safety records legibly and accurately		10	0	10
		Total	**100**	**30**	**70**
	PC1. establish and agree with appropriate people the data/information you need to provide, the formats	**100**	12.5	12.5	0
Assessable Outcomes	**Assessment criteria for the outcome**	**Total Mark**	**Out of**	**Theory**	**Skills Practical**
7.SSC/N9004 (Provide data/information in standard formats)	in which you need to provide it, and when you need to provide it				
	PC2. obtain the data/information from reliable sources		12.5	0	12.5
	PC3. check that the data/information is accurate, complete and up-to-date		12.5	6.25	6.25
	PC4. obtain advice or guidance from appropriate people where there are problems with the data/information		6.25	0	6.25
	PC5. carry out rule-based analysis of the data/information, if required		25	0	25
	PC6. insert the data/information into the agreed formats		12.5	0	12.5
	PC7. check the accuracy of your work, involving colleagues where required		6.25	0	6.25
	PC8. report any unresolved anomalies in the data/information to appropriate people		6.25	6.25	0
	PC9. provide complete, accurate and up-to-date data/information to the appropriate people in the required formats on time		6.25	0	6.25
		Total	**100**	**25**	**75**
8.SSC/N9005 (Develop your knowledge, skills and competence)	PC1. obtain advice and guidance from appropriate people to develop your knowledge, skills and competence	**100**	10	0	10
	PC2. identify accurately the knowledge and skills you need for your job role		10	0	10

	PC3. identify accurately your current level of knowledge, skills and competence and any learning and development needs		20	10	10
	PC4. agree with appropriate people a plan of learning and development activities to address your learning needs		10	0	10
	PC5. undertake learning and development activities in line with your plan		20	10	10
	PC6. apply your new knowledge and skills in the workplace, under supervision		10	0	10
	PC7. obtain feedback from appropriate people on your knowledge and skills and how effectively you apply them		10	0	10
	PC8. review your knowledge, skills and competence regularly and take appropriate action		10	0	10
		Total	**100**	**20**	**80**

Annexure2: Trainer Prerequisites for Job role: User Interface (UI) Developer mapped to Qualification Pack: SSC/Q0502

Sr. No.	Area	Details
1	**Job Description**	To deliver accredited training service, mapping to the curriculum detailed above, in accordance with the Qualification Pack SSC/Q0502.
2	**Personal Attributes**	Aptitude to conduct training, and pre/ post work to ensure competent, employable candidates at the end of the training. Strong communication skills, interpersonal skills, ability to work as part of a team; a passion for quality and for developing others; well-organised and focused, eager to learn and keep oneself updated with the latest in the mentioned field. The individual should be result oriented. The individual should also be able to demonstrate skills for communication, creative and logical thinking.
3	**Minimum Educational Qualifications**	Bachelor's Degree in Science/Technology/Computers or any graduate course
4a	**Domain Certification**	Minimum accepted score in SSC Assessment is 90% per NOS being taught in SSC/Q0502. Additional certification in computers/technology/ animation/graphics
4b	**Platform Certification**	Recommended that the Trainer is certified for the Job Role: "Trainer" mapped to the Qualification Pack: "SSC/Q1402". Minimum accepted score is 70% per NOS.
5	**Experience**	Field experience: Minimum 2 years' experience in the same domain Training experience: 1 year preferred

Model Curriculum for **User Interface (UI) Developer**

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JSS MAHAVIDYAPEETHA

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JSS COLLEGE OF ARTS, COMMERCE & SCIENCE

(An Autonomous College of University of Mysore)

Re-accredited by NAAC with 'A' grade

OOTY ROAD, MYSORE-570 025, KARNATAKA

Syllabus

B. Voc in Animation and Multimedia

2018-19

COMPUTER SCIENCE DEPARTMENT (UG)

B. Voc in Animation and Multimedia
Certificate – Level 4- Character Designer
(National Competency Certificate)

Semester 1
Vocational Content

MES / N 0501 - Understanding the script

Section – A

Pre-Production Techniques: Ideas, Themes, Concepts, Story Development. Script- Format, Storyboard. Short Film, Documentary, Feature Film. Script Terms, Understanding Genre, Different Types of Genres and Sub Genres, Read-through and Identifying
Character types. Understanding Narration Style, Time, Place and society condition status of the Character. Plot Interpretation. Three act Structure.

Introduction on how to make drawings for animation, Shapes and forms,
About 2d and drawings, Clay modeling, Layout design according to a storyboard.
Human anatomy, skeleton structure, animal anatomy and mythical creatures.
Studying Human and animal movement through sequential drawings, gesture drawing, Caricaturing – fundamentals, Exaggeration, Attitude, Silhouettes, Boundary breaking exercises and warm ups, gesture drawing, Line drawing and quick sketches, Drawing from observation, memory and imagination.

Section – B

1. Story Reading (Read-through)
2. Group Discussion
3. Observation of Character development.
4. Acting (Read-through)

MES / N 0502 - Ensuring consistency across all scenes

Section – A

Introduction to Pencil Drawing- Introduction to basic drawing techniques including proportions and Line, Using Pencils for shading, People and Animals, Proportion in portrait drawing, Highlighting and shadows, Drawings with the help of basic shapes, understanding of the relationship of bones and muscles at rest and in movement to able to translate and maintaining correct volumes.

Introduction to Perspectives: Perspective in 1 point, Perspective in 2 point, Perspective in 3 point, Eye levels, Vanishing point, Significance of Perspective in animation and composition, Humans and animal forms in perspective, Perspective-blocks, boxes and shapes, Scale diagrams in perspective, Different viewpoints, Importance of eye level.

Section – B

1. Drawing Basic shapes
2. Shapes in to forms
3. One-point Perspective - Table
4. Two-points Perspective - Exterior
5. Three-points perspective – Interior
6. Drawing simple characters using simple shapes
7. Drawing cartoons
8. Drawing male characters (6&7 Heads)
9. Drawing Female Characters (4&5 Heads)
10. Drawing an animal Character
11. Drawing a Hybrid Character (Fantasy)

MES / N 0503 - Design Characters

Section – A

Introduction on how to make drawings for animation, Shapes and forms, About 2d and drawings, Clay modeling, Layout design according to a storyboard. Human anatomy, skeleton structure, animal anatomy and mythical creatures. Studying Human and animal movement through sequential drawings, gesture drawing, Caricaturing – fundamentals, Exaggeration, Attitude, Silhouettes, Boundary breaking exercises and warm ups, gesture drawing, Line drawing and quick sketches, Drawing from observation, memory and imagination.

Intro to Raster: Foreground & background, Changing Foreground and Background colors, using the large color selection Boxes and small color swathes, using the Eyedropper tool to sample Image color, changing the Foreground Color While using a Painting Tool. Using Brushes, Selecting the Brush Shape, drawing a vertical and Horizontal Straight lines with any brush, Drawing connecting Straight Lines (at any angle) with any brush, creating a New Brush, Saving Brushes, Loading Brushes, creating a Custom Brushes, Using the Painting Modes, Fade, Airbrush Options, Pencil Options.

Intro to Vector: Understanding paths, views, selection tools, fills and strokes, setting up preferences and color settings, Creating basic geometric shapes with the Shape tools, Using a grid and smart guides to aid symmetrical drawing, Using the Bezier Pen, Direct Selection tool, and Convert tool efficiently, Applying and editing color gradients to filled regions, Creating and using swatches, tints, gradients, and patterns on filled regions.

3D MODELING: Introduction to various 3D modeling Techniques: - Organic Modeling, Mechanical & Technical Modeling. Using Templates for Modeling. Polygon and Patch. Concept of edit meshes and edit poly. Low poly modeling. Modifiers and compound objects. How to manage vertex, faces and polygon selections.

Introduction to, curves, create a curve from a surface edge, isoparm, or curve-on-surface and Bezier curve editing curves, Surface tools, Trimming, Stitching. Sculpting NURBS surfaces, NURBS Modeling Reference, import vector data as curves or generate polygonal surfaces.

Section – B(1)

1. Perspective art.
2. Traditional designs.
3. 2D Character Designing
4. Photo Collage
5. Matt Painting
6. Digital painting
7. 2d Animation basics
8. Gif Animation.

Section – B(2)

1. Modeling an Apple.
2. Modeling a simple Robot Character.
3. Modeling a Human Face.
4. Modeling Human Body.
5. Modeling Prop for Character (Costume).
6. Modeling an animal character.
7. Modeling a Fantasy Character.

MES / N 0513 - Manage and store assets

Section – A

Understanding Management, SOP, research appropriate tools, techniques, technologies and procedures for effective asset storage, Saving the work with appropriate names and/or naming conventions so that it can be identified easily.
Storing the work in an appropriate place using appropriate storage techniques to ensure it is protected from damage.

Making backup copies at appropriate time intervals of any digital files. Routinely archive any work and store it securely in a second location, if required. Identify and retrieve previous work from storage, as required.

Section – B

1. Arranging Materials in order
2. Writing Logs
3. Group discussion on Assets Allocation.
4. Assets handling and Proper storage Techniques
5. Data storage techniques.

MES / N 0104 - Maintain workplace health and safety

Section – A

Understand and comply with the organization's current health, safety and security policies and procedures

Understand the safe working practices pertaining to own occupation. Understand the government norms and policies relating to health and safety including emergency procedures for illness, accidents, fires or others which may involve evacuation of the premises. Participate in organization health and safety knowledge sessions and drills

Section – B

1. Identify the people responsible for health and safety in the workplace, including those to contact in case of an emergency.
2. Identify security signals e.g. fire alarms and places such as staircases, fire warden stations, first aid and medical rooms.
3. Identify aspects of your workplace that could cause potential risk to own and others health and safety.
4. Ensure own personal health and safety, and that of others in the workplace though precautionary measures.
5. Identify and recommend opportunities for improving health, safety, and security to the designated person.
6. Report any hazards outside the individual's authority to the relevant person in line with organizational procedures and warn other people who may be affected.
7. Follow organization's emergency procedures for accidents, fires or any other natural calamity in case of a hazard.
8. Identify and correct risks like illness, accidents, fires or any other natural calamity safely and within the limits of individual's authority.

Semester 1
General Content

L4 – Sem 1 - GC - Communication Language Kannada

ಸಾಹಿತ್ಯ ಘಟಕ

12 ಗಂಟೆಗಳು

1. ಕಾವ್ಯ

1.	ಯಾವ ಕಾಲದ ಶಾಸ್ತ್ರವೇನು ಹೇಳಿದರೇನು?	- ಕುವೆಂಪು
2.	ಪುಟ್ಟ ವಿಧವೆ	- ಬೇಂದ್ರೆ
3.	ರಂಗೋಲಿ	- ಪುತಿನ
4.	ಮುಂಬೈ ಜಾತಕ	- ಜಿಎಸ್ಎಸ್
5.	ಅಡುಗೆ ಮನೆಯ ಹುಡುಗಿ	- ವೈದೇಹಿ
6.	ನನ್ನ ಜನಗಳು	- ಸಿದ್ಧಲಿಂಗಯ್ಯ

2. ಗದ್ಯ — 12 ಗಂಟೆಗಳು

1.	ನಿರಂತರ ನೀರಿಗಾಗಿ ನಿಂತಲ್ಲೇ ಓಟ	- ನಾಗೇಶ್ ಹೆಗಡೆ
2.	ಮಾಹಿತಿ ತಂತ್ರಜ್ಞಾನ : ಒಂದು ಸ್ಥೂಲ ನೋಟ	- ಜಿ.ಎನ್. ನರಸಿಂಹಮೂರ್ತಿ
3.	ಮೂಢನಂಬಿಕೆಗಳ ಬೀಡಿನಲ್ಲಿ	- ಭುವನೇಶ್ವರಿ ಹೆಗಡೆ
4.	ಬೇಡದ ಅತಿಥಿಗಳು	- ಎ ಎನ್ ಮೂರ್ತಿರಾಯರು

ಭಾಷಾ ಘಟಕ

3. ಆಡಳಿತ ಮತ್ತು ವಾಣಿಜ್ಯ ಕನ್ನಡ — 21 ಗಂಟೆಗಳು

1. ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ ಸ್ವರೂಪ ಮತ್ತು ಲಕ್ಷಣ
2. ಸರ್ಕಾರಿ ಪತ್ರ ಸ್ವರೂಪ ಅಧಿಕೃತ ಜ್ಞಾಪನ ಮತ್ತು ಸುತ್ತೋಲೆ
3. ವಿವಿಧ ರೀತಿಯ ಅರ್ಜಿಗಳು - ರಜೆ, ವೇತನ, ಬಡ್ತಿ, ಪದೋನ್ನತಿ ಇತರೆ
4. ವಾಣಿಜ್ಯ ಕನ್ನಡದ ಸ್ವರೂಪ ಮತ್ತು ಲಕ್ಷಣ
5. ವಾಣಿಜ್ಯ ಪತ್ರದ ವಿವಿಧ ಅಂಗಗಳುವಾಣಿಜ್ಯ ಪತ್ರಗಳು- ವಿಚಾರಣಾ ಪತ್ರ, ಆದೇಶ ಪತ್ರ, ಉದರಿಪತ್ರ, ವಸೂಲಿ ಪತ್ರ, ಪರಿಚಯ ಪತ್ರ, ಪರಾಮರ್ಶನ ಪತ್ರ, ವ್ಯವಹಾರೋಜ್ಜೀವನ ಪತ್ರ, ಪರಿಪತ್ರ
6. ಗಣಕದಲ್ಲಿ ಕನ್ನಡ ಕನ್ನಡದ ಅಂತರ್ಜಾಲ ತಾಣಗಳು- ನುಡಿ, ಬರಹ- ಪಾರಿಭಾಷಿಕ ಪದಗಳು
7. ಭಾಷಾಂತರ : ಸ್ವರೂಪ ಮತ್ತು ಲಕ್ಷಣ- ಕನ್ನಡದಿಂದ ಇಂಗ್ಲಿಷಿಗೆ- ಇಂಗ್ಲಿಷಿನಿಂದ ಕನ್ನಡಕ್ಕೆ

ಪರಾಮರ್ಶನ ಗ್ರಂಥಗಳು

1.	ಸಮಗ್ರಕಾವ್ಯ	-	ಜಿ ಎಸ್ ಶಿವರುದ್ರಪ್ಪ
2.	ಬಿಂದು ಬಿಂದಿಗೆ	-	ವೈದೇಹಿ
3.	ಪಕ್ಷಿಕಾಶಿ	-	ಕುವೆಂಪು
4.	ಸಮಗ್ರಕಾವ್ಯ	-	ಬೇಂದ್ರೆ
5.	ಶತ್ರುವಿಲ್ಲದ ಸಮರ	-	ನಾಗೇಶ್‌ಹೆಗ್ಡೆ
6.	ವ್ಯಾವಹಾರಿಕ ಕನ್ನಡ	-	ಎಚ್ ಎಸ್ ಕೆ
7.	ಆಡಳಿತಕನ್ನಡ	-	ಡಾ ಅಶೋಕ್‌ಕುಮಾರ್ ರಂಜೇರ ಮತ್ತು ಇತರರು
8.	ಕಛೇರಿ ಕೈಪಿಡಿ	-	ಕುವೆಂಪು ಕನ್ನಡ ಅಧ್ಯಯನ ಸಂಸ್ಥೆ
9.	ಲೇಖನಕಲೆ	-	ಎಸ್ ಪ್ರಹ್ಲಾದರಾವ್
10.	ಆಡಳಿತಭಾಷೆ ಕೆಲವು ವಿವರಗಳು	-	ಪ್ರಧಾನ ಗುರುದತ್ತ

L4 – Sem 1 - GC - Mathematics:

Unit 1: Algebra

Quadratic and cubic equations – Progressions –Vectors-Scalar product- vector product – vector triple product –standard results and simple problems.

Unit 2: Analytical Geometry

Cartesian coordinate system –Distance formula –section formula –Equation of lines. simple problems –circles –parabola-ellipse-hyperbola-simple problems.

Unit 3: Trigonometry and Calculus

Trigonometric ratios- inverse trigonometric functions –simple problems .

Limits –Rules of differentiation –simple problems.

L4 – Sem 1 - GC – Physics:

PHYSICAL WORLD

Physics: Scope and excitement of physics - Physics, technology and society - Mention of fundamental forces in nature - Nature of physical laws.

UNITS AND MEASUREMENTS

Unit of measurement - System of units - SI units - Fundamental and derived units - Length, mass and time measurements - Accuracy and precision of measuring instruments, Errors in measurement. Significant figures, Numerical problems.

SCALAR AND VECTORS

Scalars and Vectors – Position and displacement vectors - Equality of vectors - Multiplication of a vector by real number, Addition and subtraction of two vectors, Triangle method and parallelogram method.

List of Experiments:

1) To measure diameter of a small spherical body using Vernier Calipers.
2) To measure diameter of a small cylindrical body using Vernier Calipers.
3) To measure internal diameter and depth of a given beaker using Vernier Calipers and hence find its volume.
4) To measure internal diameter and depth of a given calorimeter using Vernier Calipers and hence find its volume.
5) To measure diameter of a given wire using screw gauge.
6) To measure thickness of a given sheet using screw gauge.
7) To measure volume of an irregular lamina using screw gauge.
8) To determine the masses of two different objects using a beam balance.

L4 – Sem 1 – GC - Computer science:

L4-Sem-1-GC: COMPUTER SCIENCE – I

Computer Fundamentals
Unit 1:
Knowing computer: What is Computer, Basic Applications of Computer; Components of Computer System, Central Processing Unit (CPU), VDU, Keyboard and Mouse, Other input/output Devices, Computer Memory, Concepts of Hardware and Software; Concept of Computing, Data and Information; Applications of IECT; Connecting keyboard, mouse, monitor and printer to CPU and checking power supply. Operating Computer using GUI Based Operating System: What is an Operating System; Basics of Popular Operating Systems; The User Interface, Using Mouse; Using right Button of the Mouse and Moving Icons on the screen, Use of Common Icons, Status Bar, Using Menu and Menu-selection, Running an Application, Viewing of File, Folders and Directories, Creating and Renaming of files and folders, Opening and closing of different Windows; Using help; Creating Short cuts, Basics of O.S Setup; Common utilities.

Unit 2:
Programming Development life cycle
Understanding Word Processing: Word Processing Basics; Opening and Closing of documents; Text creation and Manipulation; Formatting of text; Table handling; Spell check, language setting and thesaurus; Printing of word document.

Using Spread Sheet: Basics of Spreadsheet; Manipulation of cells; Formulas and Functions; Editing of Spread Sheet, printing of Spread Sheet.
Introduction to Internet, WWW and Web Browsers: Basic of Computer networks; LAN, WAN; Concept of Internet; Applications of Internet; connecting to internet; What is ISP; Knowing the Internet; Basics of internet connectivity related troubleshooting, World Wide Web; Web Browsing software's, Search Engines; Understanding URL; Domain name; IP Address; Using e-governance website.

Communications and collaboration: Basics of electronic mail; Getting an email account; Sending and receiving emails; Accessing sent emails; Using Emails; Document collaboration; Instant Messaging; Netiquettes.

Small Presentation Making: Basics of presentation software; Creating Presentation; Preparation and Presentation of Slides; Slide Show; Taking printouts of presentation / handouts.

Reference Books:
Computer today by Donald H. Sanders - McGraw-Hill, 1983

Semester 2
Certificate – Level 5- Script Researcher
(National Competency Certificate)

Vocational Content

MES / N 3001 - Understand and detail the concept

Section – A

What Is a Short Story? Finding a Story to Write, A Short Story's Basic Ingredients, Sitting Down to Write.
Choosing a Protagonist, choosing a Point of View, Bringing Your Characters to Life, Tip Sheet: Three-Dimensional Characters, Character's Bio Chart, Giving Your Characters a Voice, Tip Sheet: Dialogue
How Conflict Works in a Short Story, The Protagonist's Predicament, Bad Guys, Hurricanes, and Fatal Flaws, Conflict Equals Suspense.

Scriptwriting terminology: Action, Angle, BG close up, Exterior, fade in fade out, Pan, Parenthetical, POV, Scene Heading, Slug line, SFX, Sotto voce, track with, Voice over, Character name, Cast List, Dialogue, Script Length, Action Description, Extension, Dual-Column Dialogue, Act numbers, Scene Numbers, short lines, dialogue paragraphs, Character Arc.

Section - B
1. Exercises: Generating Ideas.
2. Exercises: Creating Characters.
3. Exercises: Finding Story Conflict.
4. Exercises: Constructing a Plot.
5. Exercises: Making a Setting Vivid.
6. Exercises: Discovering and Developing Your Voice.
7. Public domain material, Protecting the idea, Proof of ownership, Confidentiality agreement, Piracy, Animation Industry in India, Case Study.

MES / N 3002 - Undertake research for scripts

Section - A

Creating Your Own Show, Writing a TV Proposal, Drama and Comedy, Documentary and Reality, Formatting and Presentation, One hour Drama, Procedural, Serialized, Half-hour Comedy or Sitcom, Single-Camera Format, Multi-Camera Format, Limited Series or Miniseries.

Scriptwriting for both short film: Dialogue, Parenthetical, Extension, Shot Transition, Dual-Column Dialogue, Act numbers, Scene Numbers, Cast List, short lines, dialogue paragraphs, Script Styles & Types, Script Length Scene Heading Action Description , Character Name, Dialogue, Parenthetical, Extension, Transition, Shots.

Section - B
1. Do a Research.
2. Understanding the impact on the society.
3. Finding the common interest.
4. Creating the effective narration format.

MES / N 3005 - Assist in drafting scripts

Section – A

Scriptwriting for feature film: Dialogue split by Action, Emphasis in Action, Abbreviations, Short Lines, Dialogue Paragraphs, Montage & Series of Shots, Supers - Titles, Signs, etc, Phone Calls and Intercuts Two people talking at the same time.

Introduction to storyboard: Introduction, Multimedia Storyboarding Tools, The Advantages of Storyboarding, Interactive Storyboarding, Using Interactive Storyboarding to Speed-up the Content-writing Phase, Using Interactive Storyboarding to Speed-up Report Document Production.
Steps of storyboard writing: Storyboard table, Topic, Timeline, Sketches, color scheme, text attributes, Audio, camera angle, Interaction of buttons and text.

Section - B
Understanding Camera terms: Extreme Lon Shot, Long Shot, Mid Shot, Close-up, Extreme Close-up, Over the shoulder. Panning, Tilt, Dolly shot, Crane Shot, Moving Shot.

MES / N 0104 - Maintain workplace health and safety

Section – A
Understand and comply with the organization's current health, safety and security policies and procedures
Understand the safe working practices pertaining to own occupation. Understand the government norms and policies relating to health and safety including emergency procedures for illness, accidents, fires or others which may involve evacuation of the premises. Participate in organization health and safety knowledge sessions and drills

Section – B
1. Identify the people responsible for health and safety in the workplace, including those to contact in case of an emergency.
2. Identify security signals e.g. fire alarms and places such as staircases, fire warden stations, first aid and medical rooms.
3. Identify aspects of your workplace that could cause potential risk to own and others health and safety.

4. Ensure own personal health and safety, and that of others in the workplace though precautionary measures.
5. Identify and recommend opportunities for improving health, safety, and security to the designated person.
6. Report any hazards outside the individual's authority to the relevant person in line with organizational procedures and warn other people who may be affected.
7. Follow organization's emergency procedures for accidents, fires or any other natural calamity in case of a hazard.
8. Identify and correct risks like illness, accidents, fires or any other natural calamity safely and within the limits of individual's authority.

Semester 2
General Content

L5 – Sem 2 - GC - Communication English:

AIMS: 1) To familiarize students with basic English
2) To enable them to develop listening & speaking skills

OBJECTIVES: Students should be able to ___

1) Write English without grammatical errors
2) Speak English Language Effectively and Accurately
3) Listen and understand public announcements and news on TV & Radio

Module – 1 Grammar

1. Subject and Verb Agreement
2. Voice
3. Articles
4. Speech
5. Question tag
6. Framing of Questions

Module – 2 Writing Skills

1. Letter Writing
   Letter of Application/Letter of Grievances/Resume Preparation
2. Comprehension
3. Essay Writing

Module – 3 Speaking Skills

1. Greeting
2. Requesting
3. Enquiring
4. Explaining
5. Reporting
6. Permission
7. Thanking

L5 – Sem 2 - GC - Mathematics:

Section – A

Unit 1: Algebra
Sets –Relation - functions- Mathematical logic and Graph theory, Matrices and determinants –invertible matrices (only 2×2 matrices) - Characteristic equations and Eigen values
(only 2×2 matrices).

Unit 2: Quadric Surfaces
Sphere - Ellipse –Cone-Ellipsoid-Paraboloid-Hyperboloid of one and two sheets – Intersection of Quadric surface and plane – Tetrahedron.

Unit 3: Integration and differential equations
Indefinite and definite integrals –simple problems – Differential equations of first order – separation of variables.

L5 – Sem 2 - GC - Physics:

Section – A

THERMODYNAMICS:
Definition of temperature, heat, change of state, green-house effect, first law of thermodynamics, thermal equilibrium, classification of thermodynamic system, zeroth law of thermodynamics, internal energy, work, isothermal process, adiabatic process, isochoric, Isobaric Process, Second law of thermodynamics, reversible and irreversible process.

MOTION IN A STRAIGHT LINE:
Rest, motion, Position and frame of reference - Definitions of path length and displacement - Definitions of average speed and average velocity, instantaneous speed and instantaneous velocity& uniform and non-uniform motion – Uniformly accelerated motion.

Section – B
List of Experiments:
1) Using a simple pendulum, plot L-T and L-T2 graphs, hence find the effectivelength of second's pendulum using appropriate graph.
2) To find the weight of a given body using parallelogram law of vectors.
3) To determine the coefficient of viscosity of a given liquid by measuring the terminal velocity of a spherical body by stoke's method.
4) To determine Surface tension of Water by capillary rise method.
5) Interfacial between Water and Kerosene.
6) Verification of Lami's theorem.
7) Verification of Gaussian distribution and calculation of standard deviation in a Monte Carlo experiment.
8) Determination of the moment of inertia of an irregular body using Torsional pendulum.

L5 – Sem 2 - GC - Computer Science:

Section - A

1. Concepts of object oriented programming: object class. Encapsulation data hiding Inheritance. Polymorphism. Analysis and design of system using Object Oriented Approach.

2. Structure of a C++Program: Include files, Declaration of an object, Main function, I/O streams.

3. Classes: Class Declaration: Data Members, Member Functions, Private and Public members. Data hiding and encapsulation, arrays within a class. Class function Defection, scope resolution operator, Private and Public member function, Nesting of member functions.

4. Objects: Creating Objects, accessing class data members, Accessing member functions. Arrays of Objects, Objects as function arguments: Pass by value by Reference, Pointers, to Objects.

Section - B

5. Constructors and Destructors: Constructors: Declaration and Definition, Default Constructors, Parameterized Constructors, Copy Constructors. Destructors: Definition and use.

Section - C

6. Function Overloading: Function Overloading: Declaration and definition.

7. Inheritance – Extending Classes: Concept of inheritance, base, derived class, defining derived, classes, visibility modes, private, public, protected; sinle inheritance: private and protected members by member functions of a derived class, multilevel inheritance, nesting of classes.

Reference Books:

Object Oriented Programming with C++ By Balagurusamy- McGraw-Hill,
Object Oriented Programming And C++ By R. Rajaram

PRACTICAL: Practical's based OBJECT ORIENTED PROGRAMING (USING C++)
Objective

Semester 3
Certificate – Level 6 – Animation Director(A)
(National Competency Certificate)

Vocational Content

MES / N 1304 - Communicate requirements to the team

Section - A

Introduction to Communication, Verbal Communication, Face to Face communication, Tone of Voice, Body Language, Physical Communication.

Introduction to Listening Skills, Self-Awareness, Active Listening, Listening in Difficult Situations, Shades of Meaning. Formal Communication, and Informal communication.

Effective Communication: Voice with Emotions, Speaking what you thinking, Having a group discussions, Making Teams and Dividing responsibility.

Section – B

1. Writing Letter
    a. Writing a letter for Long leave
    b. Writing a letter for Pramotion
2. Improvising the Content
    a. Adding an emotional touch to your letter.
    b. Correcting the meaning.
3. Group Discussion and Games for Communication.
    a. Wordless Acting
    b. Famous Pair
    c. Listen, Interpret, Draw
    d. Role-playing and Conflict Resolution
    e. y-o-u-r-n-a-m-e
4. Communication Through Activities.
    a. Listening with Intention
    b. Record/Watch yourself talk
    c. DPR on Given Content.

MES / N 1306 - Direct the animation process

Section – A

Basic Principles in animation: Squash and stretch, Anticipation, Staging, straight ahead and pose to pose, follow through and overlapping action, Slow in and slow out, Arcs, Secondary action, Timing, Exaggeration, Solid drawing, Appeal, Mass and weight, Character acting, Volume, Line of action, Path of action, Walk cycles- animal and human.

Introduction to Sculpting software interface: Mesh Manipulation, Using different, applying strokes, Projection mapping, Dynamic topology, Adding detail to poly mesh, Using symmetry tool, Exporting the mesh.

Introduction to basic material types & procedurals: Study of concepts:- opacity, smoothness, specularity and color. Drawing 2D art templates, Creating complex effects like water fire and smoke. Unwrapping the map for various 3D characters.

Introduction to the mapping and advanced texturing techniques. Shadow maps, Raytraced shadows & radiosity. Concept of lighting system and shadows. Introduction to 3 point, 2 point and dramatic lighting. Creating photo real environments and textures. Applying on to a 3D objects. Understanding how to produce final output, rendering the scene, rendering the effects, network rendering.

Introduction to advance lighting effects: Mental ray rendering and Toon shade rendering. Creating various outputs as per the end user requirements and maintaining the resolution.

Introduction to Character setup: Riggers role, Criteria for a good rig, Joints and skeletons, Creating skeleton hierarchy, Constraints, Forward(FK) and Inverse kinematics(IK), FK, IK joint structures, Animation controllers, Blend shapes, Clusters, Biped Rig- Analyzing reference, Anatomy of human body, Bone placements, Setting up Torso, Biped Arms, Fingers, Legs/Foot controls, Skinning, Facial Rig- Anatomy of a face, The Facial Action Coding System(FACS), Mouth shapes, Phonemes, Animation controllers for Face, Character GUI.

Introduction to Fur, Procedural textures: Inclination, roll and polar, Fur volume and Noise, Painting fur attributes, modifying fur direction, Modifying color of a fur descriptions, Creating nCloth collision, Constraints, Hair System: Artisan, Hair system components, Modify curve tools, Paintfx with hair, Hair collision, Hair system caching, Hairstyles.

Muscle systems Introduction to 3D Muscle system: Components of Muscle, Capsules, Spline based muscle system, Stretch based muscle systems, Muscle Objects and skins, Assigning weights to Muscle skin, Muscle Builder, Muscle Parameters, Custom muscle systems, Wrinkles, fold, jiggle, Slide, Collide, Muscle control.

Section – B(1)

1. Exercises: Ball Bounce (Heavy & Light).
2. Exercises: pendulum.
3. Exercises: Walk Cycle.
4. Exercises: Run.
5. Exercises: Vanilla Walk.
6. Exercises: Animal Walk Cycle.

Section – B(2)
1. Exercises: Human Nose sculpt.
2. Exercises: Human Eyes Sculpt.
3. Exercises: Human Mouth Sculpt.
4. Exercises: Human Ears Sculpt.
5. Exercises: Human Character planning.
6. Exercises: Human Character body sculpting.
7. Exercises: Human Character Face sculpting.

Section – B(3)
1. Exercises: Shading networks.
2. Exercises: Tire Texturing.
3. Exercises: Rusty Automotive Texturing.
4. Exercises: Human Skin Texturing.
5. Exercises: Animal Skin Texturing.
6. Exercises: 2 Point lighting.
7. Exercises: 3 Point lighting.
8. Exercises: Interior lighting (Lamps, Bulbs).

Section – B(4)

1. Exercises: Rigging with Deformers.
2. Exercises: Rigging simple vehicle.
3. Exercises: Rigging cartoon character-Legs.
4. Exercises: Rigging cartoon character- Arms.
5. Exercises: Rigging cartoon character- Face rigging.
6. Exercises: Face expressions using Blend shapes.

Section – B(5)

1. Exercises: Creating fur.
2. Exercises: Creating Hair.
3. Exercises: Simulating Sparks.
4. Exercises: Jiggle animation.
5. Exercises: Adding Muscle System to a human Arm.
6. Exercises: Muscle Weight Paint.

Semester 3
General Content

L6-Sem 3 – GC – Physics:

LAWS OF MOTION
Newton's first law of motion: Concept of inertia and force – Concept of momentum - Newton's second law of motion - Impulse, impulsive force and examples - Newton's third law of motion: Identification of action and reaction pairs with examples in everyday life.

Collisions: Elastic and inelastic collisions

SYSTEMS OF PARTICLES AND ROTATIONAL MOTION
Definitions of a rigid body, translator motion and rotatory motion - Centre of mass of a two-particle system - Mention of expression for position coordinates of centre of mass of (a) n particle system (b) a rigid body and (c) a uniform thin rod.

Section – B

List of Experiments:

1) To study the relation between force of limiting friction and normal reaction and to find the coefficient of friction between surface of a moving block and horizontal surface.

2) To find the downward force, along an inclined plane, acting on a roller due to gravity and study its relationship with the angle of Inclination by plotting graph between force and sinθ

3) Determination of the Moment of inertia of rectangular lamina by using torsional pendulum.

4) Determination of the Moment of inertia of circular lamina by using torsional pendulum.

5) Determination of the acceleration due to gravity and the radius of gyration by using Bar pendulum(Graphical method)

6) Determination of the Moment of inertia of irregular body by using torsional pendulum.

7) To find the force constant and effective mass of a helical spring by plotting T2 –m graph using the method of oscillation.

8) To study the relationship between the temperature of a hot body and time by plotting a cooling curve.

L6-Sem 3 – GC – Electronics:

Unit 1: Introduction to Electronics

AC and DC sources.
Ohm's law – statement and limitations, numerical as applicable. Definition of power and unit. Kirchhoff`s laws- statement and explanation, numerical.
Passive components
Resistors – types, fixed resistors – definition and example. Colour code. Variable resistors – definition and example. Combination of resistors in series and parallel (no derivation) numerical.
Capacitors- Types – fixed Capacitors – definition and example, Variable Capacitors – definition and example. Equivalent of capacitors in series and parallel combination (no derivation) numerical.
Inductors – types – fixed inductor - definition and example. Equivalent of inductors in series and parallel combination (no derivation) numerical.
(15 hrs)

Unit 2: Semiconductor devices

Classification of solids, Introduction to semiconductors – Intrinsic and extrinsic Semiconductors, PN Junction diodes - characteristics.
Mention of Zener diode, tunnel diode, photo diode and LED and their applications.
(15 hrs)

L6-Sem 3 – GC – Computer Science:

Section – A
Unit 1:Python: Introduction, features, First Step with Python, Interactive Mode, Script Mode, Variables and Types, Mutable and Immutable Variables, Keywords, Operators and Operands, Expression and Statements, Input and Output, Comments.
Functions: Introduction, Module, Built in Function, Composition, User Defined Functions, Parameters and Arguments, Scope of Variables, ways of defining Functions.

Conditional and Looping Construct: Control Flow Structure, Looping Constructs.
Strings: introduction, Creating and initializing strings, Strings are immutable, Traversing a string, Strings Operations & string Slicing, String methods & built in functions, Regular expressions and Pattern matching

Section - B
Unit 2:

Lists: Introduction, creating a list, accessing an element of list, traversing a List, Appending in the list, Updating array elements, Deleting Elements, Other functions & methods, List as arguments, Matrix implementation using list, Functions with list, Function call.

Dictionaries: What is dictionary? Key-value pair, Creation, initializing and accessing the elements in a Dictionary, Traversing a dictionary, Creating, initializing values during run time (Dynamic allocation), Appending values to the dictionary, Merging dictionaries: An update, Removing an item from dictionary, Dictionary functions and methods.

Tuples: What is a Tuple? Tuple Creation, Add new element to Tuple, Tuple Assignment, Tuple Slices, Tuple Functions

Reference Books:
Beginning Programming with Python for Dummies by stef Maruch & Aahz Maruch.

L6-Sem 3 – GC – Indian Constitution:

UNIT I
Preamble of the Indian Constitution

a) Salient features of Indian Constitution

UNIT II

a) Fundamental Rights
b) Fundamental Duties
c) Directive principles of State Policy

UNIT III

a) President – Election Method, Powers and Functions
b) The Role of the Prime Minister
c) The Parliament – Structure, Power and Functions(Lok Sabha and Rajya Sabha)
d) Supreme Court – Organization and Jurisdiction

UNIT IV

a) The Role of Governor in the Administration of State
b) Powers and Functions of the Chief Minister
c) Composition, Powers and Functions of both the Houses of State Legislature
d) High Court – Organization and Jurisdiction

Semester 4
Certificate – Level 6 – Animation Director (B)
(National Competency Certificate)

Vocational Content

MES / N 1307 - Direct the post-production process

Advanced Dynamics and pyrotechnics: Introduction to Dynamics, and Dyna motive solver, Particles, Emitters, Fields: Air, Drag, Gravity, Newton, Turbulence, Vortex, Volume, Particle collusions, Particle cache, Goals, Soft bodies, Springs, Rigid bodies, Constraints, Effect: Fire, Smoke, Fireworks, Lightening, Shatter, Curve flow, Surface flow, Rendering particles and effects, Maya Paint Effects, baking simulations, Render types. UNIT – 2 Fluid Effects Introduction to Fluids, Fluid field interaction, Fluid attributes, , Creating a non-dynamic 3d fluid effects, Creating dynamic 3D effect, Creating fire and smoke using Fluid dynamics, creating an ocean.

Introduction to nParticles and Nucleus solver, Nucleus node, Nucleus forces, Nucleus plane, Nucleus attributes, nParticles interaction, nConstraints, nCloth: simulations, nCloth dynamics properties, Working with nConstraints, Tearing cloth, Dynamic Property maps, Simulating cloth on moving character, nParticle caching, nConstraints, Creating Smoke simulations in nParticles, Creating liquid simulations in nParticles, Introduction to nHair, Creating Basic hair style, Creating a dynamic curve simulations.

Introduction to Video Compositing techniques and Colour Keying advanced 2D compositing and Ink paint techniques. Creating color models as per the model sheets. Creating color pallets as required paint and ink fields. Understand the dope sheets / X- sheets in production level. Arranging and adjusting the layers as per X- sheet. Advanced panning of camera and background, multiple cameras for showing depth in-between background, over lay and character layers. Introduction to compositing special effects into a scene using 3d graphics and 3d special effects in 2d layers. Concepts for Broadcast animation for logos, channel IDs and montages. Multi-Layer Compositing, Special Effects, Superimposition and Titling. Exporting various file format outputs as per the end user requirements.

Introduction to Audio Editing sound design in animated films, including recording, gathering audio, editing, mixing, and audio design principles, high-end Pro Tools editing, including use of plug-ins to premix a soundtrack, sound is a catalyst for the imagination, master/slave relationship of picture/sound, sound and memory, psychological implications of sound. Psycho-acoustics and the physics of sound. voice-over, musical composition, psychological role of Sound and aesthetic

3D Compositing and Color Grading: Compositing in Z axis, Creating camera and lights in compositing program, Creating shadows and reflections using layers, Blending videos, Roto Paint, using particles and advanced effects, 3D camera tracking and polishing, Integrating 3 D elements. Using Color correction tools, curve tool, masking and Isolating elements, Using adjustment layer for color grading, Noir theme, color and its meaning and impact on audience.

Advanced Video Editing and Visual Story Narration: post-production strategies, narrative structure, editing rhythms and cutting for performance logging and organization exercises; cutting a short scene provided by the instructor; analysis of editing in a feature film; and active participation in class discussions of student.

Section – B(1)

1. Exercises: 3d Disintegration/Shattering effects.
2. Exercises: Smoke Simulation and Rendering.
3. Exercises: Creating Ocean and waves.
4. Exercises: Creating Fire Blast Simulation-Configuring Container and emitter properties.
5. Exercises: Creating Fire Blast Simulation-Creating Debris.
6. Exercises: Creating Rain and fog.

Section – B(2)

1. Exercises: Video stabilization.
2. Exercises: Chroma Keying & Matte.
3. Exercises: 2D Camera Tracking.
4. Exercises: 3D Camera Tracking.
5. Exercises: 3D Camera Tracking and Alignment.
6. Exercises: Motion Graphics-Planning and Asset preparation
7. Exercises: Motion graphics- Final Animation
8. Exercises: Rotoscopy-Biped
9. Exercises: Rotoscopy-Qudraped.

Section – B(3)

1. Exercises: Adding BG Music.
2. Exercises: Mixing two tracks.
3. Exercises: Recording audio.
4. Exercises: Noise reduction Process.
5. Exercises: Adding Effects.
6. Exercises: Creating Physiological Effects
7. Exercises: Foley Lab.

Section – B(4)

1. Exercises: 3D camera tracking and exporting to 3D Program.
2. Exercises: adjusting Track Points.
3. Exercises: Set extension.
4. Exercises: Match Moving.
5. Exercises: matching Lighting

Section – B(5)

1. Creating Titles using text and images.
2. Storytelling with images.
3. Editing using video effects.
4. 180-degree dialogue shot editing.
5. Editing a Montage (Future, Past).
6. Shooting and editing a documentary- Shoot/Acquiring a footage
7. Shooting and Editing a documentary-Rough cuts
8. Shooting and Editing a documentary-Syncing Audio and Video
9. Shooting and Editing a documentary-Final cut and Export to media format.

Semester 4
General Content

L6 – Sem 4 – GC – Physics:

Section – A

OPTICS:
Reflection, Refraction, Spherical mirror, Concave mirror, refractive index, Relation between focal length and radius of curvature. Laws of Refraction, Snell's law, Dispersion, wave front, interference, diffraction.

CURRENT ELECTRICITY:
Resistance, Capacitance and Inductance, Ohm's law, Current and Voltage, Conductors, Insulators, Semiconductors and Super conductors and their applications, Alternating current and Direct current, Transformers and their constructions, rectification.

Section – B

List of Experiments:
1) To find the focal length of a convex mirror, using a convex lens.
2) To find the refractive index of glass.
3) To find the refractive index of water.
4) To find the focal length of a concave mirror.
5) Verification of ohm's law.
6) To determine effective resistance of two resistances connected in series.
7) To determine effective resistance of two resistances connected in parallel.
8) To determine resistance per unit length of the wire.

L6 – Sem 4 – GC – Physics:

Unit 1: Number Systems, Boolean algebra and Logic gates

Number Systems: Introduction to decimal, binary Inter – Conversion. Addition, Subtraction, Multiplication and Division in binary Number system.
1's and 2's Complement method in binary number system. Subtraction using 1's and 2's compliment
Boolean Algebra: Laws of Boolean Algebra, Logic gates - AND gate, OR gate, NOT gate, NAND gate and NOR gate Logic symbol and truth table
De – Morgan's theorem, simplification of Boolean expressions. Logic circuit for Boolean expressions and vice versa.
Universal gates - NAND gate and NOR gate.

Unit 2: Logic circuit and Memories

Combinational logic circuit: Half adder, Full adder, half subtractor, Full subtractor.
Sequential logic circuit: Flip – flop: RS, D, JK, and T flip - flop.
Shift registers: SIPO, SISO, PISO and PIPO.
Digital computer: Block diagram of digital computer and function of each block.
Semiconductor Memories: Idea of different types of semiconductor memories (RAM, ROM, PROM, EPROM and EEPROM).

L6 – Sem 4 – GC – Computer Science:

Section – A
Unit 1:

Classes in Python: Introduction, Namespaces, Scope Rules, LEGB Rule, Defining Classes, Importance of self, Class Attributes v/s Instance Attributes, Instances attributes, Adding methods dynamically, Accessing Attributes and methods, Accessing Methods, Built in class attributes, Private Members - Limited Support, Data Hiding, Static methods, Destroying Objects (Garbage Collection) Inheritance: Introduction, types of Inheritance, Method-I- By using super() function, Method-II- By using name of the super class, Multiple Inheritance, Overriding Methods, Abstract Methods,

Unit 2:

Linear List Manipulation- Data Structures, Implementation of List in memory, Sequential Memory Allocation, List Operations, Traversal in a List, Insertion of an element in a sorted list, Searching Techniques, Sorting a list.

Stacks and Queues in List: Stack , Push operation, Pop operation, Traversal in a stack, Expression- Conversion of an infix expression to postfix expression, Evaluation of Postfix Expression
Queue- Queue operations,
Data File Handling: Introduction, File access modes:

Exception Handling & Generator Functions: Generator Functions, Advantages of using generator

Reference Books:
Beginning Programming with Python for Dummies by stef Maruch & Aahz Maruch.

Semester 5
Certificate – Level 7 – Live Action Director(A)

Vocational Content

MES / N 1301 (Evaluate production concepts and ideas)
SECTION A

Unit-I: Film as a Storytelling Device- The history of Storytelling - Plays vs. novels vs. film - What is a "story"? - The "idea" vs. "story" vs. "screenplay". Structure of Screen play

Unit -II: The three act screenplay - The scene - Plot points. Script writing formats - Master Scene script format - Split page format – Fiction Script writing - Dramatic structure - Nonfiction forms and formats-Characterization

Unit- III: Narrative, tone, contrast, coincidence, Surprise, Suspense, tension techniques. Nature of protoganists, antoganists. Genres of screenplays. Principles of Characterisation.

Unit-IV Director's preparation. Directors role in film. Introduction to scene study and staging. Beats, fulcrum, dramatic blocks. Scene analysis. Art direction - location - floor management - out- doors and indoors.

Unit-V: Planning - pre-production- Concept, Story development - Casting, Locations, Financing. Production –Shooting, Direction and Cinematography. Distribution and Exhibition.

References:

- Writing the Script by Wells Root ,Jan 15, 1980
- Secrets of Film Writing by Tom Lazarus Jun 2, 2001
- Arora: Encyclopedia of Indian Cinema

SECTION B

Exercises
1. **Story Development (Conceptualization)**
2. **Script Improvisation (Shooting Script)**
3. **Casting and Team building**
4. **Location Scouting**
5. **Working out the finance**
6. **Presentation of full production planning(by PPT)**

MES / N 1302 (Sourcing financiers)

SECTION A
UNIT 1: Film business: distribution and exhibition of films - the basic mechanism of distribution and its relationship to various exhibition platforms. How the entrepreneurship of production relates to the distribution and exhibition.

UNIT 2: Publicity platforms: the who's/when/how's of publicity and a brief exposition of the various platforms available now.
Certification: a brief history and the current structure of central board of film certification. The procedure to go about film certification in India.

UNIT 3: Organizational structure of indian film industry: an overview of the different bodies that regulate and monitor the various constituents directly involved in making and marketing of films in india.
Budgeting for different types of films: relationship between budget, cost and time frame.

SECTION B
Producing practical:

location study: creative/logistics, script breakdown, mix-n-match
Budget top sheet, scheduling & call sheet preparation.

MES / N 1303 (Conceptualise the creative vision)

SECTION A

Unit I: Vision and visualisation - The social conditions and effects of visual objects. Visual culture. Critical visual methodology- Metaphor and metonymy – codes – semiology of the television medium

Unit II: An introduction to compositional interpretation - Colour - Spatial organization – Light - Expressive content- the Oedipus complex – id, ego, super ego – symbols – defence mechanisms – Dreams – Aggression and guilt – psychoanalytic analysis of the media

Unit III: Cultural analysis of visual – semiotics, denotation, connotation and iconography.

Unit IV: Analysis of film and television – six levels of analysis - psychoanalytic understanding of visual images.

Unit V: Selling magic – Breaking the advertising code – commercials and anxiety – Laconian gaze: other ways of seeing -Laura Mulvey and visual pleasure.

SECTION B
Practical Assignment: Actuality - field trip and writing observation report, and write a short film script on its basis. Produce photos of trip.

References:
☐ Media Analysis Techniques, Arthur Asa Berger, SAGE Publications, New Delhi, 1976
☐ Visual Methodologies, Gillian Rose, SAGE Publications, New Delhi, 2001
☐ Mythologies, Paladin. Barthes, R. London, 1973
☐ Techniques of interpretation, Dallas J.R.Ewing. SAGE Publication, New Delhi.

MES / N 1304 (Communicate requirements to the team)

SECTION A
Unit I: Introduction to Communication: Purpose of Communication; Process of Communication; Importance of Communication in Business; Differences between Technical and General Communication; Barriers to Communication; Measures to Overcome the Barriers to Communication.

Unit 2: Types of Communication: Types of Communication; Verbal Communication- Importance of verbal communication- Advantages of verbal communication- Advantages of written communication; Significance of Non-verbal Communication Listening Skills: Listening Process; Classification of Listening; Purpose of Listening; Common Barriers to the Listening Process; Measures to Improve Listening; Listening as an Important Skill in Work Place.

Unit 3: Language for Communication: Language and Communication; General Principles of Writing; Improving Writing Skills, Essentials of good style, Expressions and words to be avoided; Grammar and Usage

Unit 4: Communication in Organizations: Internal Communication; Stake Holders in Internal Communication; Channels of Internal Communication; External Communication; Stake Holders in External Communication; Channels of External Communication.
Communication Network: Scope and Types of Communication Network; Formal and Informal Communication Network; Upward Communication; Downward Communication; Horizontal Communication; Diagonal Communication.

SECTION B:
Practical Assignment:
1.Reading Skills: Reading Skill; Purpose of Reading; Types of Reading; Techniques for Effective Reading.

2. Team Co-ordination: Create small teams of students and assign them in different production role and ask them to prepare a PPT of there production planning.

Semester 5
General Content

L7 – Sem 5 – GC – Advertising-Concepts and Principles:

Section – A

Unit I: Advertising - Definition, Nature, scope, Origin and Growth. Roles of advertising:
Social, Communication, Marketing and Economic.

Unit II: Functions of advertising. - Advertising in marketing mix - Types of advertising - merits and demerits - advertising and consumers - buying systems - target plans.

Unit III: Advertising objectives - Advertising campaign. Conceptualization of Advertising for TV, Radio and Print. Copy, Slogans and Writings.
Media planning - developing media objectives - media budget - selection of media - implementing media plans - pre-testing and launch.
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Unit IV: PR Definition, Elements of PR – functions of PR – Need of PR – Growth of PR in India, - Publicity, propaganda and public opinion Corporate Communication with the public – internal and external - Community Relations.

Unit V: Advertising agencies, Luminaries of Advertising, Advertising Ethics. Corporate Social Responsibilities and Advertising case studies.

SECTION B:
Practical Exercise: Each Student Should Choose a product and have to Create
1. Print Ad
2. Flier
3. Poster
4. Handouts
5. CD Cover
6. Ad video

Reference:

☐ Advertising Basics BovellMichael Newman Wiley, Creative Leaps(Reference), John Wiley & Sons (Asia), 2003
☐ Innovative Promotions That Work, Lisa l.Cyr, Rock Port Publishers, 2006.
☐ Mass Media, Anmol Publications Pvt ltd., J.L Kumar, New Delhi.2006
☐ The Public Relations, 2nd Edtion, Alison Theaker, Routledge, USA, 2004
☐ Public Relations: Theory and Practice, Jane Johnston, Clara Zawawi, Allen & Unwin, 2009

L7 – Sem 5 – GC – Photography and Cinematography:

Section – A

Unit I: History of Photography, Painting and Photography, Types of Cameras – parts and functions of camera

Unit II: Lens and types of lenses for photography - Short, medium and long focal lengths. Exposure – Focusing, aperture, shutter speed, depth of field. Points of View, Composition and perspectives.

Unit III: Kinds of light- indoor and outdoor - Electronic flash and artificial lights. Capturing Colours. Light meters. Accessories and equipments for photography. Aesthetics and Technology.

Unit IV: Photo journalism – Basics of News Photography, specialization of Photography - Nature – Wild life – everyday life - People and places - Sports - Advertising - object photography.

Unit V: Ethical issues in Photography – Codes of Ethics for photographers. Tragedy image, digital improvements, privacy, moral rights of subjects etc., – Basic software of Photo Editing tools.

SECTION B:
Practical Assignments:
1. Intro to DSLR
2. Portrait Photography
3. Landscape Photography
4. Rule of third
5. Shot Composition
6. Camera moments

Reference:

☐ John hedgecoe's, New Introductory Photographic Course, Mitchell Beazley, 1990
☐ , 35mm Photographers Handbook, Pan Macmillan, Julian Clader, John Garrelt 1990
☐ Richard New man, How to take great Photographs at Night, Collins Brown,2003
☐ Photo-Journalism, Terry Hope Rotovision SA, 2001
☐ Lighting for Portrait Photography, Steve Bavister, Rotovision SA, 2001
☐ Roger hicks &Francis schultz, Darkroom basics and beyond, Patterson, 2000

L7 – Sem 5 – GC – Introduction to television broadcasting:

Section – A

Unit I: Origin and Development of Electronic Journalism – Broadcasting System UK, US and other developed and Third World Nations – Comparison.

Unit II: Indian Broadcasting Policy – Major recommendations of committees and working groups – Prasar Bharathi Bill – Question of autonomy.

Unit III: Planning and Production of TV, Radio Programmes – General and Special audience Programmes – Principles of writing for radio – Language – Different formats of radio programmes – Features, Debate, Talks, Drama, Interview etc.,

Unit IV: Planning and Production of TV Programmes – TV crews – Writing for TV –
Visualization – Anatomy of News Cast & News Gathering – Various Programmes – General and Special Audience Programmes - Various formats of TV Programmes – ETV – News, Soaps, Epics, Sports, Talk Shows etc., - TV Commercials – Sponsors – TV News Agencies – Private Channels.

Semester 6
Certificate – Level 7 – Live Action Director(B)

Vocational Content

L7 - Sem 6 – SC - MES / N 1305 (Direct the production process)

SECTION A
Unit I: Direction : Role of a contemporary director, screen grammar, spatial connections, temporal connections, mise-en-scene.

Unit II: Principles of film, narrative form, non-narrative films, dividing a feature film into parts and Genres.

Unit III: Planning, pre-production- Concept / Story development, Scripting / Screen play writing, Budgeting, Casting – Locations - Financing.

Unit IV: Basics of mise-en-scene. Space and time, narrative aspect of mise-en-scene. Cinematographer – set properties - composition, duration of the shot, scene and sequences.

Unit V:. Production – Shooting – Shots and scenes. Direction & Cinematography. Post production- Editing, Editing Equipments Sound recording, Dubbing, Special effects, Graphics & final editing.

Unit V: Architecture of the film's style and plot patterning, Codified formal system of narration devices. Ideological Constraints.
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SECTION B:
Practical Assignment: Students should Submit a Short Film or a Documentary of 5 Minutes
in team or individually.

References

- The Cinema of India(1896-2000), Thoraval, Yves(2000)
- The Subject of Cinema, Roberge, Gaston
- Films for an ecology of Mind, Roberge, Gaston (1977):
- Encyclopedia of indian Cinema, Arora.

L7 - Sem 6 – SC - MES / N 1307 (Direct the post-production process)

SECTION A

Unit I: Direction : Role of a contemporary director, screen grammar, spatial connections, temporal connections, mise-en-scene.

UNIT II : Bird's-eye view of the modern editing process and modern editing terminology
Principles of Video Editing: Various principles of Editing like Contrast, Parallelism, Symbolism, Simultaneity Continuity, Making an edit invisible, Motivation for every edit, Delivering a message, Bearing audio in mind, editing is creating, Control of Overuse technique or Visual effects.
Editing setup:-efficient editing habit, factory-standard systems to support the editing process
Non- Linear Editing (NLE) Concept.
The Three- Point Edit: Understanding Three-Point Editing, Overview of the Three-Point Editing Process, Different Ways to Do Three-Point Editing.
Working in the Timeline / Transitions / Key framing / Applying Filters / NLE Compositing / ColorCorrection & Color Grading / Titling / Final Review &Project.

UNIT III: Stabilizing a Shot , Controling shakey video, Cropping the borders efficently, Analysing and Tracking a Point in the footage, The Tracker Panel & Motion Tracker Options, Corner Pin Tracking, Exporting Track data,
Introduction to Masks, Animating Masks, Working with Mask Interpolation, Basics of Rotoscopy, Analysing the shot for Rotoscopy, Using Masks for Position Key frames, Creating a Simple Rotoscopic Animation.

UNIT IV: Introduction to Particle Playground, Filters, Plugins, Understanding the Gravity, Mass, Vortex, Turbalance, Color, Fields etc.
Animating the Emitter, Key frame animation, Path Animation, Basic expressions, BASIC COMPOSITING, Applying Layer Blending Modes, Creating a Track Matte, Keying & Key light, Compound Effects: Gradient Wipe Displacement Map, Wave World & Caustics, Pre- composing & Nesting.

SECTION B:
Practical Assignment :
1. Arrange the previously shot Rushes in Sequence(Rough cut 1)
2. Dubbing the audio (Recording the audio)
3. Aligning the audio with the Rushes (Rough Cut 2)
4. Compositing the Shots
5. Match moving
6. Finalizing the Edit and Adding Title Card and Credits
7. Rendering the Edit (Exporting)

Reference Books:

1. Eve Light Honthaner, “The Complete film Production Handbook, Volume 1”, Focal Press Publications, 2001, 3rd Illustrated Edition.
2. Adele Droblas and Seth Greenbeg, “Adobe Premiere Pro 2 Bible (W/ Cd)”, Wiley – India Publications, 2007 Edition.
3.J. J. Marshall and Zed Saeed, “After Effects 5 Bible”, John Wiley and Sons Publication, 2002.

L7 - Sem 6 – SC - MES / N 1 308 (Manage the production’s marketing and release)

SECTION A

Unit I: Concept of Brand: Introduction, Role of brand, Advantages of Branding, Core Values of Brand. Brand Equity: Concept, Brand elements. Principles of Branding, Communication Mix Strategy. Brand Media: Communication Channels and techniques, Advertising, Brand
Perception.

UNIT II: Role of media, selection of media for advertising, formulation of message, art of
copywriting. Branding and packaging strategies: Brand equity, image and personality, packaging decisions, perceptual mapping of customers, control aspects of advertising, advertising budget.

UNIT III: Strategic marketing- GAP analysis, Porte’s five force model, Ansoff’s matrix, SWOT analysis, customer relation management.

SECTION B:
Practical Assignment:
Attend a Film Launch event and write a brief Note on it with Photographic reference.

MES / N 0104 - Maintain workplace health and safety

Section – A

Understand and comply with the organization's current health, safety and security policies and procedures

Understand the safe working practices pertaining to own occupation. Understand the government norms and policies relating to health and safety including emergency procedures for illness, accidents, fires or others which may involve evacuation of the premises. Participate in organization health and safety knowledge sessions and drills

Section – B

1. Identify the people responsible for health and safety in the workplace, including those to contact in case of an emergency.
2. Identify security signals e.g. fire alarms and places such as staircases, fire warden stations, first aid and medical rooms.
3. Identify aspects of your workplace that could cause potential risk to own and others health and safety.

4. Ensure own personal health and safety, and that of others in the workplace though precautionary measures.
5. Identify and recommend opportunities for improving health, safety, and security to the designated person.
6. Report any hazards outside the individual's authority to the relevant person in line with organisational procedures and warn other people who may be affected.
7. Follow organisation's emergency procedures for accidents, fires or any other natural calamity in case of a hazard.
8. Identify and correct risks like illness, accidents, fires or any other natural calamity safely and within the limits of individual's authority.

Semester 6
General Content

L7 – Sem 6 – GC – Film Aesthetics and appreciation:

Section – A

Unit I: Introduction - Genres of films – Film History - language, style, grammar, syntax. Film perception: levels of understanding – Film as a medium: Development of cinema as a medium of art and communication.

Unit II: Understanding basic elements of Film: Aesthetics, Acting, Costume, Music Cinematography, Mise-en scene, Sound, Editing, Visual Effects and roles of artists. Film and Meaning.

Unit-III: Classic Film theory and semiotics – Sociology of films - film language - film and psycho – analysis. Post Modernism and structuralism and deconstruction. Post Colonial theory. Impressionism, expressionism, and surrealism - Subjectivity, causality and time and various schools of thoughts.

Unit-IV: Concepts of films – identities and issues - narrative form - non-narrative form- Film style: French New Wave, Soviet Montage Cinema, Asian Cinema.

Unit- V: Indian Classic Cinema. Indian Luminaries of Film and their films. Trend setters. Tamil Cinema and trends - Impact in politics, culture and economy. Film and post modernism - Film and cultural identity: Criticism and Film Review Writing.

Section – B

Practical Assignment: Students must watch select a genre and watch at least 10 movies of that genre and rank them from 1 to 10 with a brief note.

References:

- ☐ Indian Film, Eric Baranenn & Krishnaswamy OVP, 1980 2nd Edition
- ☐ How films are made, Khwaja Ahemad Abbas, National Book Trust, 1977
- ☐ Film as an art and appreciation, Maric Setton, NCERT, New Delhi
- ☐ Cinematography Censorship rules, Govt. of India Press, Nasik, 1969

L7 – Sem 6 – GC – Introduction to modern media:

Section – A

Unit I: Communication – Technology – Genesis – Application of Scientific Advancements – Electronic Revolution – Elementary Idea and about Electronic Devices – Valves – Transmitters, Integrated Circuits etc.,
Amplifiers – Oscillators – Modulators – Antenna etc.,

Unit II: Basic Block Diagram of Telecommunication Systems – Telegraphy – Telephone Exchange – Fax etc., - Telecommunication Networks – Policies.

Unit III: Principles of Radio Communication – Working of Radio Transmitters and Receivers
Elements of Radio Transmitters – Receivers – FM / AM Radio Systems – Narrowcasting.

Unit IV: Printing Technology – Type Faces – Fonts – Point System – Method of Composing Machine, Photo, Computers – VDT – DTP – Printing Methods – Traditional and Modern Methods of Electronic Scanners – Laser Printers – Facsimile.

Unit V: Computers – Digital – Computer Networks – E-Mail – Teleconferencing – Internet
Optical Fiber – Interactive Video – CD ROM – Transponder Data Flows – New Communication Technologies and Social Implications, Social Media, Blogging, Micro Blogging. Etc.,

SECTION B:
Practical Assignment:
Each student should create a Blog and a YouTube Channel.

Reference Books
1. Asok Mitra, Information Imbalance in Asia – AMIC, 1978.
2. Binod C.Agarwal, SITE INSAT.
3. Everett M.Rogers, Communication Technology, The New Media in Society.
4. Everett M. Rogers & Others, India's Information Revolution, Sage Publication, New Delhi, 1986.

L7 – Sem 6 – GC – Introduction to modern media:

Section – A

Unit I: Nature and Principles of Constitution of India (a) Fundamental Rights (b) Rights to Information (c) Freedom of Expression (d) and Freedom of Press in various political setup (i) in Capitalistic (ii) in socialistic Countries (iii) India before and after Independence.

Unit II: Constitutional restrictions on Media – Privileges of Media Personnel – The Indian Penal Code, Indian Evidence Act – Libel – Slander – Defamation – Contempt of Court. The Press Registration of Books Act 1867 – Copy Right Act – Periodical Changes – Post and Telegraphy Act – Official Secrets Act of 1923.

Unit III: Press Council – Working Journalists Act – MRPTC (Monopolies and Restrictive Trade Practice Commission) – Industrial Dispute Act – Incident Representation of Women Act of 19896. Rights and Abilities of the Editor, Printer and Publisher – Editorial autonomy and Independence – Government Information Services and their controls – PIB.

Unit IV: Code of Ethics in Different media – Morality of the Press and Cinema as Private Sectors - Radio and TV as States owned – Public utility undertakings. Evolution of code of ethics for media – Historical Perspectives & details.

Unit V: Freedom and Social Responsibility of Media - Tabloid Journalism – Investigative Journalism. Cable Media, its regulation and laws governing cable media –Internet as a media and the governing of rules of internet.

Reference Books

1. Adhikari Gautam, Press Council, Press Institute of India, New Delhi.
2. Arun Bhattacharjee, The Indian Press, Profession to Industry, Vikas Publication, New Delhi, 1972.
3. Chatterjee P.C., Broadcasting in India, Sage Publication, New Delhi,1988.
4. Christians K. Rozeth Media Ethics, Cases and Moral Reasoning, Longmans, New York/ London, 1987.
5. Clement J. Jones, Mass Media, Code of Ethics and Councils.
6. Durga Das Basu Laws of the Press in India, Joy Print Pack Pvt. Ltd, New Delhi, 1986.

JSS MAHAVIDYAPEETHA

JSS COLLEGE OF ARTS, COMMERCE & SCIENCE

(An Autonomous College of University of Mysore)
B.N. ROAD, MYSURU-570 025 KARNATAKA

B.Sc. (Honors) Degree Programme in Chemistry

NATIONAL EDUCATION POLICY (NEP) – 2020

CHOICE BASED CREDIT SYSTEM (CBCS) WITH MULTIPLE ENTRY AND EXIT OPTIONS

w.e.f.2021-22

SYLLABUS

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B.Sc Programme Syllabus
Syllabi and guide lines for B.Sc., Programme under NEP Scheme
to be implemented in the Department of Chemistry
wef 2021-2022

Course – Physics/ Chemistry (PC)

Year	Sem	Core course	Course code	Title of the paper	Lecture + Practical hours per week	No. of credits			Total credits	Total hours		Maximim marks in theory exam	Continuous Assessment							Total
													Theory				Practicals			
													C1		C2		C1	C2		
						L	T	P		Th	Pr		Test	Assignment	Test	Assignment/ Seminar	Test	Test	Record	
I B.Sc	I	DSC-1 Theory	FSA 42031	Chemistry-1	04	4	-	-	06	56	56	60	10	10	10	10	-	-		100
		DSC-1 Practicals	FSA 42031	Chemistry-DSC-1 Lab	04			2				25	-	-	-	-	10	10	05	50
		OE-1 (Open Elective)		Chemistry in daily life	03	3	-	-	03	42	-	60	10	10	10	10	-	-		100
	II	DSC-2-Theory	FSB 42031	Chemistry-2	04	4	-	-	06	56	56	60	10	10	10	10	-	-		100
		DSC-2 Practicals	FSB 42031	Chemistry-DSC-2 Lab	04			2				25	-	-	-	-	10	10	05	50
		OE-2 (Open Elective)		Molecules of life	03	3	-	-	03	42	-	60	10	10	10	10	-	-		100

B.Sc Programme Syllabus
Syllabi and guide lines for B.Sc., Programme under NEP Scheme
to be implemented in the Department of Chemistry
wef 2021-2022

Course –Chemistry/ Bio-technology (CBt)

Year	Sem	Core course	Course code	Title of the paper	Lecture + Practical hours per week	No. of credits			Total credits	Total hours		Maximim marks in theory exam	Continuous Assessment							Total
													Theory				Practicals			
													C1		C2		C1	C2		
						L	T	P		Th	Pr		Test	Assignment	Test	Assignment/ Seminar	Test	Test	Record	
I B.Sc	I	DSC-1 Theory	FSA 42037	Chemistry-1	04	4	-	-	06	56	56	60	10	10	10	10	-	-		100
		DSC-1 Practicals	FSA 42037	Chemistry-DSC-1 Lab	04			2				25	-	-	-	-	10	10	05	50
		OE-1 (Open Elective)		Chemistry in daily life	03	3	-	-	03	42	-	60	10	10	10	10	-	-		100
	II	DSC-2-Theory	FSB 42037	Chemistry-2	04	4	-	-	06	56	56	60	10	10	10	10	-	-		100
		DSC-2 Practicals	FSB 42037	Chemistry-DSC-2 Lab	04			2				25	-	-	-	-	10	10	05	50
		OE-2 (Open Elective)		Molecules of life	03	3	-	-	03	42	-	60	10	10	10	10	-	-		100

B.Sc Programme Syllabus
Syllabi and guide lines for B.Sc., Programme under NEP Scheme
to be implemented in the Department of Chemistry
wef 2021-2022

Course –Chemistry/ Zoology (CZ)

Year	Sem	Core course	Course code	Title of the paper	Lecture + Practical hours per week	No. of credits			Total credits	Total hours		Maximim marks in theory exam	Continuous Assessment							Total
													Theory				Practicals			
													C1		C2		C1	C2		
						L	T	P		Th	Pr		Test	Assignment	Test	Assignment/ Seminar	Test	Test	Record	
I B.Sc	I	DSC-1 Theory	FSA 42038	Chemistry-1	04	4	-	-	06	56	56	60	10	10	10	10	-	-		100
		DSC-1 Practicals	FSA 42038	Chemistry-DSC-1 Lab	04			2				25	-	-	-	-	10	10	05	50
		OE-1 (Open Elective)		Chemistry in daily life	03	3	-	-	03	42	-	60	10	10	10	10	-	-		100
	II	DSC-2-Theory	FSB 42038	Chemistry-2	04	4	-	-	06	56	56	60	10	10	10	10	-	-		100
		DSC-2 Practicals	FSB 42038	Chemistry-DSC-2 Lab	04			2				25	-	-	-	-	10	10	05	50
		OE-2 (Open Elective)		Molecules of life	03	3	-	-	03	42	-	60	10	10	10	10	-	-		100

Program Outcomes:

By the end of the program the students will be able to:

(Refer to literature on outcome-based education (OBE) for details on Program Outcomes)

1. **PO. 1:** To create enthusiasm among students for chemistry and its application in various fields oflife.
2. **PO. 2:** To provide students with broad and balanced knowledge and understanding of key concepts inchemistry
3. **PO. 3:** To develop in students a range of practical skills so that they can understand and assess risks and work safely measures to be followed in thelaboratory.
4. **PO. 4:** To develop in students the ability to apply standard methodology to the solution of problems inchemistry
5. **PO. 5:** To provide students with knowledge and skill towards employment or higher education in Analytical chemistry or multi-disciplinary areas involvingchemistry.
6. **PO.6:**To provide students with the ability to plan and carryout experiments independently and assess the significance of outcomes and to cater to the demands of chemical Industries of well-trainedgraduates
7. **PO. 7:** To develop in students the ability to adapt and apply methodology to the solution of unfamiliar types ofproblems.
8. **PO. 8:** To instill critical awareness of advances at the forefront of chemical sciences, to prepare students effectively for professional employment or research degrees in chemical sciences and to develop an independent and responsible workethics.

Details of the B.Sc (Honors) degree programme in Chemistry

Semester	Course Type DSC								DSE				OE		
	THEORY	L	T	P	PRACTICALS	L	T	P		L	T	P	L	T	p
I	**A1**	4	0	0	**P-1**	0	0	2					3	0	0
II	**A2**	4	0	0	**P-2**	0	0	2					3	0	0
III	**A3**	4	0	0	**P-3**	0	0	2					3	0	0
IV	**A4**	4	0	0	**P-4**	0	0	2					3	0	0
V	**A5** **A6**	3 3	0 0	0 2	**P-5** **P-6**	0 0	0 0	2 2	A1	3	0	0			
VI	**A7** **A8**	3 3	0 0	0 0	**P-7** **P-8**	0 0	0 0	2 2	A2	3	0	0			
VII	**A9** **A10** **A11**	3 3 4	0 0 0	0 0 0	**P9** **P10**	0 0	0 0	2 2	A3 RESEARCH METHADOLOGY	3 3	0 0	0 0			
VIII	**A12** **A13** **A14**	4 4 3	0 0 0	0 0 0					A4 PROJECT	3 0	0 0	0 6			
TOTAL CREDITS	69								21						

DSC: DISCIPLINESPECIFICCOURSE

DSE: DISCIPLINESPECIFICELECTIVE

OE: OPENELECTIVE.

L : T : P = Lecture : Tutorial :Practical

GENERAL REQUIREMENTS AND OTHER INFORMATIONS.

Scheme of Instructions

1. **Title and Commencement**: As per the university guidelines (12 Ref.letterUA2/379/2016-17).
2. Undergraduate programme offered with multiple entry and exitoptions

   Faculty of Science–
   Certificate – 2 semesters
   Diploma– 4semesters
   Bachelor of Science (B.Sc. 6 Semesters)
   Bachelor of Science. Honors (B.Sc.Hons, 8 Semesters)

3. **Semester and ProgrammeStructure:**

   The credit pattern for the course is L:P

3. **Subject Combinations:** As per the university guidelines (Ref. letterUA2/379/2016-17).
4. **Eligibility forAdmission.**

   For B.Sc program only those students who have completed PUC with chemistry or its equivalent examination with science subjects are eligible.

5. **Medium of Instruction:** The medium of instruction shall beEnglish/Kannada.
6. **Scheme of the Program:** As per the university guidelines (Ref.letterUA2/379/2016-17)**.**
7. **Course Registration**: As per the university guidelines (9.1 to 9.6 Ref.letterUA2/379/2016-17)**.**
8. **Attendance:** As per the university guidelines (10.1 and 10.2 Ref.letterUA2/379/2016-17)
9. **Valuation:**Aspertheuniversityguidelines(Ref.letterAC2(S)/151/2021-22,dated18/08/2021
10. Ifthestudenthaspassedinthepracticalexambysecuringprescribedmarksneednotreappear for the practical exam if he/she has failed in the theoryexam.
11. **PassingCriteria**

    A student is considered to have passed the course, only on securing a minimum of 40% from internal assessment and end examination marks put together.

    A student can take end exam irrespective of the marks scored in internal assessment of a particularcourse

    In case a student secures less than 30% in end exam or absent for end examination, the student is said to have not completed the course. The student shall complete the course by reappearing only the end examination conducted by the university.

    Makeup examination: As per the university guidelines (16. Ref. letterUA2/379/2016-17).

    Percentage and Grading: As per the university guidelines (17 Ref. letter UA2/379/2016-17)**. 18 to 22.**As per the university guidelines (Ref. letterUA2/379/2016-17)

Scheme of Examination for DSC 1 and 2
(I and II Semester)

Credits L : P		**Theory**	**Practical**	**Maximum marks**
4 : 0	**Internal assessment**	**40** C1 = 10 + 10 =20 C2= 10 + 10 =20 (test and assignment)	**25** C1= 10 C2 =10 + Record 5	
0 : 2	**Summative Assessment**	**60** (C3)	**25**	
Duration of the end examination		2 hours	4 hours	
		100	**50**	**150**

Examination and Evaluation

Question paper pattern for DSC 1 and 2
(I and II Semester)

Duration: 2 hours		**Max. Marks**: 60
The question paper contains 3 parts		
Part-A	Answer any 6 out of 8questions **(two questions from eachunit)**	6 X 2 = 12
Part-B (Inorganic Chemistry)	Answer any 2 out of 3 questions	2 x 6 = 12
Part-C (Organic Chemistry)	Answer any 2 out of 3 questions	2 x 6 = 12
Part-D (Physical Chemistry)	Answer any 2 out of 3 questions	2 x 6 = 12
Part-E (Analytical Chemistry)	Answer any 2 out of 3 questions	2 x 6 = 12
Pattern: (3 + 3) / (4 + 2)/(2+2+2)		

Scheme of Examination for Open elective

Credits L : P	Theory	Maximum marks
3: 0	Internal assessment	**40** C1 = 10 + 10 = 20 C2= 10 + 10 = 20 (test and assignment)
	Summative assessment	**60** (C3)
Duration of the end examination		2 hours
		100

Question paper pattern for Open elective (I to IV Semester)

Duration: 2 hours		**Max. Marks**: 60
The question paper contains 2 parts		
Part-A	Answer any 6 out of 8 questions	6 X 2 = 12
Part-B	Answer any 8 out of 10 questions	8 x 6 = 48
Pattern: Pattern: (3 + 3) / (4 + 2)/(2+2+2)		

I SEMESTER

DSC-1: Chemistry-1

CLASS DURATION – THEORY: 04 HOURS/WEEK

Theory and Practicals: Total Credits-06 (Theory-04, Practicals-02)

UNIT –I – Analytical chemistry

Language of analytical chemistry: Definitions of analysis, determination, measurement, techniques and methods. Classification of analytical techniques.Choice of an analytical method - accuracy, precision, sensitivity, selectivity, method validation.Figures of merit of analytical methods and limit of detection (LOD), Limit of quantification (LOQ), linear dynamic range (working range).

Errors and treatment of analytical data: Limitations of analytical methods – Errors: Determinate and indeterminate errors, absolute error, relative error, minimization of errors. Statistical treatment of finite samples -mean, median, range, standard deviation and variance. External standard calibration - regression equation (least squares method), correlation coefficient (R2).

Numerical problems

Basic laboratory practices, calibration of glassware (pipette, burette and volumetric flask), Sampling (solids and liquids), weighing, drying, dissolving, Acid treatment, Rules of work in analytical laboratory, General rule for performing quantitative determinations (volumetric and gravimetric), Safety in Chemical laboratory, Rules of fire prevention and accidents, First aid. Precautions to be taken while handling toxic chemicals, concentrated/fuming acids and organic solvents.

UNIT-II: Inorganic Chemistry

Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, significance of ψ and $\psi 2$. Quantum numbers and their significance.

Normalized and orthogonal wave functions. Sign of wave functions. Radial and angular wave functions for hydrogen atom. Radial and angular distribution curves. Shapes of s, p, d and f orbitals. Contour boundary and probability diagrams.

Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations-Electronic configurations of the elements (Z=1-30), effective nuclear charge, shielding/screening effect, Slater's rules. Variation of effective nuclear charge inPeriodicTable. **[14Hours]**

UNIT-II: Organic Chemistry

Classification and nomenclature of organic compounds, Hybridization, Shapes of organic molecules, Influence of hybridization on bond properties.

Nature of bonding in Organic molecules

Formation of Covalent bond, Types of chemical bonding, localized and delocalized, conjugation and cross conjugation, concept of resonance, electronic displacements: Inductive effect, Electromeric effect, Resonance and Hyper conjugation, cross conjugation explanation with examples. Concept of resonance, aromaticity, Huckel rule, anti-aromaticity explanation with examples. Strengths of Organic acid and bases: Comparative study with emphasis on factors effecting pK values. Relative strength of aliphatic and aromatic carboxylic acids-Acetic acid and chloroacetic acid, acetic acid and propionic acid, acetic acid and Benzoic acid. Steric effect- Relative stability of trans and cis-2-butene.

Mechanisms of Organic Reactions

Notations used to represent electron movements and directions of reactions- curly arrows, formal charges. Types of bonds breaking- homolytic and heterolytic.Types of reagents-Electrophiles, nucleophiles, nucleophilicity and basicity.Types of organic reactions- substitution, addition, elimination, rearrangement and pericyclic reactions, explanation withexamples.

Chemistry of Aliphatic hydrocarbons, Carbon-Carbon Sigmabonds

Chemistry of alkanes: Formation of alkanes, Wurtz reaction, Wurtz-Fittig reaction, Free radical substitution, Halogenation- relative reactivity and selectivity

Carbon-carbon pi bonds

Formation of alkenes and alkynes by elimination reaction.Mechanism of E1, E2, E1cb reaction.Saytzeff and Hofmann eliminations.Addition of HBr to propene, Free radical addition of HBr to propene. Addition of halogens to alkenes-carbocation and halonium ion mechanism.Stereospecificity of halogen addition.Ozonolysis mechanism - ozonolysis of propene.Addition of hydrogen halides to alkenes, mechanism, regioselectivity and relative rates of addition. Hydrogenation, hydration, hydroxylation and epoxidation of alkenes, explanation with examples, 1,2 and 1,4- addition reactions in conjugated dienes. Diels-Alder reaction, Allylic and benzylicbromination and mechanism in propene, 1-butene, 1-toluene and ethylbenzene.

[14 hours]

UNIT-III: Physical Chemistry

Gaseous State

Elementary aspects of kinetic theory of gases, Ideal and real gases. Boyle temperature (derivation not required), Molecular velocity, collision frequency, collision diameter, Collision cross section, collision number and mean free path and coefficient of viscosity, calculation of σ and η, variation of viscosity with temperature and pressure.

Maxwell's Boltzmann distribution law of molecular velocities (Most probable, average and root mean square velocities).Relation between RMS, average and most probable velocity and average kinetic energies. (Mathematical derivation not required), law of equipartition of energy.

Behaviour of real gases: Deviation from ideal gas behaviour. Compressibility factor (Z) and its variation with pressure for different gases. Causes of deviation from ideal behaviour, vander Waals equation of stat (No derivation) and application in explaining real gas behaviour. Critical phenomena - Andrewsisotherms of CO_2, critical constants and their calculation from van der Waals equation, Continuity of states, Law of corresponding states. Numerical problems.

Liquid State

Surface Tension: Definition and its determination using stalagmometer, effect of temperature and solute on surface tension

Viscosity: Definition, Coefficient of viscosity. Determination of viscosity of a liquid using Oswald viscometer.Effect of temperature, size, weight, shape of molecules and intermolecular forces.

Refraction: Specific and molar refraction- definition and advantages. Determination of refractive index by Abbes Refractometer.Additive and constitutive properties.

Parachor: Definition, Atomic and structure parachor, Elucidation of structure of benzene and benzoquinone. Viscosity and molecular structure.Molar refraction and chemicalconstitution.Numerical Problems. [14Hours]

I Semester Practicals

CHEMISTRY-DSC 1 LAB: 04HOURS/WEEK

Content of Practical Course 1: List of Experiments

PART-A Inorganic Chemistry

1. Preparation of standard sodium carbonate solution and standardization of hydrochloricacid solution (methyl orange indicator). Estimation of sodium hydroxide present in the solution using phenolphthalein indicator.
2. Determination of carbonate and hydroxide present in amixture.
3. Determination of oxalic acid and sodium oxalate in a given mixture usingstandard$KMnO_4$/NaOHsolution
4. Estimation of ferrous and ferric iron in a given mixture using standard potassiumdichromate solution
5. Preparation of standard oxalic acid solution and standardization of potassiumpermanganate solution. Estimation of hydrogen peroxide present in thesolution.
6. Preparation of standard oxalic acid solution and standardization of potassiumpermanganate solution. Estimation of ferrous ammonium sulphate present in thesolution.

PART-B Organic Chemistry

1. Preparation of acetanilide from aniline using Zn/acetic acid (Greenmethod).
2. Synthesis of p-nitro acetanilide from acetanilide using nitratingmixture.
3. Bromination ofacetanilide
4. Hydrolysis of methyl m-nitrobenzoate to m-nitrobenzoic acid (Conventionalmethod)
5. Synthesis of diazoaminobenzene from aniline (conventionalmethod).
6. Preparation of dibenzalacetone (Greenmethod).

LEARNING OUTCOMES / COURSE OUTCOMES

Chemistry as Discipline Specific Course (DSC)

B.Sc. Semester – I

CHEMISTRY:1

- The concepts of chemical analysis, accuracy, precision and statistical datatreatment
- Prepare the solutions after calculating the required quantity of salts in preparing the reagents/solutions and dilution of stocksolution.
- Describe the dual nature of radiation and matter; dual behavior of matter and radiation, de Broglie's equations, Heisenberg uncertainty principle and their relatedproblems.
- Quantum mechanics. Derivation of Schrodinger's wave equation.Radialand angularOrbital shapes of s, p, d and f atomic orbitals, nodal planes. Electronic configurations of theatoms.
- Pauli's exclusion principle, Hund'srule ,Aufbau's principle and itslimitation.
- The concepts of Organic reactions and techniques of writing the movement of electrons, bond breaking, bondforming
- The Concept of aromaticity, resonance, hyper conjugation,etc.
- Explain bond properties, electron displacement effects (inductive effect, electrometric effect, resonance effect and Hyper conjugation effect). steric effect and their applications in explaining acidic strength of carboxylic acids, basicity ofamines.
- Understand basic concept of organic reaction mechanism, types of organicreactions.
- Understand the preparation and reactions of alkanes.
- Understand the stability and conformational analysis ofcycloalkanes.
- Understand the concept of resonance ,aromaticity andantiaromaticity.
- Describe relative strength of aliphatic and aromatic carboxylicacids.
- Explain the existence of different states of matter in terms of balance between intermolecular forces and thermal energy of the particles. Explain the laws governing behavior of ideal gases and real gases. Understand cooling effect of gas on adiabatic expansion
- Understand the conditions required for liquefaction of gases. Realize that there is continuity in gaseous and liquidstate.
- Understand the properties of liquids in terms of intermolecularattractions.
- Understandtheexistenceofdifferentstatesofmatterintermsofbalancebetween

intermolecular forces and thermal energy of the particles. Explain the laws governing behavior of ideal gases and real gases. Understand cooling effect of gas on adiabatic expansion

- Understand the conditions required for liquefaction of gases. Realize that thereis continuity in gaseous and liquidstate.
- Understand the properties of liquids in terms of intermolecularattractions.

CHEMISTRY LAB (volumetric (inorganic) and Organic preparations):P-1

After studying this course and performing the experiments set in it student will be ableto:

1. Basic concepts involved in titrimetric analysis, primary standard substances, preparationof standardsolutions.
2. Explain the principles of acid-base, redox and iodometrictitrations.
3. Work out the stoichiometric relations based on the reactions involved in the titrimetricanalysis.
4. Describe the significance of organic quantitativeanalysis.
5. Understand the preparation of organic compounds involving addition, substitution, hydrolysis, diazotization and condensationreactions.

II SEMESTER

DSC-2: Chemistry-2

CLASS DURATION – THEORY: 04 HOURS/WEEK

Theory and Practicals: Total Credits-06 (Theory-04, Practicals-02)

UNIT-I: Analytical Chemistry

Titrimetric analysis: Basic principle of titrimetric analysis. Classification, Preparation and dilution of reagents/solutions.Normality, Molarity and Mole fraction. Use of N1V1= N2V2 formula, Preparation of ppm level solutions from source materials (salts), conversion factors.

Acid-base titrimetry: Titration curves for strong acid vs strong base, weak acid vs strong base andweak base vs strong acid titrations. Titration curves, Quantitative applications – selecting and standardizing a titrant, inorganic analysis - alkalinity,acidity.

Complexometrictitrimetry: Indicators for EDTA titrations - theory of metal ion indicators, titration methods employing EDTA - direct, back, displacement and indirect determinations, Application-determination of hardness of water.

Redox titrimetry: Balancing redox equations, calculation of the equilibrium constant of redox reactions, titration curves, Theory of redox indicators, calculation of standard potentials using Nernst equation. Applications.

Precipitation titrimetry: Titration curves, titrants and standards, indicators for precipitation titrations involving silver nitrate- Volhard's and Mohr's methods and their differences.

Gravimetric Analysis: Requisites of precipitation, mechanism of precipitation, Factors influencing precipitation, Co-precipitation, post-precipitation, Advantages of organic reagents over inorganic reagents, reagents used in gravimetry (8-hydroxy quinoline (oxine) and dimethyl glyoxime (DMG).

Numerical problems on all the above aspects.

[14 hours]

Unit – II Inorganic chemistry

s, p, d and f-block elements, the long form of periodic table. Detailed discussion of the following properties of the elements, with reference to s and p-block elements:

(a) Atomic radii (van der Waals)

(b) Ionic and crystalradii.

(c) Covalent radii

(d) Ionization enthalpy, successive ionization enthalpies and factors affectingionization energy. Applications of ionizationenthalpy.

(e) Electron gain enthalpy, trends of electron gainenthalpy.

(f) Electronegativity, Pauling's/ Mulliken's/ Allred Rachow's/ and Mulliken-Jaffé's electronegativity scales. Variation of electronegativity with bond order, partialcharge, hybridization, groupelectronegativity.

Trends in the chemistry of the compounds of groups 13 to 17 (hydrides, carbides, oxides and halides) are to be discussed.

[14 hours]

Unit – III Organic chemistry

Nucleophilic substitution at saturated carbon. Mechanism of SN1 and SN2 reactions with suitable

examples. Energy profile diagrams, Stereochemistry and factors effecting SN1 and SN2 reactions.
Aromatic Electrophilic substitution reactions, Mechanisms, σ and π complexes, Halogenation, Nitration, Sulphonation, Friedel Crafts alkylation and acylation with their mechanism. Activating and deactivating groups. Orientation influence, Ortho-para ratio.
Aromatic nucleophilic substitution reaction: SNAr and Benzyne mechanism with suitable examples

[14 hours]

Unit – IV Physical Chemistry

Liquid Crystals

Explanation, classification with examples- Smetic, nematic, cholesteric, dics shaped and polymeric.Structures of nematic and cholesteric phases-molecular arrangements in nematic and cholesteric liquid crystals.Applications of liquid crystals in LCDs and thermal sensing.

Solids

Forms of solids: Unit cell and space lattice, anisotropy of crystals, size and shape of crystals,
Laws of Crystallography: Law of constancy of interfacial angles, Law of rational indices, Law of symmetry (Symmetry elements), Crystal systems, Bravais lattice types and identification of lattice planes.
Miller indices and its calculation, X–Ray diffraction by crystals: Bragg's law and derivation of Bragg's equation, Single crystal and powder diffraction methods. Defects in crystals, glasses and liquid crystals.Numerical problems.

Distribution Law

Nernst Distribution Law - Statement and its derivation. Distribution constant, factors affecting distribution constant, validity of Distribution Law, Modification of distribution law when molecules undergo a) Association b) Dissociation.Application of Distribution Law in Solvent extraction. Derivation for simple and multiple extraction. Principles of distribution law in Parkes Process of desilverisation of lead. Numerical Problems.

[14 hours]

II Semester Practicals

CHEMISTRY-DSC 2 LAB: 04HOURS/WEEK

Content of Practical Course 2: List of Experiments

PART-A Physical Chemistry

1. Determination of density using specific gravity bottle and viscosity of liquids using Ostwald'sviscometer(Ethylacetate,Toluene,Chloroform,Chlorobenzeneoranyothernon-hazardousliquids)
2. Determinationofthedensityusingspecificgravitybottleandsurfacetensionofliquidsusing Stalagmometer (Ethyl acetate, Toluene, Chlorobenzene, any other non-hazardousliquids
3. Determination of the composition of liquid mixture by refractometry. (Toluene & Alcohol, Water &Sucrose)
4. Determination of partition/distribution coefficient - i) Acetic acid in waterandcyclohexane. ii) Acetic acid in Water and Butanol. iii) Benzoic acid in water and toluene.

5. Determination of rate constant of decomposition of H2O2 catalyzed byFeCl3
6. Determination of percentage composition of NaCl solution by determining miscibility temperature of phenol-watersystem.

PART-B Analytical Chemistry

1. Determination of alkali present in soaps/detergents using standardHCl
2. Determination of iron(II) using potassiumdichromate
3. Determination of oxalic acid using standard potassium permanganate solution
4. Determination of hardness of water Standardized EDTAsolution
5. Determination of alkali content in antacids using standard HClsolution.
6. Determination of chlorine in bleeching powder by iodometry (standard solution to begiven)

LEARNING OUTCOMES / COURSE OUTCOMES

Chemistry as Discipline Specific Course (DSC)

B.Sc. Semester II

CHEMISTRY:2

- Understand principles of titrimetricanalysis.
- Understand principles of different type's titrations. Titration curves for all types ofacids
  - basetitrations.
- Gain knowledge about balancing redox equations, titration curves, theory ofredox indicators andapplications.
- Understand titration curves, indicators for precipitation titrations involvingsilver nitrate- Volhard'sand Mohr's methods and theirdifferences.
- Indicators for EDTA titrations - theory of metal ion indicators. Determination of hardness ofwater.
- Understand periodic table, classification and properties of s p d and f blockelements
- Understand different scales for the measurement of electro-negativity and factors affectingit.
- Understand the chemistry of the hydrides, carbides, oxides and halides of group 13 to17
- Understand nucleophilic substitution at saturated carbon, energy profile diagramstereochemistry and factors affecting S_N^1 and S_N^2 reactions.
- Aromatic electrophilic substitution reactions like nitration sulphonationFriedel-Crafts reactions etc
- Understand liquid crystals, classification withexamples
- Understand the different forms of solids, laws of crystallography , miller indices andits calculation, X-ray diffraction studies. Brags law and itsequation

- Defects in solids , properties of glasses and concept of liquidcrystals

CHEMISTRY LAB (volumetric (inorganic) and Organic preparations): P-1

After studying this course and performing the experiments set in it student will be able to:

1. Basic concepts involved in titrimetric analysis, primary standard substances, preparation of standardsolutions.
2. Explain the principles of acid-base, redox and iodometrictitrations.
3. Describe the significance of inorganic quantitativeanalysis.
4. Determine of density followed by the determination of viscosity and surface tension of different liquidsamples.
5. Determination of partition coefficient of different liquidmixtures
6. Determination of rate constant in the decomposition reaction of hydrogenperoxide

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2. Organic Chemistry - M. K. Jain, Nagin& Co.,1987.
3. Organic Chemistry- Mehta and Mehta, PHI Learning Pvt. Ltd, NewDelhi,2005.

Physical Chemistry

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2. Castellan, G.W. Physical Chemistry, 4th Ed. Narosa,2004.
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4. P.W. Atkins: Physical Chemistry,2002.
5. W.J. Moore: Physical Chemistry,1972.
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8. Principles of Physical Chemistry - B. R. Puri, L. R. Sharma and M. S. Patania, S. L. N. Chand & Co.1987.
9. Physical Chemistry - Alberty R. A. and Silbey, R. J. John Wiley and sons,1992.
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11. Physical Chemistry (3rd Edition) - Gilbert W. Castilian, Narosa Publishing House,1985.
12. Chemical Kinetics by K. J. Laidler, Tata McGraw Hill Publishing Co., NewDelhi.
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Analytical Chemistry

1. Jeffery, G.H., Bassett, J., Mendham, J.& Denney,R.C.
2. Vogel's Textbook of Quantitative Chemical Analysis, John Wiley & Sons,1989.
3. Willard, H. H., Merritt, L.L., Dean, J. & Settle, F.A. Instrumental Methods of Analysis, th
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4. Christian, G.D; Analytical Chemistry, VI Ed. John Wiley & Sons, New York,2004.
5. Harris, D. C. Exploring Chemical Analysis, Ed. New York, W.H. Freeman,2001.
6. Skoog, D. A. Holler F.J. &Nieman, T.A. Principles of Instrumental Analysis,Cengage Learning India Ed,2017.
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Open Elective Course - Semester – I

Title of the Course: OE-1: CHEMISTRY IN DAILY LIFE

Unit- I

Dairy Products: Composition of milk and milk products. Analysis of fat content, minerals in milk and butter.Estimation of added water in milk. Beverages: Analysis of caffeine in coffee and tea, detection of chicory in coffee, chloral hydrate in toddy, determination of methyl alcohol in alcoholic beverages.

Food additives, adulterants, and contaminants- Food preservatives like benzoates, propionates, sorbates, disulphites. Artificial sweeteners: Aspartame, saccharin, dulcin, sucralose, and sodium cyclamate. Flavors: Vanillin, alkyl esters (fruit flavors), and monosodium glutamate.

Artificial food colorants: Coal tar dyes and non-permitted colors and metallic salts. Analysis of pesticide residuesinfood. [14 hours]

Unit- II

Vitamins: Classification and Nomenclature. Sources, deficiency diseases, and structures of Vitamin A1, Vitamin B1, Vitamin C, Vitamin D, Vitamin E & Vitamin K1.

Oils and fats: Composition of edible oils, detection of purity, rancidity of fats and oil. Tests for adulterants like argemone oil and mineral oils. Halphen test.

Soaps & Detergents: Definition, classification, manufacturing of soaps and detergents, composition anduses [14 hours]

Unit- III

Chemical and Renewable Energy Sources:

principles and applications of primary & secondary batteries and fuel cells. Basics of solar energy, future energy storer.

Polymers: Basic concept of polymers, classification and characteristics of polymers. Applications of polymers as plastics in electronic, automobile components, medical fields, and aerospace materials.Problems of plastic waste management.Strategies for the development of environment-friendly polymers.

[14 hours]

COURSE OUTCOMES OEC-1 Chemistry

On completion of the course students will be able to:

1. Understand the chemical constituents in various day to day materials using by a commonman.
2. Understand the chemical constituents in vitamins, soaps and detergents
3. Understand the renewable chemical energy resources
4. Understand different types of polymers and their applications.

Reference Books

1. B. K. Sharma: Introduction to Industrial Chemistry, Goel Publishing, Meerut(1998)
2. Medicinal Chemistry- AshtoushKar.
3. Analysis of Foods – H.E. Cox:13.
4. Chemical Analysis of Foods – H.E. Cox and Pearson.
5. Foods: Facts and Principles. N. Shakuntala Many and S. Swamy, 4thed. New Age International(1998)
6. Physical Chemistry – P l Atkins and J. de Paula – 7thEd. 2002, Oxford UniversityPress.
7. Handbook on Fertilizer Technology by Swaminathan and Goswamy, 6th ed. 2001,FAI.
8. Organic Chemistry by I. L. Finar, Vol. 1 & 2. 9. Polymer Science and Technology, J. R. Fired (Prentice Hall).

Open Elective Course - Semester – II

Title of the Course: OE-2: Molecules of Life

UNIT I

Carbohydrates

Classification of carbohydrates, reducing and non-reducing sugars, General properties of glucose and fructose, their open chain structures.Epimers, mutarotation and anomers.

Linkage between monosaccharides, structure of disaccharides (sucrose, maltose, lactose) and polysaccharides (starch and cellulose) excluding their structure elucidation.

Amino Acids, Peptides and Proteins

Classification of amino acids, Zwitterion structure and Isoelectric point. Overview of Primary, Secondary, Tertiary and Quaternary structure of proteins.Determination of primary structure of peptides.

UNIT II

Enzymes and correlation with drug action

Mechanism of enzyme action, factors affecting enzyme action, Co-enzymes and cofactors and their role in biological reactions, Specificity of enzyme action (including stereospecificity),

Enzyme inhibitors and their importance, phenomenon of inhibition (Competitive and Non competitive inhibition including allosteric inhibition).

Drug action-receptor theory. Structure–activity relationships of drug molecules, binding role of –OH group, -NH2 group, double bond and aromatic ring

Lipids

Introduction to lipids, classification.Biological importance of triglycerides, phospholipids, glycolipids, and steroids (cholesterol).

UNIT III

Nucleic Acids

Components of nucleic acids: Adenine, guanine, thymine and cytosine (Structure only), other components of nucleic acids, Nucleosides and nucleotides (nomenclature), Structure of polynucleotides; Structure of DNA (Watson-Crick model) and RNA (types of RNA), Genetic Code, Biological roles of DNA and RNA: Replication, Transcription and Translation.

Concept of Energy in Biosystems

Calorific value of food.Standard caloric content of carbohydrates, proteins and fats.Oxidation of foodstuff (organic molecules) as a source of energy for cells. Introduction to Metabolism (catabolism, anabolism), ATP: the universal currency of cellular energy, ATP hydrolysis and free energy change. Conversion of food into energy. Outline of catabolic pathways of Carbohydrate- Glycolysis, Fermentation, Krebs Cycle. Overview of catabolic pathways of Fats and Proteins. Interrelationships in the metabolic pathways of Proteins, Fats and Carbohydrates

Course Outcome / Learning Outcome:

After studying this paper the student would be able to

1. Acquire knowledge about different types of sugars and their chemical structures.
2. Identify different types of amino acids and determine the structure ofpeptides.
3. Explain the actions of enzymes in our body and interpret enzymeinhibition.
4. Predict action of drugs. Depict the biological importance of oils and fats. Importance of lipids in the metabolism. Differentiate RNA and DNA and their replication. Explain production of energy in ourbody.

Reference Books:

1. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt.Ltd. (PearsonEducation).
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd.(Pearson Education).
3. Finar, I. L. Organic Chemistry (Volume 2), Dorling Kindersley (India) Pvt. Ltd.(Pearson Education).
4. Nelson, D. L. & Cox, M. M. Lehninger's Principles of Biochemistry 7thEd.,
5. W. H. Freeman. Berg, J.M., Tymoczko, J.L. &Stryer, L. Biochemistry,2002.

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE
(Autonomous)
B N ROAD, MYSURU- 570 025

DEPARTMENT OF CHEMISTRY

Syllabus

CHOICE BASED CREDIT SYSTEM

For B.Sc programmes

Physics, Chemistry, Mathematics
Chemistry, Zoology, Biotechnology
Chemistry, Botany, Zoology

2019-20

BSc UG Syllabus PROGRAMME PCM

PROGRAMME CODE: BSc-01,Credit pattern

L:Lecture, T:Tutorial, P:Practicals) PCM01

Semester	Course Type	Course code	Course Title	L:T:P	Total Credit
III	DSC 3	DMC24001	**SOLUTIONS & ORGANIC CHEMISTRY**	4:0:0	4
		DMC24101	Practical 3: **SOLUTIONS & ORGANIC CHEMISTRY**	0:0:2	2
IV	DSC 4	DMD24001	**CO-ORDINATION CHEMISTRY & PHYSICAL CHEMISTRY**	4:0:0	4
		DMD24101	Practical 4: **CO-ORDINATION CHEMISTRY & PHYSICAL CHEMISTRY**	0:0:2	2
V	DSE 1A	DME24001	**INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE**	4:0:0	4
	DSE1A	DME24101	Practical 5: **INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE**	0:0:2	2
	DSE1B	DME24201	**INDUSTRIAL CHEMICALS AND ENVIRONMENT**	4:0:0	4
	DSE1B	DME24301	Practical 6: **INDUSTRIAL CHEMICALS AND ENVIRONMENT**	0:0:2	2
	SEC1A	DME24401	**FUEL CHEMISTRY**	2:0:0	2
	SEC1B	DME24601	**BASIC ANALYTICAL CHEMISTRY**	2:0:0	2
VI	DSE2A	DMF24001	**ORGANOMETALLICS, BIOINORGANIC CHEMISTRY, POLY NUCLEAR HYDROCARBONS AND UV,IR SPECTROSCOPY**	4:0:0	4
	DSE2A	DMF24101	Practical 7: **ORGANOMETALLICS, BIOINORGANIC CHEMISTRY, POLY NUCLEAR HYDROCARBONS AND UV,IR SPECTROSCOPY**	0:0:2	2
	DSE2B	DMF24201	**QUANTUM CHEMISTRY, SPECTOSCOPY AND PHOTOCHEMISTRY**	4:0:0	4
	DSE2B	DMF24301	Practical 8: **QUANTUM CHEMISTRY, SPECTOSCOPY AND PHOTOCHEMISTRY**	0:0:2	2

Scheme for Examination and Assessment

Course type	IA C1		IA C2		SEE C3		Exam duration	
	Th	Pr	Th	Pr	Th	Pr	Th	Pr
DSC	15	7.5	15	7.5	70	35	3h	3h
DSE	15	7.5	15	7.5	70	35	3h	3h
SEC	7.5	-	7.5	-	35	-	2h	-

SCHEME OF VALUATION FOR PRACTICAL EXAMINATION

- A candidate appearing for the exam should submit a duly signed and certified practical record
- Each candidate has to perform one experiment in the specified duration of three hours
- Practical record has to be valued by the examiners at the time of examination
- IA for ***FIFTEEN*** marks in practical is awarded in the lab

I. EVALUATION OF EXPERIMENTS:

Sl. no	Component	Marks
1	Conducting experiment	25
2	Viva-voce	05
3	Practical record	05
TOTAL		**35**

BSc UG Syllabus PROGRAMME CZBt

PROGRAMME CODE: BSc-05,Credit pattern

L:Lecture, T:Tutorial, P:Practicals)CZBt05

Semester	Course Type	Course code	Course Title	L:T:P	Total Credit
III	DSC 3	DMC24005	**SOLUTIONS & ORGANIC CHEMISTRY**	4:0:0	4
		DMC24105	Practical 3: **SOLUTIONS & ORGANIC CHEMISTRY**	0:0:2	2
IV	DSC 4	DMD24005	**CO-ORDINATION CHEMISTRY & PHYSICAL CHEMISTRY**	4:0:0	4
		DMD24105	Practical 4: **CO-ORDINATION CHEMISTRY & PHYSICAL CHEMISTRY**	0:0:2	2
V	DSE 1A	DME24005	**INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE**	4:0:0	4
	DSE1A	DME24105	Practical 5: **INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE**	0:0:2	2
	DSE1B	DME24205	**INDUSTRIAL CHEMICALS AND ENVIRONMENT**	4:0:0	4
	DSE1B	DME24305	Practical 6: **INDUSTRIAL CHEMICALS AND ENVIRONMENT**	0:0:2	2
	SEC1A	DME24405	**FUEL CHEMISTRY**	2:0:0	2
	SEC1B	DME24605	**BASIC ANALYTICAL CHEMISTRY**	2:0:0	2
VI	DSE2A	DMF24005	**ORGANOMETALLICS, BIOINORGANIC CHEMISTRY, POLY NUCLEAR HYDROCARBONS AND UV,IR SPECTROSCOPY**	4:0:0	4
	DSE2A	DMF24105	Practical 7: **ORGANOMETALLICS, BIOINORGANIC CHEMISTRY, POLY NUCLEAR HYDROCARBONS AND UV,IR SPECTROSCOPY**	0:0:2	2
	DSE2B	DMF24205	**QUANTUM CHEMISTRY, SPECTOSCOPY AND PHOTOCHEMISTRY**	4:0:0	4
	DSE2B	DMF24305	Practical 8: **QUANTUM CHEMISTRY, SPECTOSCOPY AND PHOTOCHEMISTRY**	0:0:2	2

Scheme for Examination and Assessment

Course type	IA C1		IA C2		SEE C3		Exam duration	
	Th	Pr	Th	Pr	Th	Pr	Th	Pr
DSC	15	7.5	15	7.5	70	35	3h	3h
DSE	15	7.5	15	7.5	70	35	3h	3h
SEC	7.5	-	7.5	-	35	-	2h	-

SCHEME OF VALUATION FOR PRACTICAL EXAMINATION

- A candidate appearing for the exam should submit a duly signed and certified practical record
- Each candidate has to perform one experiment in the specified duration of three hours
- Practical record has to be valued by the examiners at the time of examination
- IA for ***FIFTEEN*** marks in practical is awarded in the lab

II. EVALUATION OF EXPERIMENTS:

Sl. no	Component	Marks
1	Conducting experiment	25
2	Viva-voce	05
3	Practical record	05
TOTAL		**35**

BSc UG Syllabus PROGRAMME CBZ

PROGRAMME CODE: BSc-08,Credit pattern

L:Lecture, T:Tutorial, P:Practicals)CBZ08

Semester	Course Type	Course code	Course Title	L:T:P	Total Credit
III	DSC 3	DMC24008	**SOLUTIONS & ORGANIC CHEMISTRY**	4:0:0	4
		DMC24108	Practical 3: **SOLUTIONS & ORGANIC CHEMISTRY**	0:0:2	2
IV	DSC 4	DMD24008	**CO-ORDINATION CHEMISTRY & PHYSICAL CHEMISTRY**	4:0:0	4
		DMD24108	Practical 4: **CO-ORDINATION CHEMISTRY & PHYSICAL CHEMISTRY**	0:0:2	2
V	DSE 1A	DME24008	**INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE**	4:0:0	4
	DSE1A	DME24108	Practical 5: **INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE**	0:0:2	2
	DSE1B	DME24208	**INDUSTRIAL CHEMICALS AND ENVIRONMENT**	4:0:0	4
	DSE1B	DME24308	Practical 6: **INDUSTRIAL CHEMICALS AND ENVIRONMENT**	0:0:2	2
	SEC1A	DME24408	**FUEL CHEMISTRY**	2:0:0	2
	SEC1B	DME24608	**BASIC ANALYTICAL CHEMISTRY**	2:0:0	2
VI	DSE2A	DMF24008	**ORGANOMETALLICS, BIOINORGANIC CHEMISTRY, POLY NUCLEAR HYDROCARBONS AND UV,IR SPECTROSCOPY**	4:0:0	4
	DSE2A	DMF24108	Practical 7: **ORGANOMETALLICS, BIOINORGANIC CHEMISTRY, POLY NUCLEAR HYDROCARBONS AND UV,IR SPECTROSCOPY**	0:0:2	2
	DSE2B	DMF24208	**QUANTUM CHEMISTRY, SPECTOSCOPY AND PHOTOCHEMISTRY**	4:0:0	4
	DSE2B	DMF24308	Practical 8: **QUANTUM CHEMISTRY, SPECTOSCOPY AND PHOTOCHEMISTRY**	0:0:2	2

Scheme for Examination and Assessment

Course type	IA C1		IA C2		SEE C3		Exam duration	
	Th	Pr	Th	Pr	Th	Pr	Th	Pr
DSC	15	7.5	15	7.5	70	35	3h	3h
DSE	15	7.5	15	7.5	70	35	3h	3h
SEC	7.5	-	7.5	-	35	-	2h	-

SCHEME OF VALUATION FOR PRACTICAL EXAMINATION

- A candidate appearing for the exam should submit a duly signed and certified practical record
- Each candidate has to perform one experiment in the specified duration of three hours
- Practical record has to be valued by the examiners at the time of examination
- IA for ***FIFTEEN*** marks in practical is awarded in the lab

III. EVALUATION OF EXPERIMENTS:

Sl. no	Component	Marks
1	Conducting experiment	25
2	Viva-voce	05
3	Practical record	05
TOTAL		**35**

DEPARTMENT OF CHEMISTRY

Programme Outcome for Bachelor of Science in Physics, Chemistry and Mathematics:

After completing the graduation in the Bachelor of Science the students are able to:

PO1. Demonstrate proficiency in Mathematics and the Mathematical concepts needed for a proper understanding of Physics.

PO2. Demonstrate the ability to justify and explain their thinking and/or approach.

PO3. Demonstrate the ability to think, express and present in a clear, logical and succinct arguments.

PO4. Develop state-of-the-art laboratory skills and professional communication skills.

PO5. Apply the scientific method to design, execute, and analyze an experiment and also to explain their scientific procedures as well as their experimental observations.

PO6. Appreciate the role of chemistry in the society

PO7. Use this as a basis for ethical behaviour in issues facing chemists /drugs.

PO8. Understand chemistry as an integral part for addressing social, economic, and environmental problems.

PO9. Develop and understand the value of Mathematical proof and demonstrate proficiency in writing and understanding proofs.

PO10. Investigate and apply mathematical problems and solutions in aspects of science and technology.

PO11. Gain experience investigating the real world problems

PO12. Apply mathematical ideas and models to those problems.

Program Specific Outcome:

Bachelor of Science in Physics, Chemistry and Mathematics

After completing the graduation in Physics, Chemistry and Mathematics the students are able to:

PSO1. Find career opportunities and develop competence to write competitive examinations.

PSO2. Develop proficiency in the analysis of complex physical problems and the use of mathematical or other appropriate techniques to solve them.

PSO3. Apply appropriate techniques for the qualitative and quantitative analysis of chemicals in laboratories and in industries.

PSO4. Create a hypothesis and appreciate how it relates to broader theories.

PSO5. Demonstrate skills in the use of Computers.

Programme Outcome for Bachelor of Science in Chemistry, Zoology and Biotechnology:

After completing the graduation in the Bachelor of Science the students are able to:

PO1. Demonstrate the ability to justify, explain, and/or approach the concept both in written and oral forms

PO2. Demonstrate the ability to present clear, logical and succinct arguments

PO3. Develop state-of-the-art laboratory skills and professional communication skills.

PO4. Apply the scientific method to design, execute, and analyze an experiment.

PO5. Appreciate the central role of chemistry in the society and use this as a basis for ethical behaviour in issues facing chemists/drugs.

PO6. Understand Chemistry as an integral part for addressing social, economic, and environmental problems.

PO7. Identify the major groups of organisms with an emphasis on animals and plants.

PO8. Compare and contrast the characteristics of animals that differentiate themselves from other living and non-living creatures.

PO9. Give specific examples of physiological adaptations.

PO10. Design and develop solution to Biotechnology problems keeping in mind the safety measures for environment and society.

PO11. Support Biotechnology research activity with strong technical background knowledge.

Programme Specific Outcome for Bachelor of Science in Chemistry, Zoology and Biotechnology:

After completing the graduation in Chemistry, Zoology and Biotechnology the students are able to:

PSO1. Find jobs at all level of chemical, pharmaceutical, food products and life oriented material Industries

PSO2. Apply appropriate techniques for the qualitative and quantitative analysis of chemicals in laboratories and in industries.

PSO3. Recognize the relationship between different structures and functions at different levels.

PSO4. Characterize the biological, chemical and physical features of environments that Animals inhabit.

PSO5. Demonstrate effectively the applications of biochemical and biological sciences.

PSO6. Know and apply appropriate tools and techniques in biotechnological manipulation

PSO7. Understand his or her responsibilities in biotechnological practices.

Programme Outcome for Bachelor of Science in Chemistry, Botany, Zoology:

After completing the graduation in the Bachelor of Science the students are able to:

PO1. Demonstrate the ability to justify, explain, and/or approach the concept both in written and oral forms

PO2. Demonstrate the ability to present clear, logical and succinct arguments

PO3. Develop state-of-the-art laboratory skills and professional communication skills.

PO4. Apply the scientific method to design, execute, and analyze an experiment.

PO5. Appreciate the central role of chemistry in the society and use this as a basis for ethical behaviour in issues facing chemists/drugs.

PO6. Identify the taxonomic position of plants using required principles and methods.

PO7. Understand the impact of the plant diversity in societal and environmental context, and demonstrate the knowledge of, and need for sustainable development.

PO8. Use interdisciplinary approaches with quantitative skills to work on biological problems.

PO9. Understand Chemistry as an integral part for addressing social, economic, and environmental problems.

PO10. Identify the major groups of organisms with an emphasis on animals and plants.

Programme Specific Outcome

Bachelor of Science in Chemistry, Botany and Zoology

After completing the graduation in the Bachelor of Science the students are able to:

PSO1. Find jobs at all level of chemical, pharmaceutical, food products, life oriented material industries, etc.

PSO2. Apply appropriate techniques for the qualitative and quantitative analysis of chemicals in laboratories and in industries.

PSO3. Explicate ecological interconnectedness of life

PSO4: Analyze the avenues and remedies for burning environmental issues

PSO5. Recognize the relationship between different structures and functions at different levels.

PSO6. Characterize the biological, chemical and physical features of environments that Animals inhabit.

DMC24001/ DMC24005/ DMC24008

SEMESTER-III
SOLUTIONS AND ORGANIC CHEMISTRY

Course outcome:

After completion of the course the student is able to:

CO1: Understand the concepts of electrochemistry.
CO2: Study organometallic compounds.
CO3: Learn the synthesis and reactions of amino acids, carbohydrates, alkaloids, vitamins, hormones and terpenes.
CO4: Understand the qualitative organic analysis of organic compounds and enthalpy reactions.

CHEMISTRY-DSC 2C:

Theory: 60 Lectures

Section A: Physical Chemistry-2 (30 Lectures)

Solutions

Concentrations-different ways of expression, solutions of gases in gases,Henry's law,Thermodynamics of ideal solutions: Ideal solutions and Raoult's law, deviations from Raoult's law – non-ideal solutions. Vapour pressure-composition and temperature-composition curves of ideal and non-ideal solutions. Distillation of solutions.Lever rule.Azeotropes. Chemical potential of ideal and non ideal solution: Gibbs Duhem-Morgules equation. Entropy change of mixing for an ideal solution

Liquid mixtures:

Classification of binary mixtures into partially miscible, completely miscible and immiscible pairs of liquids. Principle of steam distillation Raoult's law, Critical solution temperature, partially miscible liquids: phenol water system, triethyl-amine water system and nicotine water system, Binary mixtures of completely miscible liquids, vapour pressure – composition diagrams and vapour pressure – temperature diagram. Classification into types- obeying Raoult's law (type I), positive deviation (type II),negative deviation (type III)from Raoult's law.Principles of fractional distillation, fractional distillation type I, type II and type III liquid mixtures, azeotropic mixtures. Binary mixtures of completely miscible liquids, principles of steam distillation – applications.(to be briefed)

Colligative properties

Introduction:vapour pressure, variation of vapour pressure with temperature(explanation with graph). Definition of boiling point and freezing point.Effect of dissolution of solute, vapour pressure of the solvent, lowering of vapour pressure, Raoult's law – relation between relative lowering of vapour pressure and molar mass.Determination of molar mass of solute by dynamic method, problems.

Elevation of boiling point:– definition and its relation to lowering of vapour pressure

and molar mass (to be derived). Ebullioscopic constant of the solvent and its relation to the boiling point (only equation). Determination of molar mass of the solute by Walker-Lumsden's method,

Depression in freezing point:– definition. Relation to lowering of vapour pressure and molar mass (to be derived).Cryoscopic constant, its relation to the melting point (only equation). Determination of molar mass of non-volatile solute by Beckmann's method. Abnormal molecular weights – causes - vant Hoff's factor, evaluation of degree of dissociation and association.Problems pertaining to all the colligative properties

(12 Lectures)

Phase Equilibrium

Phases, components and degrees of freedom of a system, criteria of phase equilibrium.Gibbs Phase Rule and its thermodynamic derivation. Phase diagrams of one-component systems (water and sulphur) and two component systems involving eutectics, congruent and incongruent melting points (lead-silver, FeCl3-H2O and Na-K only).

(5 Lectures)

Conductance and Electrochemistry

Introduction, conductance (specific, equivalent and molar conductance – definition and SI unit), conductance cell and cell constant, determination of equivalent conductance by meter-bridge method, variation of Λ and k with dilution, ionic mobility, ionic conductance and their relationship. Kohlrausch's law and its significance, transport number – definition and explanation, anomalous transport number, relationship between ionic conductance and transport number (to be derived). Determination of transport number by Hittorff's and moving boundary method (transport number of H+ using CdCl2 as supporting electrolyte) (Numerical problems to be worked out).

Application of conductance measurement:

a) Solubility and solubility product of sparingly soluble salt.
b) Ionic product of water
c) degree of ionization of weak electrolyte
   I. conductometric titration (strong acid Vs strong base, weak acid Vs strong base, strong acid Vs weak base, weak acid and weak base with examples)
   II. hydrolysis constant (taking aniline hydrochloride as an example)

Electromotive force:

Electrolytic and electro chemical cells,.Single electrode potential, sign of electrode potential (reduction potential to be adopted) convention of representing a cell, electrode reaction of a daniellcell.EMF and standard EMF of a cell, cell reaction, reversible and irreversible cells. Nernst equation (to be derived) and calculation of electrode potential, primary reference electrode – standard hydrogen electrode, secondary reference electrode – calomel and Ag - AgCl electrode – construction and working, electro-chemical series, equilibrium constant and free energy of a cell reaction, and its derivation, concentration cells with and without transference, EMF of concentration cells, liquid junction potential and salt bridge.Numerical problems on Nernst equation and EMF calculation.Fuel cells – working of H_2O_2 fuel cell and its importance.

Application of EMF measurements:

a)Determination of pH of a solution using quinhydrone electrode and glass electrode using dip type calomel electrode – principles and procedure.

b)Potentiometric titration – principle, location of end points in neutralization reactions (NaOH Vs HCl), Oxidation – reduction reactions ($K_2Cr_2O_7$ Vs FAS), precipitation reaction (KCl Vs $AgNO_3$) and complex reactions ($ZnSO_4$ Vs $K_3[Fe(CN)_6]$

(13 Lectures)

Section B:Organic Chemistry-2 (30 Lectures)

Organometallic compounds:-

Definition with example.Organo magnesium compounds (Grignard reagents) Formation ethyl magnesium bromide and its synthetic applications(synthesis of alcohols, acids, aldehydes, ketones and carboxylic acids)

Organo zinc compounds:- Preparation of diethyl zinc and its applications

Organolithium Compounds:- Preparation and synthetic applications of LDA

Amines and Diazonium Salts

Amines:-Definition, classification with example. Synthesis by Gabriel phthalimide method, reduction of amides.Separation of amine mixture by Hinsberg's method. Distinction tests for 1°,2°, 3° amines (acetylation and Hoffmann's exhaustive methylation). Action of nitrous acid on different amines(Both aliphatic and aromatic 1°,2°, 3° amines), basicity of amines, effect of substituent on basicity of aliphatic and aromatic amines. Hoffmann-Martius rearrangement.

Diazonium Compounds: Preparation, mechanism of preparation and synthetic applications of benzene diazonium chloride. Conversion to phenol, halobenzene, phenyl hydrazine and coupling reaction.

(10 Lectures)

Amino Acids, Peptides and Proteins:

Preparation of Amino Acids: Strecker synthesis using Gabriel's Phthalimidesynthesis.Zwitterion, Isoelectric point and Electrophoresis.

Reactions of Amino acids: ester of –COOH group, acetylation of NH_2group,complexation with Cu^{2+} ions,

Elementary account of Primary, Secondary, Structure of proteins. Peptides(Amides)Synthesis of simple peptides (upto dipeptides) by N-protection (t-butyloxycarbonyl and Carbobenzoxy carbonyl) **(4 Lectures)**

Carbohydrates: Definition and importance, classification based on composition with examples-reducing and non-reducing sugars. Monosaccharides:- Glucose- reactions of glucose (with H_2N-OH, HCN, $C_6H_5NHNH_2$, Br_2 water, Conc.HNO_3, reductions with HI/red P , Methanol(dry HCl), acetic anhydride and reduction reactions. Mutarotation. Structural elucidation of glucose and fructose :- open chain structure, ring structure-Fisher and Haworth structure. Determination of ring size by methylation method. Fischer and Haworth structures of fructose, galactose and mannose Interconversions reactions-1) Ascending (Killiani's synthesis) 2) Descending (Wohl's degradation) 3) Aldose to Ketose 4) Ketose to Aldose 5) Epimerization

Disaccharides:- structural elucidation of sucrose, structural formulae of maltose and lactose (Haworth structure).Polysaccharides:- Partial structural formulae of starch and Cellulose. **(8 Lectures)**

Alkaloids:- definition, classification based on heterocyclic rings-isolation, synthesis and structural elucidation of nicotine .Structure of Morphine, Atropine, Cocaine & physiological importance of alkaloids.

Vitamins:- Definition, classification, structural elucidation and synthesis of vit-A, Synthesis of vit-C, Sources & importance of Vitamin-B, calciferol, E ,D & K

Hormones:- definition, classification, synthesis and functions of adrenaline and thyroxine.

Terpenes:- definition, isoprene rule, Classification, isolation (Solvent extraction and

Steam distillation), structural elucidation of citral and it's synthesis, structural formulae of α-terpeneol, Camphor and menthol. **(8 Lectures)**

Reference:

- Barrow, G.M. Physical Chemistry Tata McGraw-Hill (2007).
- Castellan, G.W. Physical Chemistry 4th Ed. Narosa (2004).
- Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry, Cengage Learning India Pvt. Ltd.: New Delhi (2009).
- Mahan, B.H. University Chemistry, 3rd Ed. Narosa (1998).
- Petrucci, R.H. General Chemistry, 5th Ed., Macmillan Publishing Co.: New York (1985).
- Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- Finar, I. L. Organic Chemistry (Volume 2), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- Nelson, D. L. & Cox, M. M. Lehninger's Principles of Biochemistry 7thEd., W. H. Freeman.
- Berg, J.M., Tymoczko, J.L. &Stryer, L. Biochemistry, W.H. Freeman, 2002.

- Puri & Sharma,A Textbook of Chemistry

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DMD24001/ DMD24005/ DMD24008

SEMESTER-IV

COORDINATION CHEMISTRY AND PHYSICAL CHEMISTRY

Theory: 60 Lectures

Course outcome:

After completion of the course the student is able to:

CO1: Know about co-ordination chemistry.
CO2: Understand kinetic theory of gases, properties of liquids and crystallography.
CO3: Acquire knowledge on the qualitative analysis of mixtures.

CHEMISTRY-DSC 2D:

Chemistry of transition elements:

Position in the periodic table, electronic configuration, general characteristics-atomic and ionic radii, ionization energy, variable oxidation states, (Latimer diagrams) spectral properties, redox potentials, colour and magnetic properties, catalytic activity, complex formation and interstitial compounds formation (3d, 4d and 5d series).

Chemistry of inner transition elements: Lanthanides: Electronic configuration and position in the periodic table, oxidation states, spectral properties, colour and magnetic properties, complex formation and ionic radii, lanthanide contraction – cause & its consequences and solvent extraction method.

General survey of actinides – comparison with lanthanides, transuranic elements. Action of ion exchange resins – cation exchange and anion exchange resins, exchange of inorganic ions, ion exchange capacity, separation of lanthanides by ion- exchange method. Comparison of d and f block elements.

(12 Lectures)

Coordination Chemistry

Ligands, classification of ligands and chelation, nomenclature of co-ordination compounds, physical methods in the study of complexes – change in conductance, colour and pH.Stability of complexes – stability constant, a brief outline of thermodynamic stability of metal complexes, factors affecting the stability of complexes.Polynuclear complexes, inner metallic complexes.Sidwick-EAN rule

Isomerism in co-ordination complexes: Stereo-isomerism – Geometrical and optical isomerism exhibited by co-ordination compounds of co-ordination number 4 and 6.

Metal-ligand bonding in transition metal complexes:

Valence bond theroy: Salient features, formation of octahedral complexes on the basis of VBT, outer and inner orbital octahedral complexes- $[Fe(CN)_6]^{4-}$, $[Fe(CN)_6]^{3}$-, $[Co(CN)_6]^{3-}$, [CoF6]3- $[Cr(H_2O)_6]^{3+}$ and $[Fe(H_2O)_6]^{2+.}$ Formation of tetrahedral and square planner complexes on the basis of VBT – $[Ni(CN)4]^{2-}$, $[Cu(NH3)]^{2+}$, $[Zn(NH3)4]^{2+}$and $[Ni(CO)_4]$, limitations of VBT.

Crystal field theory: Important features of crystal field theory, crystal field splitting of d-orbitals in tetrahedral, octahedral and square planar complexes, crystal field stabilization energy (CFSE), factors affecting the magnitude of Δo, (nature of ligand,

oxidation state of the metal ion, size of the orbitals, geometry of the complex), high spin (HS) and low spin (LS) complexesSpectrochemical series, magnetic properties of metal complexes based on crystal field theory-[Co(NH3)6]3+, [CoF6]3-, [Fe(CN)6]4-, [Fe(CN)6]3- and [Ni(CN)4]2-. Magnetic susceptibility, measurement of magnetic moment by Gouy's method.Tetragonal distortion of octahedral geometry.Jahn-Teller distortion.Applications of complex formation in biological systems

(18 Lectures)

Section B: Physical Chemistry-3 **(30 Lectures)**

Kinetic Theory of Gases

Postulates of Kinetic Theory of Gases and derivation of the kinetic gas equation.Deviation of real gases from ideal behaviour, compressibility factor, causes of deviation. van der Waals equation of state for real gases. Boyle temperature (derivation not required). Critical phenomena, critical constants and their calculation from van der Waals equation.Andrews isotherms of CO2.

Maxwell Boltzmann distribution laws of molecular velocities and molecular energies (graphic representation – derivation not required) and their importance.

Temperature dependence of these distributions.Most probable, average and root mean square velocities (no derivation). Collision cross section, collision number, collision frequency, collision diameter and mean free path of molecules. Viscosity of gases and effect of temperature and pressure on coefficient of viscosity (qualitative treatment only)

(8 Lectures)

Liquids

Properties of liquids

Viscosity : Definition of co-efficient of viscosity, factors affecting viscosity – temperature, size, mass, shape of molecules, intermolecular forces, determination of viscosity of liquids by Ostwald's method**.**.

Surface tension : Definition, effect of temperature and solute on surface tension.Determination of surface tension of liquids using stalagmometer. Effect of temperature on surface tension and coefficient of viscosity of a liquid (qualitative treatment only).

Parachor : Definition, sudgen equation, calculation of parachor and its application w.r.t. the elucidation of structures- of benzene, quinine and isocyanide ion(Numerical problems).

Polarization- induced, orientation and molar polarization – definitions, clausius-Mossotiz equation (no derivation) and its application. **(8 Lectures)**

Solids :

Introduction, laws of crystallography - law of constancy of interfacial angles, law of rational indices- weiss and miller indices. Unit cell, Space lattices and lattice planes, seven crystal systems, lattice planes in cubic crystals (Simple cubic, body centered cubic and face centered cubic).

Elements of symmetry – plane, axis and centre, elements of symmetry in cubic system, types of lattices, Bragg's equation and its derivation. X-ray diffraction and determination of crystal structure of rock salt by rotating crystal method. Application of X-ray studies – distance between lattice planes, density of crystals, determination of Avogadro number. (Numerical problems) Defects in crystals.

Liquid crystals:
Mesomorphic state – definition, classification of liquid crystals smectic and nematic with examples, molecular arrangement in the two types and uses. Nano materials – definition, properties and application **(8 Lectures)**

Chemical Kinetics:
The concept of reaction rates.Effect of temperature, pressure, catalyst and other factors on reaction rates.Order and molecularity of a reaction.Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants).Half–life of a reaction. General methods for determination of order of a reaction (Differential method, integration, halflife period and isolation methods) Concept of activation energy and its calculation from Arrhenius equation.
Theories of Reaction Rates: Collision theory based on hard sphere model and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only). **(6 Lectures)**

Reference:

- Barrow, G.M. Physical Chemistry Tata McGraw-Hill (2007).
- Castellan, G.W. Physical Chemistry 4th Ed. Narosa (2004).
- Kotz, J.C., Treichel, P.M. & Townsend, J.R. General ChemistryCengage Learning India Pvt. Ltd., New Delhi (2009).
- Mahan, B.H. University Chemistry 3rd Ed. Narosa (1998).
- Petrucci, R.H. General Chemistry 5th Ed. Macmillan Publishing Co.: New York (1985).

- Cotton, F.A. & Wilkinson, G. Basic Inorganic Chemistry, Wiley.
- Shriver, D.F. & Atkins, P.W. Inorganic Chemistry, Oxford University Press.
- Wulfsberg, G. Inorganic Chemistry, Viva Books Pvt. Ltd.
- Rodgers, G.E. Inorganic & Solid State Chemistry,Cengage Learning India Ltd., 2008.
- R D Madan,Textbook of Chemistry
- Madan, Malik Tuli,Comprehensive Chemistry
- Satyaprakash, Text book of Chemistry

DME24001/ DME24005/ DME24008

DSE-1A **SEMESTER-V**

INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE

Theory: 60 Lectures

Course outcome:

After completion of the course the student is able to:

CO1: Understand the synthesis and applications of glass and ceramics, vitamins, hormones**,** soaps and detergents; and higher aspects of spectroscopy.
CO2: Understand the types and manufacture of different fertilizers.
CO3: Understand the different methods of prevention of corrosion.

CHEMISTRY-DSE:
Silicate Industries
Glass*:* Rawmaterials, Glassy state and its properties, classification (silicate and non-silicate glasses).Manufacture and processing of glass. Composition and properties of the following types of glasses: Soda lime glass, lead glass, armoured glass, safety glass, borosilicate glass, fluorosilicate, coloured glass, photosensitive glass.
Ceramics:Important clays and feldspar, ceramic, their types and manufacture. Hightechnology ceramics and their applications, superconducting and semiconducting oxides, fullerenes carbon nanotubes and carbon fibre.
Cement::Classification of cement, ingredients and their role, Manufacture of cementand the setting process, quick setting cements.
Abrasives: Definition, classification with examples – hardness, manufacture and applications of carborundum, alundum and tungsten carbide.
Refractories: Definition, properties, classification with examples. Different steps involved in the manufacture of refractories. Applications of refractories.
Inorganic polymers:
Definition – examples, general properties, comparison with organic polymers, glass transition temperature Silicones: Definition, nomenclature, preparation (linear, cross-linked and cyclic). Factors affecting the nature of silicon polymers, properties (chemical and thermal stabilities(chemical properties) uses of silicon polymers, silicon fluids/oils – uses, silicon elastomers / rubbers, silicon resins (preparation and uses)
Phosphazenes: Definition, types, structures, preparation, properties and uses. Crystalline polymetaphosphates – Maddrell's and Kuroll's salts – properties and uses.Nature of bonding in phosphazenes.
Fluorocarbons: Definition, examples, preparation, properties and uses of Freon-12, Freon-22, PTFE and poly per fluorovinyl chloride.
Non-aqueous solvents:
Liquid ammonia- Reasons for the solvent properties, typical reactions- solubility of alkali metals; acid-base, precipitation, ammonolysis, Ionization of weak acids,

advantages and disadvantages.

Liquid SO_2- Reasons for the solvent properties, typical reactions-acid-base, solvolysis, precipitation, amphoteric and redox reactions **(25 Lectures)**

Fertilizers:

Different types of fertilizers. Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates; polyphosphate, superphosphate, compound and mixed fertilizers, potassium chloride, potassium sulphate. **(5 Lectures)**

Surface Coatings:

Objectives of coatings surfaces, preliminary treatment of surface, classification of surface coatings.Paints and pigments-formulation, composition and related properties. Oil paint, Vehicle, modified oils, Pigments, toners and lakes pigments, Fillers, Thinners, Enamels, emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint), Dyes, Wax polishing, Water and Oil paints, additives, Metallic coatings (electrolytic and electroless), metal spraying and anodizing.

(10 Lectures)

Batteries:

Primary and secondary batteries, battery components and their role, Characteristics of Battery.Working of following batteries: Pb acid, Li-Battery, Solid state electrolyte battery.Fuel cells, Solar cell and polymer cell.

(4 Lectures)

Alloys:

Classification of alloys, ferrous and non-ferrous alloys, Specific properties of elements in alloys.Properties and applications of steel. Manufacture of Steel (removal of silicon decarbonization, demanganization, desulphurization dephosphorisation) and surface treatment (argon treatment, heat treatment, nitriding, carburizing). Composition and properties of different types of steels.
Production of Ferro alloys: Ferro chrome and Ferro manganese.

(8 Lectures)

Catalysis:

General principles and properties of catalysts, homogenous catalysis (catalytic steps and examples) and heterogenous catalysis (catalytic steps and examples).Theories of catalysis, Auto catalyst.Industrial applications, Deactivation or regeneration of catalysts.Phase transfer catalysts, application of zeolites as catalysts.

(4 Lectures)

Chemical explosives:

Origin of explosive properties in organic compounds, Classification with examples, preparation and explosive properties of lead azide, PETN, cyclonite (RDX).Introduction to rocket propellants.

(4 Lectures)

Reference:

- E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK.
- R. M. Felder, R. W. Rousseau: Elementary Principles of Chemical Processes, Wiley Publishers, New Delhi.
- W. D. Kingery, H. K. Bowen, D. R. Uhlmann: Introduction to Ceramics, Wiley Publishers, New Delhi.
- J. A. Kent: Riegel'sHandbook of Industrial Chemistry, CBS Publishers, New Delhi.
- P. C. Jain & M. Jain: Engineering Chemistry,DhanpatRai& Sons, Delhi.
- R. Gopalan, D. Venkappayya, S. Nagarajan: Engineering Chemistry,Vikas Publications, New Delhi.
- B. K. Sharma: Engineering Chemistry, Goel Publishing House, Meeru

DME24201/ DME24205/ DME24208

DSE!B **SEMESTER V**

INDUSTRIAL CHEMICALS AND ENVIRONMENT

Theory: 60 Lectures

Course outcome:

After completion of the course the student is able to:

CO1: Understand the environmental issues
CO2: Know about the metallurgy of metals
CO3: Understand the hazards and handling certain gases and chemicals

Industrial Gases and Inorganic Chemicals

Industrial Gases: Large scale production, uses, storage and hazards in handling of the following gases: oxygen, nitrogen, argon, neon, helium, hydrogen, acetylene, carbon monoxide, chlorine, fluorine, sulphur dioxide and phosgene.

Inorganic Chemicals: Manufacture, application, analysis and hazards in handling the following chemicals: hydrochloric acid, nitric acid, sulphuric acid, caustic soda,

common salt, borax, bleaching powder, sodium thiosulphate, hydrogen peroxide, potash alum, chrome alum, potassium dichromate and potassium permanganate.

(10 Lectures)

Industrial Metallurgy

Preparation of metals (ferrous and nonferrous) and ultrapure metals for semiconductor technology

(4 Lectures)

Environment and its segments

Ecosystems. Biogeochemical cycles of carbon, nitrogen and sulphur.

Air Pollution: Major regions of atmosphere. Chemical and photochemical reactions in atmosphere. Air pollutants: types, sources, particle size and chemical nature; Photochemical smog: its constituents and photochemistry. Environmental effects of ozone, Major sources of air pollution

Pollution by SO_2, CO_2 , CO, NO_x, H_2S and other foul smelling gases. Methods of estimation of CO, NO_x, SO_x and control procedures

Effects of air pollution on living organisms and vegetation.Greenhouse effect and Global warming, Ozone depletion by oxides of nitrogen, chlorofluorocarbons and Halogens, removal of sulphur from coal.Control of particulates

Water Pollution: Hydrological cycle, water resources, aquatic ecosystems, Sourcesand nature of water pollutants, Techniques for measuring water pollution, Impacts of water pollution on hydrological and ecosystems

Water purification methods: Effluent treatment plants (primary, secondary and tertiary treatment). Industrial effluents from the following industries and their treatment: electroplating, textile, tannery, dairy, petroleum and petrochemicals, agro, fertilizer, etc. Sludge disposal.

Industrial waste management, incineration of waste.Water treatment and purification (reverse osmosis, electro dialysis, ion exchange). Water quality parameters for waste water, industrial water and domestic water

(30 Lectures)

Energy & Environment

Sources of energy: Coal, petrol and natural gas. Nuclear Fusion / Fission, Solar energy, Hydrogen, geothermal, Tidal and Hydel, etc.

Nuclear Pollution: Disposal of nuclear waste, nuclear disaster and its management.

(10 Lectures)

Biocatalysis

Introduction to biocatalysis: Importance in "Green Chemistry" and Chemical Industry.

(6 Lectures)

Reference:

- E. Stocchi: *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK.
- R.M. Felder, R.W. Rousseau: *Elementary Principles of Chemical Processes*, Wiley Publishers, New Delhi.
- J. A. Kent: *Riegel's Handbook of Industrial Chemistry, CBS Publishers, NewDelhi.*
- *S. S. Dara: A Textbook of Engineering Chemistry*, S. Chand & Company Ltd.New Delhi.
- K. De, *Environmental Chemistry*: New Age International Pvt., Ltd, New Delhi.
- S. M. Khopkar, *Environmental Pollution Analysis*: Wiley Eastern Ltd, New Delhi.
- S.E. Manahan, *Environmental Chemistry*, CRC Press (2005).
- G.T. Miller, *Environmental Science* 11th edition. Brooks/ Cole (2006).
- A. Mishra, *Environmental Studies*. Selective and Scientific Books, New Delhi (2005).

DMF24001/ DMF24005/ DMF24008

DSE1A SEMESTER-VI

ORGANOMETALLICS, BIOINORGANIC CHEMISTRY, POLYNUCLEAR HYDROCARBONS AND UV, IR SPECTROSCOPY

Theory: 60 Lectures

Course outcome:

After completion of the course the student is able to:

CO1: Understand the techniques involved in metallurgy.
CO2: Understand the role of ions in different biological systems.
CO3: Understand the applications of spectroscopy.

DSE-1A:

Section A: Inorganic Chemistry-4 **(30 Lectures)**

Metallurgy: Terms and principles involved in metallurgy, Ellingam'sdiagram,Types of metallurgy: Pyro metallurgy- extraction of Nickel by sulphide ore- generall metallurgy followed by Monds process (purification, Manganese from oxides ores- Reduction by the Alumino Thermite process- refininmg by electrolytic process.

Hydro metallurgy: Extraction of Gold from native ore by cyanide process, and refining by quartation process.

Electro metallurgy: Extraction of Lithium by fusion method Followed by electrolysis of lithium chloride.

Powder metallurgy: Importance, metal powder production &applications. Production of Tungsten powder.Principles of Electroplationg. **(10 Lectures)**

Organometallic Compounds

Definition and Classification with appropriate examples based on nature of metal-carbon bond (ionic, s, p and multicentre bonds). Structures of methyl lithium, Zeiss salt and ferrocene.. Preparation , properties , boding and appliations of alkyle and aryls of Li, Al, Hg,Sn and Ti.

Nature of M-CO bonding in carbonyls. Preparation, properties and structures of mono nuclear and binuclear metal carbonyls-Ni(CO)4, Cr(CO)6, Fe(CO)5, Mn2(CO)10, Co2(CO)8. Applications of EAN rule to mononuclear metalcarbonyls.

Behaviour of carbon monoxide. Synergic effects (VB approach)- (MO diagram of CO can be referred to for synergic effect to IR frequencies). **(10 Lectures)**

Chemistry of nonmetallics:

Boron : Boron hydrides – Diborane – preparation, properties, uses and structureCarbon: Fullerenes- Production, structure of C60 and C70. Diamond and Graphite-Properties and structure.

Silicon: Structure of silica. Silicates-types of silicates with examples.

Nitrogen: Preparation(any two methods), properties, uses, structure of hydrazine, hydroxyl amine and hydrazoic acid.

Sulphur: Preparation, properties, structures and applications of thionyl chloride, sulphuryl chloride and SF6.

Halogens: Preparation, properties and structure of bleaching powder.

Pseudo halogens: preparation, properties and structure of cyanogens, thiocyanogen, tellurocyanogen and oxucyanogen.(any one method of preparation and any three properties to be discussed). **(5 Lectures)**

Bio-Inorganic Chemistry

A brief introduction to bio-inorganic chemistry.Essential and trace elements in biological process. Role of metal ions present in biological systems with special reference to Na^+, K^+ and Ca2+, Mg^{2+} ions: Na/K pump; Role of Mg^{2+} ions in energy production and chlorophyll. Role of Ca^{2+} in blood clotting, Enzymatic role of Iron in Hemoglobin and myoglobin, Magnesium in Chlorophyll, Cobalt in Vitamin B12.

Stabilization of protein structures and structural role (bones).

Biological functions and toxicity of Cr, Mn, Co, Ni, I, Hg, Mo, and Se. **(5 Lectures)**

Section B: Organic Chemistry-4 **(30 Lectures)**

Polynuclear and heteronuclear aromatic compounds:

Polynuclear Hydrocarbons: Resonance structures of Naphthalene, anthracene and Phenanthracene.

Structural elucidation of naphthalene. Reactions of naphthalene- oxidation, reduction and electrophilic substitution reactions

HetrocyclicCompounds:Definition, classification with examples, synthesis of Furan, thiophene, pyrrole, pyridine, indole (Fischer method), quinoline (Skrup's synthesis), isoquinoline, pyrimidine (one method each). Aromaticity and basicity of pyrrole and pyridine.Electrophillic substitution reactions of pyrrole and pyridine.

Uric acid- Structure, Synthesis. Conversion of uric to purine and caffeine

Dyes: Colour and Constitution, Witt's theory, Classification of dyes based on structures with examples, synthesis of Methyl orange, Bismark brown, indigo and malachite green, structural elucidation of alizarin and it's synthesis**.**

Drugs: Chemotherapy and chemotherapeutic agents, definition of drugs, types of drugs, antipyretics, analgesics, anaesthetics, sedatives, narcotics, antiseptics, antibacterials, antibiotics, antimalarials and sulpha drugs with examples. Synthesis of paracetamol, sulphanilamide, sulphaguanidine **(13 lectures)**

Active methylene compounds: Definition, Ethyl acetoacetate and diethyl malonatepreparation, Mechanism of Claisen condensation, keto-enoltautomerism and its evidence.Synthetic applications of EAA and DEM:- Synthesis of mono carboxylic acids, dicarboxylic acids-succinic acid, adipic acid, antipyrine,Barbituric acid, acetyl acetone, Crotonic acid and Cinnamic acid**.** **(4 lectures)**

Application of Spectroscopy to Simple Organic Molecules

Application of visible, ultraviolet and Infrared spectroscopy in organic molecules. Electromagnetic radiations, electronic transitions, $\lambda_{max,}$ chromophore, auxochrome, bathochromic and hypsochromic shifts. Woodward rules for calculating λmax of conjugated dienes

IR-Spectroscopy: Introduction,functional group region and finger print region stretching frequency, Graphical representation of IR spectra of benzoic acid and methyl benzoate . Absorption frequencies of Simple functional groups

NMR Spectroscopy: Basic principles of proton magnetic resonance , nuclear magnetic spin quantum number I, influence of the magnetic field on the spin of nuclei, magnetic resonance-chemical shift (δ value), use of TMS as reference, nuclear shielding effects, equivalent and non-equivalent protons, spin-spin splitting.
NMR spectra of Simple organic molecules (like ethyl alcohol, ethane, propane, benzene, toluene, acetone, and methyl chloride) to be discussed.. **(13 Lectures)**

Reference:

- James E. Huheey, Ellen Keiter& Richard Keiter: Inorganic Chemistry:Principles of Structure and Reactivity, Pearson Publication.
- G.L. Miessler& Donald A. Tarr: Inorganic Chemistry, Pearson Publication.
- J.D. Lee: A New Concise Inorganic Chemistry, E.L.B.S.
- F.A. Cotton & G. Wilkinson: Basic Inorganic Chemistry, John Wiley & Sons.
- I.L. Finar: Organic Chemistry (Vol. I & II), E.L.B.S.
- John R. Dyer: Applications of Absorption Spectroscopy of OrganicCompounds, Prentice Hall.
- R.M. Silverstein, G.C. Bassler& T.C. Morrill: Spectroscopic Identification ofOrganic Compounds, John Wiley & Sons.
- R.T. Morrison & R.N. Boyd: Organic Chemistry, Prentice Hall.
- Peter Sykes: A Guide Book to Mechanism in Organic Chemistry, Orient Longman.
- ArunBahl and B. S. Bahl: Advanced Organic Chemistry, S. Chand

DMF24201/ DMF24205/ DMF24208

DSE1B **SEMESTER VI**

QUANTUM CHEMISTRY, SPECTROSCOPY & PHOTOCHEMISTRY

Theory: 60 Lectures

COURSE OUTCOME:

After completion of the course the student is able to:

CO1: Understand the concepts in quantum chemistry
CO2: Know about photochemistry
CO3: Know the concept of spectroscopy with applications

Quantum Chemistry

Postulates of quantum mechanics, quantum mechanical operators, Schrödinger equation and its application to free particle and "particle-in-a-box" (rigorous treatment), quantization of energy levels, zero-point energy and Heisenberg Uncertainty principle; wavefunctions, probability distribution functions, nodal properties, Extension to two and three dimensional boxes, separation of variables, degeneracy.

Qualitative treatment of simple harmonic oscillator model of vibrational motion: Setting up of Schrödinger equation and discussion of solution and wavefunctions. Vibrational energy of diatomic molecules and zero-point energy.

Angular momentum: Commutation rules, quantization of square of total angular momentum and z-component.

Rigid rotator model of rotation of diatomic molecule. Schrödinger equation, transformation to spherical polar coordinates. Separation of variables. Spherical harmonics. Discussion of solution.

Qualitative treatment of hydrogen atom and hydrogen-like ions: setting up of Schrödinger equation in spherical polar coordinates, radial part, quantization of energy (only final energy expression). Average and most probable distances of electron from nucleus.

Setting up of Schrödinger equation for many-electron atoms (He, Li). Need for approximation methods. Statement of variation theorem and application to simple systems (particle-in-a-box, harmonic oscillator, hydrogen atom).

Chemical bonding: Covalent bonding, valence bond and molecular orbital approaches, LCAO-MO treatment of H_2^+. Bonding and antibonding orbitals. Qualitative extension to H_2. Comparison of LCAO-MO and VB treatments of H_2 (only wavefunctions, detailed solution not required) and their limitations. Refinements of the two approaches (Configuration Interaction for MO, ionic terms in VB). Qualitative description of LCAO-MO treatment of homonuclear and heteronuclear diatomic molecules (HF, LiH). Localised and non-localised molecular orbitals treatment of triatomic (BeH_2, H_2O) molecules. Qualitative MO theory and its application to AH_2 type molecules.

(24 Lectures)

Molecular Spectroscopy:

Interaction of electromagnetic radiation with molecules and various types of spectra; BornOppenheimer approximation.

Rotation spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution.

Vibrational spectroscopy: Classical equation of vibration, computation of force constant, amplitude of diatomic molecular vibrations, anharmonicity, Morse potential, dissociation energies, fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomic molecules, modes of vibration, concept of group frequencies. Vibration-rotation spectroscopy: diatomic vibrating rotator, P, Q, R branches.

Raman spectroscopy: Qualitative treatment of Rotational Raman effect; Effect of nuclear spin, Vibrational Raman spectra, Stokes and anti-Stokes lines; their intensity difference, rule of mutual exclusion.

Electronic spectroscopy: Franck-Condon principle, electronic transitions, singlet and triplet states, fluorescence

and phosphorescence, dissociation and predissociation, calculation of electronic transitions of polyenes using free electron model.

Nuclear Magnetic Resonance (NMR) spectroscopy: Principles of NMR spectroscopy, Larmor precession, chemical shift and low resolution spectra, different scales, spin-spin coupling and high resolution spectra, interpretation of PMR spectra of organic molecules.

Electron Spin Resonance (ESR) spectroscopy: Its principle, hyperfine structure, ESR of simple radicals.

(24 Lectures)

Photochemistry

Characteristics of electromagnetic radiation, Lambert-Beer's law and its limitations, physical significance of absorption coefficients. Laws, of photochemistry, quantum yield, actinometry, examples of low and high quantum yields, photochemical equilibrium and the differential rate of photochemical reactions, photosensitised reactions, quenching. Role of photochemical reactions in biochemical processes, photostationary states, chemiluminescence.

(12 Lectures)

Reference:

- Banwell, C. N. & McCash, E. M. Fundamentals of Molecular Spectroscopy 4th Ed. Tata McGraw-Hill: New Delhi (2006).
- Chandra, A. K. Introductory Quantum Chemistry Tata McGraw-Hill (2001).
- House, J. E. Fundamentals of Quantum Chemistry 2nd Ed. Elsevier: USA (2004).
- Lowe, J. P. & Peterson, K. Quantum Chemistry, Academic Press (2005).
- Kakkar, R. Atomic & Molecular Spectroscopy: Concepts & Applications, Cambridge University Press (2015).

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DME24401/ DME24405/ DME24408

VI SEMESTER

SEC1A FUEL CHEMISTRY

SKILL ENHANCEMENT COURSE-SEC

30 Lectures

Course outcome:

After completion of the course a student is able to:

CO1: Understand soil sample for calcium and magnesium content.
CO2: Understand water parameters.
CO3: Identify food adulterants.
CO4: Understand chromatography.

Review of energy sources (renewable and non-renewable). Classification of fuels and their calorific value

Coal: Uses of coal (fuel and nonfuel) in various industries, its composition,carbonization of coal.Coal gas, producer gas and water gas—composition and uses. Fractionation of coal tar, uses of coal tar bases chemicals,

requisites of a good metallurgical coke, Coalgasification (Hydro gasification and Catalytic gasification), Coal liquefaction and Solvent Refining.

Petroleum and Petrochemical Industry: Composition of crude petroleum, Refiningand different types of petroleum products and their applications.

Fractional Distillation (Principle and process), Cracking (Thermal and catalytic cracking), Reforming Petroleum and non-petroleum fuels (LPG, CNG, LNG, bio-gas, fuels derived from biomass), fuel from waste, synthetic fuels (gaseous and liquids), clean fuels Petrochemicals: Vinyl acetate, Propylene oxide, Isoprene, Butadiene, Toluene and its derivatives Xylene.

Lubricants: Classification of lubricants, lubricating oils (conducting and non-conducting) Solid and semisolid lubricants, synthetic lubricants.
Properties of lubricants (viscosity index, cloud point, pore point) and their determination.

Reference :

- Stocchi, E. Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK (1990).
- Jain, P.C. & Jain, M. Engineering ChemistryDhanpatRai& Sons, Delhi.
- Sharma, B.K. & Gaur, H. Industrial Chemistry,Goel Publishing House, Meerut (1996).

DME24601/ DME24605/ DME24608

SEC1B

BASIC ANALYTICAL CHEMISTRY

30 Lectures

Course outcome:

After completion of the course a student is able to:

CO1: Analyze food products
CO2: Analyze soil sample
CO3: Determine the contaminants in water
CO4: Study about chromatography

Introduction: Introduction to Analytical Chemistry and its interdisciplinary nature.Concept of sampling.Importance of accuracy, precision and sources of error in analytical measurements.Presentation of experimental data and results, from the point of view of significant figures.

Analysis of soil: Composition of soil, Concept of pH and pH measurement,Complexometric titrations, Chelation, Chelating agents, use of indicators

a. Determination of pH of soil samples.
b. Estimation of Calcium and Magnesium ions as Calcium carbonate by complexometric titration.

Analysis of water: Definition of pure water, sources responsible for contaminatingwater, water sampling

methods, water purification methods.

a. Determination of pH, acidity and alkalinity of a water sample.
b. Determination of dissolved oxygen (DO) of a water sample.

Analysis of food products: Nutritional value of foods, idea about food processingand food preservations and adulteration.

a. Identification of adulterants in some common food items like coffee powder, asafoetida, chilli powder, turmeric powder, coriander powder and pulses, etc.
b. Analysis of preservatives and colouring matter.

Chromatography: Definition, general introduction on principles of chromatography,paper chromatography, TLC etc.

a. Paper chromatographic separation of mixture of metal ion (Fe^{3+} and Al^{3+}).
b. To compare paint samples by TLC method. **Ion-exchange:** Column, ion-exchange chromatography etc.
Determination of ion exchange capacity of anion / cation exchange resin (using batch procedure if use of column is not feasible).

Analysis of cosmetics: Major and minor constituents and their function

a. Analysis of deodorants and antiperspirants, Al, Zn, boric acid, chloride, sulphate.
b. Determination of constituents of talcum powder: Magnesium oxide, Calcium oxide, Zinc oxide and Calcium carbonate by complexometric titration.

Suggested Applications (Any one):

a. To study the use of phenolphthalein in trap cases.
b. To analyze arson accelerants.
c. To carry out analysis of gasoline.

Suggested Instrumental demonstrations:

a. Estimation of macro nutrients: Potassium, Calcium, Magnesium in soil samples by flame photometry.

b. Spectrophotometric determination of Iron in Vitamin / Dietary Tablets.
c. Spectrophotometric Identification and Determination of Caffeine and Benzoic Acid in Soft Drink.

Reference:

- Willard, H.H., Merritt, L.L., Dean, J. &Settoe, F.A. *Instrumental Methods ofAnalysis*. 7thEd. Wadsworth Publishing Co. Ltd., Belmont, California, USA,1988.
- Skoog, D.A. Holler F.J. &Nieman, T.A. *Principles of Instrumental Analysis*, Cengage Learning India Ed.
- Skoog, D.A.; West, D.M. & Holler, F.J. *Fundamentals of AnalyticalChemistry 6th Ed.,* Saunders College Publishing, Fort Worth (1992).
- Harris, D. C. *Quantitative Chemical Analysis*, W. H. Freeman.
- Dean, J. A. *Analytical Chemistry Notebook*, McGraw Hill.
- Day, R. A. & Underwood, A. L. *Quantitative Analysis*, Prentice Hall of India.

- Freifelder, D. *Physical Biochemistry 2nd Ed.,* W.H. Freeman and Co., N.Y. USA (1982).
- Cooper, T.G. *The Tools of Biochemistry,* John Wiley and Sons, N.Y. USA. 16 (1977).
- Vogel, A. I. *Vogel's Qualitative Inorganic Analysis 7th Ed.,* Prentice Hall.
- Vogel, A. I. Vogel's *Quantitative Chemical Analysis 6th Ed.,* Prentice Hall.
- Robinson, J.W. *Undergraduate Instrumental Analysis 5th Ed.,* Marcel Dekker, Inc., New York (1995)

Chemistry Syllabus for practicals for B.Sc Course

Note: Students should be trained to use both chemical and electronic balances (three digit)
DMA24101/ DMA24105/ DMA24108

III Semester : Practical 3 — 3 hours per week

DMC24101/ DMC24105/ DMC24108
Systematic semi micro qualitative analysis of a mixture of two simple salts (with no interfereing radicals).
The constituent ions in the mixture to be restricted to the following
Anions : HCO_3^- , CO_3^{2-}, SO_3^-, Cl^-, Br^-, NO_3^-, BO_3^{3-}, SO_4^{2-}, PO_4^{3-}
Cations : Pb^{2+}, Bi^{3+}, Cd^{2+}, Al^{3+}, Fe^{3+}, Fe^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+},Sr^{2+}, Ca^{2+}, Mg^{2+},K^+, Na^+, NH^{4+}
Note :

1. Mixture requiring elimination of phosphate and borate should not be given.
2. Combination of anions in second group shall be avoided.
3. Salts that yields double decomposition shall be avoided. ($BaSO_4$).
4. The combination of two cations in the mixture should belong to different groups. However combinations like Mg^{2+} and NH^{4+} and Na^+ and NH^{4+} can be given.

IV Semester : Practical 4 — 3 hours per week

DMD24101/ DMD24105/ DMD24108
Part 1 :

1. Determination of the density using specific gravity bottle and viscocity of a liquid using Ostwald's viscometer
2. Determination of the density using specific gravity bottle and surface tension of a liquid using stalagmometer.
3. Determination of molecular mass of a non-volatile solute by walker-Lumsden method.
4. Determination of rate constant of the decomposition of hydrogen peroxide catalysed by $FeCl_3$.
5. Determination of transition temperature of the salt hydrates .
6. Determination of rate constant of saponification of ethylacetate titrimetrically.
7. Determination of percentage composition of sodium chloride solution by determining the miscibility temperature of phenol-water system.

8. Determination of the mass present in the given solution of a strong acid using strong base by thermometric titration method
9. Determination of molecular weight of a polymer material by viscocity measurements (cellulose acetate/ Methyl acrylate)
10. Study of kinetics of reaction between $K_2S_2O_8$ and KI, second order, determination of rate constant.

V Semester: Practical 5A 3 hours per week

DME24101/ DME24105/ DME24108

Part 1: Gravimetric estimation

1. Gravimetric estimation of Barium as Barium sulphate.
2. Gravimetric estimation of Iron as Iron(III) oxide
3. Gravimetric estimation of copper as copper thiocyanate
4. Gravimetric estimation of Nickel as nickel dimethyl glyoximate
5. Gravimetric estimation of magnesium as magnesium hydroxyl quinolate

Part 2 : Volumetric estimations

1. Estimastion of iron in the given sample of haematite by dichromate method.
2. Estimation of percentage of calcium in limestone by oxalate method
3. Estimation of manganese in the given sample of pyrolusite.
4. Estimation of magnesium in the given sample of dolomite by EDTA method.
5. Determination of % purity of copper in the given sample of copper wire.

V Semester: Practical 5B 3 hours per week

DME24301/ DME24305/ DME24308

1. Determination of dissolved oxygen in water.
2. Determination of Chemical Oxygen Demand (COD)
3. Determination of Biological Oxygen Demand (BOD)
4. Percentage of available chlorine in bleaching powder.
5. Measurement of chloride, sulphate and salinity of water samples by simple titration method (AgNO3 and potassium chromate).
6. Estimation of total alkalinity of water samples ($CO3^{2-}$, $HCO3^{-}$) using double titration method.
7. Measurement of dissolved CO2.
8. Study of some of the common bio-indicators of pollution.
9. Estimation of SPM in air samples.
10. Preparation of borax/ boric acid.

VI Semester : Practical 6 A 3 hours per week

DMF24101/ DMF24105/ DMF24108

Part 1: Physical chemistry experiments (instrumental)

1. Determination of Equivalent conductance of the given electrolyte(both strong and weak electrolyte)
2. Determination of percentage composition of benzene and carbon tetra chloride by using Abbe's refractrometer.
3. Determination of concentration of an acid/ base by conductometric method.
4. Potentiometric titration of Ferrous ammonium sulphate and $K_2Cr_2O_7$.
5. Determination of PKa of weak acid by potentiometric method
6. PH titration of strong acid and strong base.
7. Calorimetric estimation of Fe3+ ion using Ammonium thiocyanate
8. Calorimetric estimation of Cu2+ ion using NH_4OH
9. Calorimetric estimation of Asprin using $FeCl_3$

Part 2 : Isolation of organic compounds from natural products

1. Isolation of hesperidins from orange peels
2. Isolation of caffeine from Tea leaves
3. Isolation of Nicotine from Tobacco leaves.

VI Semester : Practical 6B 3 hours per week

DMF24301/ DMF24305/ DMF24308

DSE LAB

UV/Visible spectroscopy

1. Study the 200-500 nm absorbance spectra of KMnO4 and K2Cr2O7 (in 0.1 M H2SO4) and determine the λmax values. Calculate the energies of the two transitions in different units (J molecule-1, kJ mol-1 , cm -1, eV).
2. Study the pH-dependence of the UV-Vis spectrum (200-500 nm) of K2Cr2O7.
3. Record the 200-350 nm UV spectra of the given compounds (acetone, acetaldehyde, 2-propanol, acetic acid) in water. Comment on the effect of structure on the UV spectra of organic compounds.
    i. Colourimetry
4. Verify Lambert-Beer's law and determine the concentration of CuSO4/KMnO4/K2Cr2O7 in a solution of unknown concentration
5. Determine the concentrations of KMnO4 and K2Cr2O7 in a mixture.
6. Study the kinetics of iodination of propanone in acidic medium
7. Determine the amount of iron present in a sample using 1,10-phenathroline.
8. Determine the dissociation constant of an indicator (phenolphthalein).
9. Study the kinetics of interaction of crystal violet/ phenolphthalein with sodium hydroxide.
10. Analyse the given vibration-rotation spectrum of HCl(g)

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE
(Autonomous)

Ooty Road, Mysuru-570025

Model Curriculum Structures for Bachelor of Science (Basic and Honours) Programme with Computer Science as Major & Minor Course Model Syllabus for I and II Semesters and Open Elective Courses in Computer Science

As per

NATIONAL EDUCATION POLICY - 2020 (NEP-2020)

2021-22

DEPARTMENT OF COMPUTER SCIENCE

The objectives of the B.Sc. - Computer Science Program

1. The primary objective of this program is to provide a foundation of computing principles for effectively using information systems and enterprise softwares.
2. It helps students analyze the requirements for system programming and exposes students for information systems
3. This programme provides students with options to specialize in various software systems.
4. To produce outstanding Computer Scientists who can apply the theoretical knowledge into practice in the real world and develop standalone live projects themselves
5. To provide opportunity for the study of modern methods of information processing and its applications.
6. To develop among students the programming techniques and the problem- solving skills through programming
7. To prepare students who wish to go on to further studies in computer science and related subjects.
8. To acquaint students to Work effectively with a range of current, standard, Office Productivity software applications.

Program Outcomes:

1. **Discipline knowledge:** Acquiring knowledge on basics of Computer Science and ability to apply to design principles in the development of solutions for problems of varying complexity.

2. **Problem Solving:** Improved reasoning with strong mathematical ability to Identify, formulate and analyze problems related to computer science and exhibiting a sound knowledge on data structures and algorithms.

3. **Design and Development of Solutions:** Ability to design and development of algorithmic solutions to real world problems.

4. **Programming a computer:** Exhibiting strong skills required to program a computer for various issues and problems of day-to-day scientific applications.

5. **Application Systems Knowledge**: Possessing a minimum knowledge to practice existing computer application software.

6. **Communication:** Must have a reasonably good communication knowledge both in oral and writing.

7. **Ethics on Profession, Environment and Society:** Exhibiting professional ethics to maintain the integrality in a working environment and also have concern on societal impacts due to computer-based solutions for problems.

8. **Lifelong Learning:** Should become an independent learner. So, learn to learn ability.

9. **Motivation to take up Higher Studies:** Inspiration to continue educations towards advanced studies on Computer Science.

Additional Program Outcomes for B. Sc. (Hons) in Computer Science

The four years Bachelors in Computer Science (Hons) program enables students to attain the following additional attributes besides the afore-mentioned attributes:

1. Apply standard Software Engineering practices and strategies in real -time software project development
2. Design and develop computer programs/computer-based systems in the areas related to AI, algorithms, networking, web design, cloud computing, IoT and data analytics.
3. Acquaint with the contemporary trends in industrial/ research settings and thereby innovate novel solutions to existing problems
4. The ability to apply the knowledge and understanding noted above to the analysis of a given information handling problem.
5. The ability to work independently on a substantial software project and as an effective team member.

IIIA. Model Program Structures for the Under-Graduate Programs in Universities and Colleges in Karnataka

Bachelor of Science (Basic/ Hons.) in subjects with practical with both subjects as majors

Sem.	Discipline Core (DSC) (Credits) (L+T+P)	Discipline Elective (DSE) / Open Elective (OE) (Credits) (L+T+P)	Ability Enhancement Compulsory Courses (AECC),		Skill Enhancement Courses (SEC)			Total Credits
					Skill based credits (L+T+P)	Value based (Credits) (L+T+P)		
I	Discipline A1(4+2) Discipline B1(4+2)	OE-1 (3)	L1-1(3), L2-1(3) (4 hrs. each)	Environmental Studies (3)		Physical Education for fitness (1) (0+0+2)	Health & Wellness (1) (0+0+2)	25
II	Discipline A2(4+2) Discipline B2(4+2)	OE-2 (3)	L1-2(3), L2-2(3) (4 hrs. each)		SEC-1: Digital Fluency (2)(1+0+2)	Physical Education - Yoga(1) (0+0+2)	NCC/NSS/R&R(S&G) /Cultural (1) (0+0+2)	25
Exit option with Certificate (50 credits)								
III	Discipline A3(4+2) Discipline B3(4+2)	OE-3 (3)	L1-3(3), L2-3(3) (4 hrs. each)	Constitution of India (3)		Physical Education-Sports (1) (0+0+2)	NCC/NSS/R&R(S&G) /Cultural (1)(0+0+2)	25
IV	Discipline A4(4+2) Discipline B4(4+2)	OE-4 (3)	L1-4(3), L2-4(3) (4 hrs. each)		SEC-2: Artificial Intelligence (2) (1+0+2)	Physical Education -Games (1) (0+0+2)	NCC/NSS/R&R(S&G) /Cultural (1)(0+0+2)	25
Exit option with Diploma (100 credits) or continue the third year with both the subjects as majors								
V	Discipline A5(3+2), Discipline A6(3+2) Discipline B5(3+2), Discipline B6(3+2)				SEC-3: SEC such as Cyber Security (2) (1+0+2)			23
VI	Discipline A7(3+2), Discipline A8(3+2) Discipline B7(3+2) Discipline B8(3+2) Internship (2)				SEC-4: Professional Communication (2)			24
Exit option with Bachelor of Arts, B.A./ Bachelor of Science, B. Sc. Basic Degree (146 credits) or choose one of the Disciplines as Major								
VII	Discipline A/B-9(3+2) Discipline A/B-10(3+2) Discipline A/B-11(3)		DS-A/B Elective-1(3) DS-A/B Elective-2(3) Res. Methodology(3)					22
VIII	Discipline A/B-12(3+2) Discipline A/B-13(3) Discipline A/B-14(3)		DS-A/B Elective-3(3) Research Project (6) *					20

NEP 2020 Syllabus – B.Sc. (Cs M) and B.Sc. (P Cs) 2021-22 onwards

Year	Sem	Combination	Course Code	Title	Hours / Week			Credits			Maximum Marks						Exam Duration	Total Marks
											Th. IA		Pr. IA		Exam			
					L	T	P	L	T	P	C1	C2	C1	C2	Th.	Pr.		
I	I	**Cs M**	**FSA45034** [DSC-1]	Computer Fundamentals and Programming in C	4	0	0	4	0	0	20	20	-	-	60	-	2½ Hours	100
		P Cs	**FSA45035** [DSC-1]	Computer Fundamentals and Programming in C	4	0	0	4	0	0	20	20	-	-	60	-	2½ Hours	100
		Cs M	**FSA45034** [DSC-1L]	C Programming Lab	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		P Cs	**FSA45035** [DSC-1L]	C Programming Lab	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		IBA EG	FHA21031	SEC - DIGITAL FLUENCY	1	0	1	1	0	2	-	-	10	15*	-	25	1 Hours	50
		IBA HP	FHA21032		1	0	1	1	0	2	-	-	10	15*	-	25	1 Hours	50
		IBA KG	FHA21033		1	0	1	1	0	2	-	-	10	15*	-	25	1 Hours	50
		IBA HE	FHA21034		1	0	1	1	0	2	-	-	10	15*	-	25	1 Hours	50
		IBA JP	FHA21035		1	0	1	1	0	2	-	-	10	15*	-	25	1 Hours	50
			FSA880	**Open Elective (OE) - Office Automation**	3	0	0	3	0	0	-	-	10	15*	-	25	2 Hours	50
			FSA890	**Open Elective (OE) - C Programming Concepts**	3	0	0	3	0	0	-	-	10	15*	-	25	2 Hours	50
	II	**Cs M**	**FSB45034** [DSC-2]	Data Structures using C	4	0	0	4	0	0	20	20	-	-	60	-	2½ Hours	100
		P Cs	**FSB45035** [DSC-2]	Data Structures using C	4	0	0	4	0	0	20	20	-	-	60	-	2½ Hours	100
		Cs M	**FSB45034** [DSC-2 L]	Data structures Lab	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		P Cs	**FSB45035** [DSC-2 L]	Data structures Lab	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50

Year	Sem	Combination	Course Code	Title	Hours / Week			Credits			Maximum Marks						Exam Duration	Total Marks
											Th. IA		Pr. IA		Exam			
					L	T	P	L	T	P	C1	C2	C1	C2	Th.	Pr.		
I	II	I BCA	FAB210	SEC - DIGITAL FLUENCY	1	0	2	1	0	1	-	-	10	15*	25	-	3 Hours	50
		I B.Sc. PC	FSB21031															
		I B.Sc. PM	FSB21032															
		I B.Sc. PE	FSB21033															
		I B.Sc. CsM	FSB21034															
		I B.Sc. PCs	FSB21035															
		I B.Sc. BtZ	FSB21036															
		I B.Sc. CBt	FSB21037															
		I B.Sc. CZ	FSB21038															
		I B.Sc. BZ	FSB21039															
		I B.Sc. BtBc	FSB21040															
		I B.Sc. MbBt	FSB21041															
		I B.Sc. MbBc	FSB21042															
			FSB880	OE – E Commerce	3	0	0	3	0	0	-	-	10	15*	-	25	2 Hours	50
			FSB890	OE-Web Designing	3	0	0	3	0	0	-	-	10	15*	-	25	2Hours	50
		Exit option with Certificate (50 credits)																

Note: 15* is spilt 10 marks for Practical's of C2 + 5 marks for practical Record/ Report

Discipline Specific Elective Courses:		
Group 1: • IoT • Cyber Law and Cyber Security • Web Programming - PHP and MySQL • Clouds, Grids, and Clusters • Software Testing	**Group-2:** • Information and Network Security • Data Compression • Discrete Structures • Opensource Programming • Multimedia Computing • Big Data	**Group-3:** • Data Analytics • Storage Area Networks • Pattern Recognition • Digital Image Processing • Parallel Programming • Digital Signal Processing
Open Electives in Computer Science: (For BA, BSc, BCom, BSW, BBA, BBM students studying Core Courses other than Computer Science/ Computer Applications)		
• Office Automation • Multimedia Processing • Computer Animation • Accounting Package	• C Programming Concepts • Python Programming Concepts • R Programming	• E-Content Development • E-Commerce • Web Designing

Model Syllabus for BSc (Basic and Honors), Semesters I and II

Semester: I

Course Code: DSC-1	**Course Title:** Computer Fundamentals and Programming in C
Course Credits: 04	Hour of Teaching/Week: 04
Total Contact Hours: 52	Formative Assessment Marks: 40
Exam Marks: 60	Exam Duration: 03

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

- Confidently operate Desktop Computers to carry out computational tasks
- Understand working of Hardware and Software and the importance of operating systems
- Understand programming languages, number systems, peripheral devices, Networking, Multimedia and internet concepts
- Read, understand and trace the execution of programs written in C language
- Write the C code for a given problem
- Perform input and output operations using programs in C
- Write programs that perform operations on arrays

Course Content

Content	Hours
Unit - 1	
Fundamentals of Computers: Introduction to Computers - Computer Definition, Characteristics of Computers, Evolution and History of Computers, Types of Computers, Basic Organisation of a Digital Computer; Number Systems – different types, conversion from one number system to another; Computer Codes – BCD, Gray Code, ASCII and Unicode; Boolean Algebra – Boolean Operators with Truth Tables; Types of Software – System Software and Utility Software; Computer Languages - Machine Level, Assembly Level & High Level Languages, Translator Programs – Assembler, Interpreter and Compiler; Planning a Computer Program - Algorithm, Flowchart and Pseudo code with Examples. **Introduction to C Programming:** Over View of C; History and Features of C; Structure of a C Program with Examples; Creating and Executing a C Program; Compilation process in C.	13
Unit - 2	
C Programming Basic Concepts: C Character Set; C tokens - keywords, identifiers, constants, and variables; Data types; Declaration & initialization of variables; Symbolic constants. **Input and output with C:** Formatted I/O functions - *printf* and *scanf,* control stings and escape sequences, output specifications with *printf* functions; Unformatted I/O functions to read and display single character and a string - *getchar, putchar, gets* and *puts* functions. **C Operators & Expressions:** Arithmetic operators; Relational operators; Logical operators; Assignment operators; Increment & Decrement operators; Bitwise operators; Conditional operator; Special operators; Operator Precedence and Associatively; Evaluation of arithmetic expressions; Type conversion.	13
Unit - 3	
Control Structures: Decision making Statements - *Simple if, if_else*, *nested if_else, else_if ladder, Switch-case*, *goto, break* & *continue* statements; Looping Statements - Entry controlled and Exit controlled statements, *while, do-while, for* loops, Nested loops.	13

Arrays: One Dimensional arrays - Declaration, Initialization and Memory representation; Two Dimensional arrays - Declaration, Initialization and Memory representation. Strings: Declaring & Initializing string variables; String handling functions - *strlen, strcmp, strcpy and strcat;* Character handling functions - *toascii, toupper, tolower, isalpha, isnumeric* etc.	
Unit - 4	
Pointers in C: Understanding pointers - Declaring and initializing pointers, accessing address and value of variables using pointers; Pointers and Arrays; Pointer Arithmetic; Advantages and disadvantages of using pointers; **User Defined Functions:** Need for user defined functions; Format of C user defined functions; Components of user defined functions - return type, name, parameter list, function body, return statement and function call; Categories of user defined functions - With and without parameters and return type. **User defined data types:** Structures - Structure Definition, Advantages of Structure, declaring structure variables, accessing structure members, Structure members initialization, comparing structure variables, Array of Structures; Unions - Union definition; difference between Structures and Unions.	13

Text Books

1. Pradeep K. Sinha and Priti Sinha: Computer Fundamentals (Sixth Edition), BPB Publication
2. E. Balaguruswamy: Programming in ANSI C (TMH)

References

1. Kamthane: Programming with ANSI and TURBO C (Pearson Education)
2. V. Rajaraman: Programming in C (PHI – EEE)
3. S. ByronGottfried: Programming with C (TMH)
4. Kernighan & Ritche: The C Programming Language (PHI)
5. Yashwant Kanitkar: Let us C
6. P.B. Kottur: Programming in C (Sapna Book House)

Course Code: **DSC-1L**	**Course Title: C Programming Lab**
Course Credits: 02	Hour of Teaching/Week: 04
Total Contact Hours: 52	Formative Assessment Marks: 25
Exam Marks: 25	Exam Duration: 03

Practice Lab

The following activities be carried out/ discussed in the lab during the initial period of the semester.

1. Basic Computer Proficiency a. Familiarization of Computer Hardware Parts
   b. Basic Computer Operations and Maintenance.
   c. Do's and Don'ts, Safety Guidelines in Computer Lab

2. Familiarization of Basic Software – Operating System, Word Processors, Internet Browsers, Integrated Development Environment (IDE) with Examples.

3. Type Program Code, Debug and Compile basic programs covering C Programming fundamentals discussed during theory classes.

Programming Lab

Part A:

1. Write a C Program to read radius of a circle and to find area and circumference
2. Write a C Program to read three numbers and find the biggest of three

3. Write a C Program to demonstrate library functions in *math.h*
4. Write a C Program to check for prime
5. Write a C Program to generate n primes
6. Write a C Program to read a number, find the sum of the digits, reverse the number and check it for palindrome
7. Write a C Program to read numbers from keyboard continuously till the user presses 999 and to find the sum of only positive numbers
8. Write a C Program to read percentage of marks and to display appropriate message (Demonstration of else-if ladder)
9. Write a C Program to find the roots of quadratic equation (demonstration of switch-case statement)
10. Write a C program to read marks scored by n students and find the average of marks (Demonstration of single dimensional array)
11. Write a C Program to remove Duplicate Element in a single dimensional Array
12. Program to perform addition and subtraction of Matrices

Part B:

1. Write a C Program to find the length of a string without using built in function
2. Write a C Program to demonstrate string functions.
3. Write a C Program to demonstrate pointers in C
4. Write a C Program to check a number for prime by defining *isprime( )* function
5. Write a C Program to read, display and to find the trace of a square matrix
6. Write a C Program to read, display and add two m x n matrices using functions
7. Write a C Program to read, display and multiply two m x n matrices using functions
8. Write a C Program to read a string and to find the number of alphabets, digits, vowels, consonants, spaces and special characters.
9. Write a C Program to Reverse a String using Pointer
10. Write a C Program to Swap Two Numbers using Pointers
11. Write a C Program to demonstrate student structure to read & display records of n students.
12. Write a C Program to demonstrate the difference between structure & union.

Note: Student has to execute a minimum of 10 programs in each part to complete the Lab course

Evaluation Scheme for Lab Examination

Assessment Criteria		**Marks**
Program – 1 from Part A	Flowchart / Algorithm	02
	Writing the Program	05
	Execution and Formatting	03
Program -2 from Part B	Flowchart/Algorithm	02
	Writing the Program	05
	Execution and Formatting	03
Viva Voice based on C Programming		05
Total		**25**

Semester: II

Course Code: **DSC-2**	**Course Title:** Data Structures using C
Course Credits: 04	Hour of Teaching/Week: 04
Total Contact Hours: 52	Formative Assessment Marks: 40
Exam Marks: 60	Exam Duration: 03 Hours

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

• Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithms

• Describe common applications for arrays, records, linked structures, stacks, queues, trees, and graphs

• Write programs that use arrays, records, linked structures, stacks, queues, trees, and graphs

• Demonstrate different methods for traversing trees

• Compare alternative implementations of data structures with respect to performance

• Describe the concept of recursion; give examples of its use

• Discuss the computational efficiency of the principal algorithms for sorting and searching

Course Content

Content	**Hours**
Unit - 1	
Introduction to data structures: Definition; Types of data structures - Primitive & Non-primitive, Linear and Non-linear; Operations on data structures. Algorithm Specification, Performance Analysis, Performance Measurement Recursion: Definition; Types of recursions; Recursion Technique Examples - Fibonacci numbers, GCD, Binomial coefficient ${}_nC_r$, Towers of Hanoi; Comparison between iterative and recursive functions.	13
Unit - 2	
Arrays: Basic Concepts – Definition, Declaration, Initialisation, Operations on arrays; Types of arrays; Arrays as abstract data types (ADT); Representation of Linear Arrays in memory; Traversing linear arrays; Inserting and deleting elements; Sorting – Selection sort, Bubble sort, Quick sort, Selection sort, Insertion sort; Searching - Sequential Search, Binary search; Iterative and Recursive searching; Multidimensional arrays; Representation of multidimensional arrays; Sparse matrices. Dynamic memory allocation: Static & Dynamic memory allocation; Memory allocation and de-allocation functions - *malloc*, *calloc*, *realloc* and *free*.	13
Unit - 3	
Linked list: Basic Concepts – Definition and Representation of linked list, Types of linked lists - Singly linked list, Doubly liked list, Header liked list, Circular linked list; Representation of Linked list in Memory; Operations on Singly linked lists – Traversing, Searching, Insertion, Deletion; Memory allocation; Garbage collection. Stacks: Basic Concepts – Definition and Representation of stacks; Operations on stacks; Applications of stacks; Infix, postfix and prefix notations; Conversion from infix to postfix using stack; Evaluation of postfix expression using stack; Application of stack in function calls.	13

Unit - 4	
Queues: Basic Concepts – Definition and Representation of queues; Types of queues - Simple queues, Circular queues, Double ended queues, Priority queues; Operations on Simple queues; Trees: Definition; Tree terminologies –node, root node, parent node, ancestors of a node, siblings, terminal & non-terminal nodes, degree of a node, level, edge, path, depth; Binary tree: Type of binary trees - strict binary tree, complete binary tree, binary search tree and heap tree; Array representation of binary tree. Traversal of binary tree; *preorder, inorder* and *postorder* traversal; Reconstruction of a binary tree when any two of the traversals are given.	13

Text Books

1. Satraj Sahani: Fundamentals of Data Structures

References

1. Tanenbaum: Data structures using C (Pearson Education)
2. Kamathane: Introduction to Data structures (Pearson Education)
3. Y. Kanitkar: Data Structures Using C (BPB)
4. Kottur: Data Structure Using C
5. Padma Reddy: Data Structure Using C
6. Sudipa Mukherjee: Data Structures using C – 1000 Problems and Solutions (McGraw Hill Education, 2007))

Course Code: **DSC-2Lab**	**Course Title: Data Structures Lab**
Course Credits: 02	Hour of Teaching/Week: 04
Total Contact Hours: 52	Formative Assessment Marks: 25
Exam Marks: 25	Exam Duration: 03

Programming Lab

Part A:

1. Write a C Program to find GCD using recursive function
2. Write a C Program to display Pascal Triangle using binomial function
3. Write a C Program to generate n Fibonacci numbers using recursive function.
4. Write a C Program to implement Towers of Hanoi.
5. Write a C Program to implement dynamic array, find smallest and largest element of the array.
6. Write a C Program to create two files to store even and odd numbers.
7. Write a C Program to create a file to store student records.
8. Write a C Program to read the names of cities and arrange them alphabetically.
9. Write a C Program to sort the given list using selection sort technique.
10. Write a C Program to sort the given list using bubble sort technique.

Part B:

1. Write a C Program to sort the given list using insertion sort technique.
2. Write a C Program to sort the given list using quick sort technique.
3. Write a C Program to sort the given list using merge sort technique.
4. Write a C Program to search an element using linear search technique.
5. Write a C Program to search an element using recursive binary search technique.
6. Write a C Program to implement Stack.
7. Write a C Program to convert an infix expression to postfix.

8. Write a C Program to implement simple queue.
9. Write a C Program to implement linear linked list.
10. Write a C Program to display traversal of a tree.

Evaluation Scheme for Lab Examination

Assessment Criteria		**Marks**
Program – 1 from Part A	Flowchart / Algorithm	02
	Writing the Program	05
	Execution and Formatting	03
Program -2 from Part B	Flowchart/Algorithm	02
	Writing the Program	05
	Execution and Formatting	03
Viva Voice based on C Programming		05
Total		**25**

Open Elective courses offered by the Department of Computer Science

Open Elective 1: Office Automation

Course Outcomes (COs):

- Be familiar various office automation tools.
- Create and format a document**.**
- Create and analyse data using Excel.
- Create and customize a presentation for a specific topic.

Unit-1 **14 Hrs**

Introduction, Block diagram of a computer, Input and output devices, memory and storage devices, Types of software, Introduction to operating system – functions, types of operating system and examples.

Introduction to word processing – creating and saving a document, formatting a document – Line spacing, paragraph, Fonts, inserting symbols, header and footer, shape, Tables, Find and replace, Mail merge, saving a document in different formats.

Unit-2 **14 Hrs**

Introduction to spread sheet – entering different types of data like text, numbers, date, , functions and formulae- different categories of functions, chart-creating and formatting a chart, filter, working with single and multiple work books, cell referencing, printing and previewing a document.

Unit-3 **14 Hrs**

Introduction to presentation tools-creating and viewing a presentation, applying design template, formatting options, inserting different objects in a presentation, customize a presentation, adding audio to a presentation, Slide animation, preview Slide transitions Slide show options, adding effect to presentation.

Reference books

1. Computer Basics with Office Automation- Archana Kumar, Dreamtech press, First Edition.
2. The Handbook of Office Automation- Ralph Tomas Reilly, Iuniverse publication, First Edition.

Open Elective-2: C Programming Concepts

Course Outcomes (COs): After completing this course satisfactorily, a student will be able to

- Confidently operate Desktop Computers to carry out computational tasks.
- Understand working of Hardware and Software and the importance of operating systems.
- Understand programming languages, number systems, peripheral devices, networking,
- multimedia and internet concepts.
- Read, understand and trace the execution of programs written in C language.
- Write the C code for a given problem.
- Perform input and output operations using programs in C.
- Write programs that perform operations on arrays.

Unit-1 **14 Hrs**

Fundamentals of Computers: Introduction to Computers -Hardware, software System software, Application software, Utility software, Operating System; Computer Languages – Machine Level, Assembly Level & High-Level Languages, Translator Programs – Assembler, Interpreter and Compiler; Planning a Computer Program – Algorithm and Flowchart with Examples.

Introduction to C Programming: Over View of C; History and Features of C; Structure of a C Program with Examples; Creating and Executing a C Program; Compilation process in C. C Programming Basic Concepts: C Character Set; C tokens - keywords, identifiers, constants, and variables; Data types; Declaration & initialization of variables; Symbolic constants.

Unit-2 **14 Hrs**

Input and output with C: Formatted I/O functions - printf and scanf, control stings and escape sequences, output specifications with printf functions; Unformatted I/O functions to read and display single character and a string - getchar, putchar, gets and puts functions, C Operators & Expressions: Arithmetic operators; Relational operators; Logical operators; Assignment operators; Increment & Decrement operators; Bitwise operators; Conditional operator; Special operators; Operator Precedence and Associatively; Evaluation of arithmetic expressions; Type conversion.

Control Structures: Decision making Statements - Simple if, if_else, nested if_else, else_if ladder, Switch-case, goto, break & continue statements; Looping Statements - Entry controlled and Exit controlled statements, while, do-while, for loops, Nested loops.

Unit-3 **14 Hrs**

User Defined Functions: Need for user defined functions; Format of C user defined functions; Components of user defined functions - return type, name, parameter list, function body, return statement and function call; Categories of user defined functions - With and without parameters and return type.

Arrays: One Dimensional arrays - Declaration, Initialization and Memory representation; Two Dimensional arrays - Declaration, Initialization and Memory representation. Strings: Declaring & Initializing string variables; String handling functions - strlen, strcmp, strcpy and strcat; Character handling functions - toascii, toupper, tolower, isalpha, isnumeric etc. Basics of Pointers in C: Understanding pointers - Declaring and initializing pointers, accessing address and value of variables using pointers; Pointer Arithmetic; Advantages and disadvantages of using pointers;

Text Books:

1. Pradeep K. Sinha and Priti Sinha: Computer Fundamentals (Sixth Edition), BPB Publication
2. E. Balgurusamy: Programming in ANSI C (TMH)

References:

1. Kamthane: Programming with ANSI and TURBO C (Pearson Education)
2. V. Rajaraman: Programming in C (PHI –EEE)
3. S. ByronGottfried: Programming with C (TMH)
4. Kernighan & Ritche: The C Programming Language (PHI)
5. Yashwant Kanitkar: Let us C 6. P.B. Kottur: Programming in C (Sapna Book House)

Course Content
Semester: I / II
Course Title: SEC **Digital Fluency** Course Credits: 2
Total Contact Hours: 15 hours of theory and 30 hours of practicals
Duration of ESA:
Formative Assessment Marks: 5**0 marks**
Summative Assessment Marks: 50 marks

Model Syllabus Authors:
Course Outcomes (COs):
At the end of the course the student should be able to:
(Write 3-7 course outcomes. Course outcomes are statements of observable student actions that serve as evidence of knowledge, skills and values acquired in this course)
1. Have an intelligent conversation on the key concepts and applications of Artificial Intelligence (AI), Big Data Analytics (BDA), Internet of Things (IoT), Cloud Computing, and Cybersecurity
2. Develop holistically by learning essential skills such as effective communication, Problem-solving, design thinking, and teamwork
3. Build his/her personal brand as an agile and expansive learner – one who is interested in Horizontal and vertical growth?

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)
This mapping needs to be done considering POs of respective programs.
Course Outcomes (COs) /
Program Outcomes (POs)
1 2 3 4 5 6 7 8 9 10 11 12
1. Have an intelligent conversation on the key concepts and applications of AI, BDA, IoT, Cloud Computing, and Cyber security
2. Develop holistically by learning essential skills such as effective communication, problem-solving, design thinking, and teamwork
3. Build his/her personal brand as an agile and expansive learner – one who is interested in horizontal and vertical growth
Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark 'X' in the intersection cell if a course outcome addresses a particular program outcome.

Course Content (Digital 101)

Details of topic	**Duration**

Module 1: Emerging Technologies 05 hours

Overview of Emerging Technologies:
i. Artificial Intelligence, Machine Learning, Deep Learning,
ii. Database Management for Data Science, Big Data Analytics,
iii. Internet of Things (IoT) and Industrial Internet of Things (IIoT)
iv. Cloud computing and its service models & v. Cyber Security and Types of cyber attack

Module 2: Applications of Emerging Technologies 05 hours

Applications of emerging technologies:
i. Artificial Intelligence
ii. Big Data Analytics
iii. Internet of Things
iv. Cloud Computing
v. Cyber Security

Module 3: Building Essential Skills beyond Technology 05 hours

Importance of the following:
i. Effective Communication Skills
ii. Creative Problem Solving & Critical Thinking
iii. Collaboration and Teamwork Skills
iv. Innovation & Design Thinking
v. Use of tools in enhancing skills

References to learning resources:

1. The learning resources made available for the course titled “Digital 101” on Future Skills Prime Platform of NASSCOM

Structure of BA (Honors) and MA

In

Economics

Acronyms Expanded	
AECC	Ability Enhancement Compulsory Course
DSCC	Discipline Specific Core Course
SEC/SB/VB	Skill Enhancement Course- Skill Based/Value Based
OEC	Open Elective Course
DSE	Discipline Specific Elective

B.A. PROGRAM

Proposed Scheme of Teaching and Evaluation for B.A (Basic/Honours) with Economics as MajorEG-2021-2022

(I Sem-II Sem)

Sem	Course No C1/C2	Course Code	Title of the course	Course Type	Credit Pattern (L+T+P)	Total Credit	Teaching hrs/week	Evaluation Pattern			
								C1	C2	C3	Total Marks
I	Course1	FHA41031	Basic Economics –I	DSC1	3+0+0	3	3	20	20	60	100
I	Course2	FHA42031	Contemporary Indian Economy	DSC2	3+0+0	3	3	20	20	60	100
I	Open Elective Course	---	1. Kautilya's Arthshastra	OEC	3+0+0	3	3	20	20	60	100
I	Open Elective Course	---	2. Pre-reforms Indian Economy	OEC	3+0+0	3	3	20	20	60	100
I	Open Elective Course	FHA800	3. Development Studies	OEC	3+0+0	3	3	20	20	60	100
II	Course1	FHB41031	Basic Economics -II	DSC3	3+0+0	3	3	20	20	60	100
II	Course2	FHB42031	Karnataka Economy	DSC4	3+0+0	3	3	20	20	60	100
II	Open Elective Course	---	1. Contemporary Indian Economy	OEC	3+0+0	3	3	20	20	60	100
II	Open Elective Course	---	2. Sustainable Development	OEC	3+0+0	3	3	20	20	60	100
II	Open Elective Course	FHB800	3. Economics of Business Environment	OEC	3+0+0	3	3	20	20	60	100

Note:

1. In lieu of the research project, two additional elective papers/ Internship may be offered.
2. One Hour of Lecture is equal to 1Credit
3. Two Hours of Practical is equal to 1Credit
4. One Hour of Tutorial is equal to 1 Credit (Except Languages)

BA (Honours) and MA (Economics) List of Open Electives

Semester	Open Elective Papers	Semester	Open Elective Papers
I	1. Kautilya's Arthshastra 2. Pre-reforms Indian Economy 3. Development Studies	**II**	1. Contemporary Indian Economy 2. Sustainable Development 3. Economics of Business Environment
III	1. Rural Economics 2. Economics of Insurance 3. Economics of Human Development	**IV**	1. Karnataka Economy 2. Entrepreneurial Economics 3. Economics and Law
V	1. Agricultural Economics 2. Industrial Economics 3. Financial Economics (Choose any one)	**VI**	1. Labour Economics 2. Economics of Non-Farm Sector 3. Tertiary Economics (choose any one)
	Vocational Course – 1 1. Entrepreneurial Economics 2. Digital Economics (Choose any one)		Vocational Course – 2 1. Micro Entrepreneurs Development 2. Project Planning & Management (choose any one)
VII	1. Population Studies 2. Urban Economics 3. Economics of Infrastructure (choose any one)	**VIII**	1. Institutional Economics 2. International Finance 3. Co-operative Economics
	1. Economics of Governance 2. Gender Economics 3. Economics of Health & Education (choose any one)		
IX	1. Economics and Law 2. Global Economic Environment 3. Managerial Economics	**X**	1. Economics of Financial Statement Analysis 2. Stock Market Analysis 3. Economics of Information Communication and Technology

SYLLABUS FOR FIRST TWO SEMESTERS OF BA
in
ECONOMICS

BA (Honours) Economics
Semester - 1
DSC 1.1: Basic Economics – I (Economic Analysis -I) 3 credits

Course Outcomes:

By the end of the course the student will be able to:

1. Identify the facets of an economic problem.
2. Learn basic economic concepts and terms.
3. Explain the operation of a market system;
4. Analyse the production and cost relationships of a business firm;
5. Evaluate the pricing decisions under different market structures; and
6. Use basic cost-benefit calculations as a means of decision making (i.e., thinking like an economist)

Content of Basic Economics 1	42 Hrs
Unit– 1 Basic Concepts in Economics:	14
Chapter No. 1 Nature and Scope of Economics: • Meaning of Economics • Nature of Economics • Scope of Economics • Methods of Economics • Why Study Economics? **Chapter No. 2 Thinking Like an Economist:** • Thinking Like an Economist • The Economist as Scientist • The Economist as Policy Adviser • Economic Policy **Chapter No. 3 Economic System:** • Types of Economic Activities • Organisation of Economic Activities • Circular Flow of Economic Activities • Evolution of the Present Economic System **Practicum:** 1. Group Discussions on Choice Problem 2. Assignment on Types of Economic Systems	5 4 5
Unit – 2 Demand, Supply and Markets:	14
Chapter No. 4. Firms and Households: • Meaning of Firms and Household • Relationship Between Firms and Household • Input Markets • Output Markets **Chapter No. 5. Demand and Supply:** • Individual Demand • Market Demand • Demand Determinants • Supply and its Determinants • Market Equilibrium	4 5

Chapter No. 6. Elasticity and its Measurement: • Types of Elasticity of Demand • Price, Income and Cross Elasticities • Measurement of Elasticity of Demand • Determinants of Elasticity of Demand **Practicum:** 1. Estimation of Demand and Supply Elasticities 2. Solving an Equilibrium Problem	5
Unit – 3 Cost and Market Structures:	14
Chapter No. 7 Production and Production Function: • Meaning and features of production • Production function: Cobb-Douglas Production function • Total Product • Average Product • Marginal Product	4
Chapter No. 8. Production Cost and Revenue: • TC, AC and MC • Cost in the Short-run • Fixed Costs and Variable Costs • Long run AC and MC • TR, MR and AR	5
Chapter No. 9. Market Structure: • Markets : Meaning and Features of Perfect and Imperfect/Monopolistic Competition • Meaning and Features of Monopoly, Duopoly and Oligopoly	5
Practicum: 1. Calculation of various costs and comparing them with production concepts; a mini-project can be taken up wherever possible 2. Studying the real-life pricing mechanism through a project/ case studies	
References (indicative): 1. Cohen, A.J. (2020). *Macroeconomics for Life: Smart Choices for All? + MyLab Economics with Pearson eText* (updated 2nd ed.). Toronto, ON: Pearson CanadaInc. Type: Textbook: ISBN:9780136716532 2. Cohen, A.J. (2015). *Microeconomics for Life: Smart Choices for You + MyLab Economics with Pearson eText* (2nd ed.). Toronto, ON: Pearson Canada Inc. Type: Textbook: ISBN:9780133899368 3. Case Karl E. and Fair Ray C. Principles of Economics, Pearson Education Asia, 2014. 4. Mankiw N. Gregory. Principles of Economics, Thomson,2013. 5. Stiglitz J.E. and Walsh C.E. Principles of Economics, W.W. Norton & Co, New York, 2011.	

Semester I

Course Title: **DSC 1.2: Contemporary Indian Economy:**	
Total Contact Hours: 42	Course Credits: 3
Formative Assessment Marks:40	Duration of ESA/Exam: 2½ hrs
Model Syllabus Authors:	Summative Assessment Marks: 60

Course Pre-requisite(s):

Course Outcomes (COs):

At the end of the course the student should be able to:

i. Understand the current problems of Indian Economy
ii. Identify the factors contributing to the recent growth of the Indian Economy
iii. Evaluate impact of LPG policies on economic growth in India
iv. Analyze the sector specific policies adopted for achieving the as rational goals
v. Review various economic policies adopted

Content of Course 1	42 Hrs
Unit – 1 LPG POLICIES, ECONOMIC REFORMS AND AGRICULTURE:	14
Chapter No. 1 Recent Issues: • Genesis and Impact of LPG • India's population policy • Demographic Dividend • India's human development in global perspective	4
Chapter No. 2 Urbanization and governance: • Urbanization and Smart City Mission • Impact of COVID-19 Pandemic • Atma Nirbhara Bharat Abhiyan • Non-farm Sector	4
Chapter No. 3 Economic Reforms and Agriculture: • Agriculture and WTO • Commercialization and Diversification • Price Policy and Subsidies • Public Distribution System : TPDS • Impact of Public Expenditure on Agricultural Growth (1991 onwards) • Doubling Farm Incomes -MGNREGS (brief introduction) **Practicum** 1. Mini-project to ascertain the impact of pandemic on lives of different sections of population 2. Field visits to understand the agrarian situation	6
Unit – 2 INDUSTRY, BUSINESS, FISCAL POLICY:	14
Chapter No. 4. Industrial Policy: • New Industrial Policy and Changes • Public Sector Reforms • Privatisation and Disinvestment	4

• Competition Policy	
Chapter No. 5. Business: • Ease of Doing Business • Performance of MSMEs • Role of MNC's in Industrial Development • Make in India, Infrastructure Development : Health, Education, Transportation and Power (in brief) • National Monetization Pipeline (The teacher should include the latest policy of the government) **Chapter No. 6. Fiscal Policy:** • Tax, Expenditure, Budgetary Deficits • Fiscal Reforms - Public Debt Management • Fiscal Responsibility and Budget Management (FRBM)Act • GST (meaning and features), Fiscal Federalism and Fiscal Consolidation (in brief) • Recommendations of the Current Finance Commission **Practicum**: Mini-projects to assess the business climate	5 5
Unit – 3 MONETARY POLICY, FOREIGN TRADE AND INVESTMENT:	14
Chapter No. 7 Monetary Policy: • Organisation of India's Money Market • Financial Sector Reforms • Review of Monetary Policy of RBI **Chapter No. 8. Money and Capital Markets:** • Working of SEBI in India • Changing roles of the Reserve Bank of India • Commercial banks : Credit Creation • Foreign Banks and Non-Banking Financial Institutions • Demonetization and its impact **Chapter No. 9. Foreign Trade and Investment:** • Direction of India's foreign trade • Balance of payments since1991 (trends) • New Exchange Rate Regime: Partial and full convertibility • Capital account convertibility • FDI – Trends and Patterns • New EXIM policy • Bilateral and Multilateral Trade Agreements (in brief) **Practicum:** 1. Computation and analysis of Wholesale Price Index, Consumer Price Index: components and trends. 2. Group Discussions on India's trade policies and trade agreements **References:** • Bardhan, P.K. (9th Edition) (1999), The Political Economy of Development in India, Oxford University Press, New Delhi. • Bhaduri Amit, (2015), A Model of Development By Dispossession, Fourth Foundation • Byres Terence J. (ed.), (1998), The State, Development Planning and Liberalisation in India, Delhi, OUP	3 5 6

- Dutt Ruddar and K.P.M Sundaram (2001): Indian Economy, S Chand & Co. Ltd. New Delhi.
- Frankel Francine R., (2004), India's Political Economy, Delhi. OUP Jenkins Rob, 2000, Economic Reform in India, Cambridge,CUP
- Jalan, B. (1996), India’s Economic Policy- Preparing for the Twenty First Century, Viking, New Delhi.
- Joshi Vijaya and L.M.D. Little, (1998), India's Economic Reform 1991-2001, Delhi,OUP.
- Kapila Uma: Indian Economy: Policies and Performances, Academic Foundation
- Mishra S.K & V.K Puri (2001) “Indian Economy and –Its development experience”, Himalaya Publishing House.
- Mukharji Rahul (ed.) (2007), India’s Economic Transition: The Politics of Reforms, edited by Rahul Mukherji, Oxford University Press , New Delhi.
- Stuart and John Harris, (2000), Reinventing India, Cambridge Polity

Semester I

Course Title: **OEC 1.3.1: Kautilya's Arthashastra (OEC):**	
Total Contact Hours: 42	Course Credits: 3
Formative Assessment Marks:40	Duration of ESA/Exam: 2½ hrs
Model Syllabus Authors:	Summative Assessment Marks: 60

Course Pre-requisite(s): *12th Standard Pass*

Course Outcomes (COs):

At the end of the course the student should be able to:

1. This course will enlighten the students about the ancient fundamentals about political and economic constituents, which will frame out a basic land of understanding the modern trends. This will help them to understand the upcoming needs in the area of policy making for states at national and international level.
2. This treatise deals with the science of Governance, so it projects out all the dimensions needed to be understood by students about the present socio-economic and political rules and regulations of the state.

Unit	Description	Hours
I	**Chapter 1:** Introduction to Arthashastra **Chapter 2:** Various disciplines of Indian Education System **Chapter 3:** Place of Kautilya's Arthashastra among them	2 2 2
II	**Chapter 4:** Importance of science dealing with governance - Introduction to Tantrayuktis – The methods of preparing a compendium, tools and techniques of writing a compendium. **Chapter 5:** Governance Procedure- Appointment of the ministers, duties of Government superintendents, treasury, spies, royal writ, punishment- Vakparushya and Dandaparushya; **Chapter 6:** Laws of Inheritance – Determination of forms of Agreements, determination of legal disputes, Division of inheritance, Special shares in inheritance, Distinction between sons	5 5 5
III	**Chapter 7:** Economic Dimension- Body of income of the state, collection of revenue, duties of a Chamberlin (Koshadhyksha), Forty ways of embezzlement of the revenue, Punishment for the embezzlement of revenue, Expenditure, Loss and Profit, Keeping up the Accounts, Recovery of Debts, Deposits of the state, Resumption of the gifts, Remission of Taxes **Chapter 8:** Political Dimension- Six-fold Policy- War, Combination of Powers, Agreement of Peace with or without definite terms, Double Policy, Circle of States, Conduct of Corporations, Secret means, Plan of treatise,	9 9 3
Suggested readings: 1. Arthashastra of Kautilya by T. Ganapati Shastri, Chaukhambha Surbharti Prakashana, Varanasi,		

India, 2005.
2. Arthashastra of Kautilya by Sri. Vacaspati Gairola, Chaukhambha Vidyabahavan, Varanasi, India, 2013.
3. Kautilya, The Arthashastra by L.N. Rangarajan, Penguin Books Ltd, London.
4. Kautilya's Arthashastra: The Way of Financial Management and Economic Governance, Jaico Publishing House, Mumbai, India.

Semester 1

Course Title: **OEC 1.3.2: Pre-Reforms Indian Economy (OEC)**	
Total Contact Hours: 42	Course Credits: 3
Formative Assessment Marks:40	Duration of ESA/Exam: 2½ hrs
Model Syllabus Authors:	Summative Assessment Marks: 60

Course Pre-requisite(s): *12th Standard Pass*

Course Outcomes (COs):

At the end of the course the student should be able to:

i. Trace the evolution of Indian Economy
ii. Identify the structural features and constraints of the Indian Economy
iii. Evaluate planning models and strategy adopted in India
iv. Analyze the sector specific problems and contributions towards overall economic growth
v. Review various economic policies adopted

Unit	Description	Hours
Unit-I	**Features and problems of Indian Economy:**	**15**
	Chapter 1: Features of Indian Economy: • India as a Developing Economy • Demographic Features • Human Development Index(HDI), • Problems of Poverty: Unemployment and Income Inequality	4
	Chapter 2: Issues in Agriculture sector in India: • Land reforms (in brief) • Green Revolution • Agriculture Marketing in India • Agricultural Price Policy	6
	Chapter 3: Industrial and Service Sectors: • Industrial Policy • Industrial Development • Micro, Small and Medium Enterprises • Performance of Public Sector in India • Service Sector in India. **Practicum:** 1. Identifying economic problems and their causes; 2.Mini-project on any aspect of Indian Agriculture, Industry, Service and Public Sectors	5
Unit-II	**Economic Policies:**	13
	Chapter 4: Planning: • Mixed Economy • Bombay Plan • Gandhian Model • Nehru-Mahalanobis Model • Objectives and Achievements Of Economic Planning in India (before 1991)	5
	Chapter 5: Monetary policy in India • Instruments of Monetary Policy	2

	• Black money in India – Magnitude and Impact **Chapter-6: Fiscal Policy in India:** • Tax Revenue • Public Expenditure • Budgetary Deficits • Fiscal Reforms • Public Debt Management and Reforms • Centre State Finance Relations (before 1991) **Practicum:** Assignment on successes and failures of India's planning; Monetary and Fiscal Policy instruments	6
III	**External sector and Nature of Reforms in India**	**14**
	Chapter-7: India's Foreign Trade: • Salient Features • Volume, Composition And Direction of Trade • Balance of Payments • Import Substitution and Protection **Chapter-8: Pre-reforms Strategies:** • Stabilization Strategies/Measures in all the three sectors of the economy • Tariff Policy: Types and Impact • Exchange Rate Dynamics **Chapter 9: Planning Commission:** • Organization and Objectives • Functions Practicum: Calculation of BoP and evaluating trade policies; Assignment and group discussion on the planning commission.	6 6 2

Suggested Readings:

1. Dutt Ruddar and K.P.M Sundaram (2001): Indian Economy, S Chand & Co. Ltd. New Delhi.
2. Mishra S.K & V.K Puri (2001) "Indian Economy and –Its development experience", Himalaya Publishing House.
3. Kapila Uma: Indian Economy: Policies and Performances, Academic Foundation
4. Bardhan, P.K. (9th Edition) (1999), The Political Economy of Development in India, Oxford University Press, New Delhi.
5. Jalan, B. (1996), India's Economic Policy- Preparing for the Twenty First Century, Viking, New Delhi.

Semester I

Course Title: **OEC 1.3.3: Development Studies (OEC)**	
Total Contact Hours: 42	Course Credits: 3
Formative Assessment Marks:40	Duration of ESA/Exam: 2½ hrs
Model Syllabus Authors:	Summative Assessment Marks: 60

Course Pre-requisite(s): *12th Standard Pass*

Course Outcomes (COs):

At the end of the course the student should be able to:

i. Graduates will be able to excel in higher studies and/or to succeed in profession.
ii. Graduates will get a solid foundation of fundamentals required to solve socioeconomic problems and also to pursue higher studies.
iii. Graduates will demonstrate knowledge to appreciate of the dimensions of contemporary development issues, to generate sensitivity to problems concerning ethics and human values to develop orientation towards effective communication and critical analysis, and to appreciate the interrelationships among disciplines as they relate to everyday realities.
iv. Graduates will cultivate professional and ethical attitude, effective Communication skills, teamwork skills, multidisciplinary approach, and to facilitate an advanced understanding and appreciation of the principles, methodologies, value systems, and thought processes employed in human inquiries.

Unit	Description	Hrs
I	**Development: Meaning and Current Challenges**	**9**
	Chapter-1: Meaning of Development: • The Concept of Development, • Growth and Development • Transition from quantitative to qualitative indices	3
	Chapter-2: Modern economic growth: • Characteristics of Modern Economic Growth • Regional and Global Disparities • Common Characteristics and Dissimilarities among Developing Countries.	3
	Chapter-3: Current Development Challenges: • Inequality • Migration • Conflicts Practicum: Group discussion on migration	3
II	**Approaches to Development:**	12
	Chapter-4: Development Ethics • Concept and Meaning • Principles and Importance of Development Ethics	2
	Chapter-5: Assessing Development: • Per Capita Income	4

	• Physical Quality of Life Index (PQLI) • Gender Empowerment Index • HDI **Chapter-6: Approaches of Development:** • Adam Smith	6
	• Marx • Schumpeter • Structuralist Approach • Neo-liberalism, IMF and Structural Adjustment • Capabilities Approach Practicum: Calculation of different Human Development Indices	
III	**Theories and Current Issues in Development:**	21
	Chapter-7: Theories of Development • Theorizing Development - Modernization Theory, Dependency Theory • Capitalist World System • The Evolution of Thought on Poverty Reduction • Colonial Regimes and Their Legacies **Chapter-8: The Industrial Revolution** • Genesis and Spread • International specialization of Labour/Industry • Industrial Labour • ILO and its activities to promote labour standards **Chapter-9: Environment and Development** • Increasing degradation of natural environment – Water and Air pollution and Deforestation • Depletion of Global Commons • Sustainable development - Concept and Measures • Sustainable Development Goals (SDGs) • Climate Change – Causes, Impact, Measures of Mitigation and Adaptations Practicum: Identify the different pollution sources	6 5 10

Suggested Readings:

1. Crocker, D. (2008). Ethics and development theory-practice, Ethics of Global Development Agency, Capability, and Deliberative Democracy,67-106
2. Des Gasper (2008), 'Denis Goulet and the Project of Development Ethics: Development, 8, 99. 481-9, Elsevier Science, 1,pp.10-26.
3. Drèze, Jean and Amartya Sen(2002), India: Development and Participation, second edition. Oxford: Oxford University Press.
4. Gasper, D. (2004). The ethics of development: From Economism to human development. Edinburgh: Edinburgh UniversityPress
5. Huntington, Samuel (1971), The change to change: Modernization, development andpolitics. Comparative Politics,3.
6. Myrdal, Gunnar. (1974), "What is Development?" Journal of Economic Issues8(4):729-736.
7. Peet, Richard with Elaine Hartwick (2009), Theories of Development: Contentions, Arguments, Alternatives (2nd edition). New York: Guilford.
8. Sen, Amartya (1999) Development as Freedom. New York: Anchor Books.

Semester - II

Course Title: **DSC 2.1: Basic Economics - II:**	
Total Contact Hours: 42	Course Credits: 3
Formative Assessment Marks:40	Duration of ESA/Exam: 2½ hrs
Model Syllabus Authors:	Summative Assessment Marks: 60

Course Pre-requisite(s): *Basic Economics I*

Course Outcomes (COs):

At the end of the course the student should be able to:

1. Understand the operation of the overall economic system;
2. Calculate national income and related aggregates
3. Explain the relationship between macroeconomic aggregates;
4. Analyse the nature of business cycles and policies towards controlling them;
5. Evaluate the macroeconomic policies for solving major problems like poverty and unemployment

Unit	Description	Hrs
I	**Macro Economic Concepts and Relationships:**	**12**
	Chapter-1: Macroeconomy; • Introduction to National Income Accounting • Concepts of GDP, GNP and National Income • Approaches to calculating GDP, Personal Income, Nominal and Real GDP • Limitations of the GDP Concept	5
	Chapter-2: Monetary Economy • Characteristics of Money • The Demand for Money • The Supply Of Money and Overall Liquidity Position • Credit Creation	4
	Chapter-3: Inflation • Meaning and Causes of Inflation • Calculating Inflation Rate • Impact of Inflation	3
	Practicum: 1. Understanding the relationships between various NI concepts used in India's NI accounting; 2.Estimating the components of money supply and interpreting the various price indices.	
II	**Macroeconomic Challenges and Policies:**	12
	Chapter-4: Macroeconomic Challenges: • Unemployment • Business Cycles • Economic Growth	3
	Chapter-5: Monetary Policy: • Objectives • Instruments	3
	Chapter-6: Fiscal Policy: • Public Finance vs. Private Finance • Fiscal policy - Role of Government: Allocation, Distribution and Stabilisation • Characteristics of Public Goods,	6

	• Rationale in the Provision of Public Goods Practicum: 1. Reviewing the Monetary Policy of RBI; 2.A project to identify the nature and causes of poverty and the latest central budget	
III	**Public Policy and Globalization:**	18
	Chapter 7: Poverty and Public Policy: • Meaning, Types and Measurement of Poverty • Poverty Alleviation Strategies in India **Chapter 8: International Trade:** • The Economic basis for trade—Absolute Advantage and Comparative Advantage. • Terms of Trade: Meaning and Types • Exchange Rates: Meaning, Types And Determinants • Trade Barriers: Tariffs, Subsidies and Quotas • Balance of Payments: The Current and Capital Account **Chapter 9:Globalization:** • Meaning • Importance • Pros and cons of Globalization **Practicum:** Survey on identification of poor; Calculating the components of BoP of India	6 9 3

References (indicative)

1. Cohen, A.J. (2020). *Macroeconomics for Life: Smart Choices for All? + MyLab Economics with Pearson eText* (updated 2nd ed.). Toronto, ON: Pearson Canada Inc. Type: Textbook: ISBN: 9780136716532
2. Cohen, A.J. (2015). *Microeconomics for Life: Smart Choices for You + MyLab Economics with Pearson eText* (2nd ed.). Toronto, ON: Pearson Canada Inc. Type: Textbook: ISBN: 9780133899368
3. Case Karl E. and Fair Ray C. Principles of Economics, Pearson Education Asia,2014.
4. Mankiw N. Gregory. Principles of Economics, Thomson,2013.
5. Stiglitz J.E. and Walsh C.E. Principles of Economics, W.W. Norton & Co, New York,2011.

Semester II

Course Title: **DSC 2.2: Karnataka Economy**	
Total Contact Hours: 42	Course Credits: 3
Formative Assessment Marks:40	Duration of ESA/Exam: 2½ hrs
Model Syllabus Authors:	Summative Assessment Marks: 60

Course Pre-requisite(s):

Course Outcomes (COs):

At the end of the course the student should be able to:

1. Understand the nature of economic growth and problems of Karnataka state.
2. Explain the process of structural growth in Karnataka Economy;
3. Evaluate the policies and programmes undertaken by the Govt. of Karnataka for bringing about socio-economic development

Units	Description	Hours
Unit - I	**Characteristics of Karnataka Economy:**	**12**
	Chapter-1: State Income • State Domestic Product and PCI • Measures to redress economic inequality.	2
	Chapter-2: Human and Natural Resources • Population • Human Development Index • Poverty and Unemployment– Anti-Poverty and Employment generation Programmes • Functioning of Panchayat Raj Institutions	6
	Chapter-3: Natural Resources in Karnataka: • Land, Water, Forest and Mineral Resources in Karnataka • Sustainable Development Goals in Karnataka • Karnataka Environmental Policy Practicum: conduct field visit to Forest/Reservoir/Mining and prepare the report	4
II	**Agriculture and Industries in Karnataka:**	18
	Chapter-4: Agriculture in Karnataka: • Importance of Agriculture • Problems in Agriculture • Land Reforms • Cropping Pattern • Irrigation • Watershed Development Programme • Dry Land Farming • Farmers Suicide – Causes And Solutions	9
	Chapter-5: Rural Development: • Regional Imbalance: Prof. D. M. Nanjundappa report • Public Distribution System • Rural Development Programmes.	3

	Chapter 6: Industrial Development in Karnataka: • Major Industries in Karnataka - Problems and Prospects • MSMEs - Problems and Measures • IT Industries in Karnataka • Industrial Finance in Karnataka • Industrial Policy of Karnataka Practicum: visit to industrial units in local area and prepare the report/Trace-out the impact of Prof. D. M. Nanjundappa Committee report	6
III	**Infrastructure and Finances:**	12
	Chapter7: Economic Infrastructure in Karnataka: • Transportation: Road, Rail, Water and Air Transport • Information and Communication Technology Facilities; **Chapter 8: Social Infrastructure:** • Drinking Water, Sanitation • Housing • Health and Education • Rural Electrification **Chapter 9: State Finance:** • Sources of Revenue: Direct and Indirect Taxes • GST : Impact of GST • State Expenditure • States Indebtedness • State Finance Commission • Current State Budget Practicum: Discussion on State budget	3 4 5

References (Indicative):

1. Government of Karnataka, Economic Survey [Various Issues]
2. Planning Department, Annual Publication, Government of Karnataka.
3. Karnataka at Glance, Annual Publication Government of Karnataka.
4. Madaiah M & Ramapriya. Karnataka Economy Growth: Issues and Development, Himalaya Pub., House, NewDelhi.
5. Adul Aziz and K.G. Vasanti. (Eds) Karnataka Economy.
6. Government District Development Reports
7. Hanumantha Rao. Regional Disparities and Development in Karnataka.
8. Krishnaiah Gowda H.R. Karnataka Economy, Spandana Publications, Bangalore
9. Nanjundappa D.M. Some Aspects of Karnataka Economy.
10. Puttaswamiah K. Karnataka Economy, Two Volumes

Semester II

Course Title: **OEC 2.3.1: Contemporary Indian Economy**	
Total Contact Hours: 42	Course Credits: 3
Formative Assessment Marks:40	Duration of ESA/Exam: 2½ hrs
Model Syllabus Authors:	Summative Assessment Marks: 60

Course Pre-requisite(s):

Course Outcomes (COs):

At the end of the course the student should be able to:

vi. Understand the current problems of Indian Economy
vii. Identify the factors contributing to the recent growth of the Indian Economy
viii. Evaluate impact of LPG policies on economic growth in India
ix. Analyze the sector specific policies adopted for achieving the aspirational goals
x. Review various economic policies adopted

Content of Course 1	42 Hrs
Unit – 1 LPG POLICIES, ECONOMIC REFORMS AND AGRICULTURE:	14
Chapter No. 1 Recent Issues: • Genesis and Impact of LPG • India's population policy • Demographic Dividend • India's human development in global perspective	4
Chapter No. 2 Urbanization and governance: • Urbanization and Smart City Mission • Impact of COVID-19 Pandemic • Atma Nirbhara Bharat Abhiyan • Non-farm sector	4
Chapter No. 3 Economic Reforms and Agriculture: • Agriculture and WTO • Commercialization and Diversification • Price policy and Subsidies • Public Distribution System : TPDS • Impact of public expenditure on agricultural growth (1991 onwards) • Doubling Farm Incomes -MGNREGS (brief introduction)	6
Practicum 3. Mini-project to ascertain the impact of pandemic on lives of different sections of population 4. Field visits to understand the agrarian situation	
Unit – 2 INDUSTRY, BUSINESS, FISCAL POLICY:	14
Chapter No. 4. Industrial Policy: • New Industrial Policy and changes • Public sector reforms • Privatisation and Disinvestment	4

• Competition Policy	
Chapter No. 5. Business: • Ease of Doing Business • Performance of MSMEs • Role of MNC's in Industrial Development • Make in India, infrastructure development : Health, Education, Transportation and Power (in brief) • National Monetization Pipeline (The teacher should include the latest policy of the government) **Chapter No. 6. Fiscal Policy;** • Tax, Expenditure, Budgetary Deficits • Fiscal Reforms - Public Debt Management • Fiscal Responsibility and Budget Management (FRBM)Act • GST (meaning and features), Fiscal Federalism and Fiscal Consolidation (in brief) • Recommendations of the Current Finance Commission **Practicum**: Mini-projects to assess the business climate	5 5
Unit – 3 MONETARY POLICY, FOREIGN TRADE AND INVESTMENT:	14
Chapter No. 7. Monetary Policy: • Organisation of India's Money Market • Financial Sector Reforms • Review of Monetary Policy of RBI **Chapter No. 8. Money and Capital Markets:** • Working of SEBI in India • Changing roles of the Reserve Bank of India • Commercial banks : Credit Creation • Foreign banks and Non-banking Financial Institutions • Analysis of Price Behaviour in India • Demonetization and its impact **Chapter No. 9. Foreign Trade and Investment:** • Direction of India's Foreign Trade • Balance of Payments since1991 (trends) • New Exchange Rate Regime: Partial and Full Convertibility • Capital Account Convertibility • FDI – Trends and Patterns • New EXIM Policy • Bilateral and Multilateral Trade Agreements (in brief) **Practicum**: 1. Computation and analysis of Wholesale Price Index, Consumer Price Index: Components and Trends. 2. Group Discussions on India's trade policies and trade agreements **References** • Bardhan, P.K. (9th Edition) (1999), The Political Economy of Development in India, Oxford University Press, New Delhi. • Bhaduri Amit, (2015), A Model of Development By Dispossession, Fourth Foundation • Byres Terence J. (ed.), (1998), The State, Development Planning and Liberalisation' in India, Delhi, OUP • Dutt Ruddar and K.P.M Sundaram (2001): Indian Economy, S Chand & Co. Ltd. New	3 5 6

Delhi. • Frankel Francine R., (2004), India's Political Economy, Delhi. OUP Jenkins Rob, 2000, Economic Reform in India, Cambridge, CUP • Jalan, B. (1996), India's Economic Policy- Preparing for the Twenty First Century, Viking, New Delhi. • Joshi Vijaya and L.M.D. Little, (1998), India's Economic Reform 1991-2001, Delhi, • Kapila Uma: Indian Economy: Policies and Performances, Academic Foundation • Mishra S.K & V.K Puri (2001) "Indian Economy and –Its development experience", Himalaya Publishing House. • Mukharji Rahul (ed.) (2007), India's Economic Transition: The Politics of Reforms, edited by Rahul Mukherji, Oxford University Press , New Delhi. • Stuart and John Harris, (2000), Reinventing India, Cambridge Polity	

Semester II

Course Title: **OEC 2.3. 2: Sustainable Development Goals**	
Total Contact Hours: 42	Course Credits: 3
Formative Assessment Marks:40	Duration of ESA/Exam: 2½ hrs
Model Syllabus Authors:	Summative Assessment Marks: 60

Course Pre-requisite(s):

Course Outcomes (COs):

At the end of the course the student should be able to:

i. Understand the basic concept of Sustainable Development (SD), the environmental, social and economic dimensions.
ii. Know the history of the SD idea.
iii. Be able to discuss the conflicts which are involved in the SD concept on the national as well as on the global scale.
iv. Be able to discuss the (dis-)advantages of instruments for SD;
v. Evaluate the sustainable development goals and their attainments

Unit	Description	Hrs
I	**Development, Environment and Pollution**	**15**
	Chapter-1: Environmental Goods and Services: • Relationship between Environment and Development • Environmental Kuznets Curve – Meaning and Evidence **Chapter-2: Resource Use and Management:** • Resource Taxonomy – Renewable and Non-renewable Resources • Economic Theory of Depletable Resources • Optimal Use of Renewable Resources • Resource Scarcity and Economic Growth – Limits to Growth Model • Tragedy of Commons and Common Property Resources • Resource Pricing and Resource Conservation **Chapter-3: Sustainable Development** • Sustainable Development – Meaning and Indicators • Objectives and Principles • Approaches and Strategies for Sustainable Development • Environmental Accounting Measures **Practicum:** Mini project on the impact of local environment	3 6 6
II	**Sustainable Development Goals**	10
	Chapter-4: Introduction and History • Brundtland Committee Recommendations • Rio Summit and Agenda21 • SDGs: Targets and Indicators **Chapter-5: Government and the SDGs** • Planning	3 4

	• Localizing the SDGs • SDG Policy Instruments • Industrial Policies and the SDGs **Chapter-6: Financing the SDGs**	3
	• Types of Financing • New Financing Mechanisms and Global Funds **Practicum:** Assignments on Progress in attainment of various SDGs in India and their states	
III	**SDGs and their Achievement:**	17
	Chapter-7: Realizing the SDGs: • De-growth and Circular Economy • Sustainable Production and Consumption • Sustainable Cities and Transportation • Sustainable Designs, Technology, Digital Revolution and Innovation • Renewable Energy **Chapter-8: Tools for SDGs Achievement:** • Governance and Policy Tools • Openness, Participation and Accountability • Effectiveness and Coherence • India's framework for Sustainable Development **Chapter-9: Other Issues in SDGs:** • Social business, Civil Society Organizations (CSOs) and Operations • Development Assistance • Cross-Border Cooperation **Practicum:** Group Discussion on sustainable practices – other agriculture	8 5 4

Suggested Readings:

- Baumol, W.J. and W.E. Oates (1988): *The Theory of Environmental Policy* (2e), CUP, Cambridge.
- Bhattacharya, R.N. (Ed): Environmental Economics: An Indian Perspective, OUP, New Delhi.
- Dalby, Simon, et al. Achieving the Sustainable Development Goals: Global Governance Challenges. Routledge,2019.
- Day, G.S., and P.J.H. Schoemaker (2011), Innovating in uncertain markets: 10 lessons for green technologies, MIT Sloan Management Review, 52.4:37-45.
- Elliott, Jennifer. An introduction to sustainable development. Routledge,2012.
- Gagnon, B., Leduc, R., and Savard, L., Sustainable development in engineering: a review of principles and definition of a conceptual framework. Working Paper 08-18,2008.
- Hanley, Shogren and White (1997): *Environmental Economics in Theory and Practice*, Macmillan.
- Kolstad, C.D. (1999): *Environmental Economics*, OUP,ND.
- Pearce, D.W. and R. Turner (1991): *Economics of Natural Resource Use and Environment*, John Hopkins Press, Baltimore.
- Sachs, Jeffrey D. The age of sustainable development. Columbia University Press,2015
- Tietenberg, T. (1994): *Environmental Economics and Policy*, Harper Collins,NY.

Semester II

Course Title: **OEC 2.3. 3: Business Environment:**	
Total Contact Hours: 42	Course Credits: 3
Formative Assessment Marks:40	Duration of ESA/Exam: 2½ hrs
Model Syllabus Authors:	Summative Assessment Marks: 60

Course Pre-requisite(s):

Course Outcomes (COs):

At the end of the course the student should be able to:

i. Explain the elements of Business Environment.
ii. Identify the environmental constraints in the growth of a business firm.
iii. Analyze the ways to utilize the current environmental conditions to achieve higher business growth.

Unit	Content of Course:	42 Hrs
I	**Introduction to Business Environment:**	12
	Chapter-1: Introduction: • Definition, Objectives, Importance of Business Environment. • Strategies of Business Environment • Business Environment Determinants • The Micro Environment of Business and The Macro Environment of Business. **Chapter-2: Economic Environment:** • Meaning of Economic Environment • Impact of Liberalization Privatization & Globalization (LPG) on Indian Business Environment. • Monetary policy – Meaning and Objectives • Fiscal policy – Meaning and Objectives • EXIM policy – Meaning and Objectives • Industrial policy – Meaning and Objectives (Latest Policy Measures). **Chapter-3: Global Business Environment:** • Meaning • Globalization: Nature and Impact of Globalization • Challenges of International Business • WTO and its Implications on Indian Economy. **Practicum** 1. Group discussion on WTO and its impact on Indian business	3 6 3
II	**Non-Economic Environment:**	10
	Chapter-4: Social and Cultural Environment: • Business and Society • Social Objectives of Business • Corporate Social Responsibility • Consumer Rights & Corporate Governance • Business Ethics **Chapter-5: Technological Environment:** • Meaning	4 2

	• Technological Changes – R & D in India • Public and Private Investment in R and D. **Chapter-6: Financial Environment:** • Introduction and Meaning • An Overview of Indian Financial System • Financial Institutions and their Roles • Role of Foreign Direct Investment and its impact on Indian Business **Practicum:** Students are expected to analyze the major economic and financial indicators such as GDP/BSE/NSE and submit the report .	4
III	**Governance and Business in India:**	22
	Chapter-7: Political Environment: • Introduction and Meaning • Political Environment and the Economic System • Provisions of Indian Constitution for Business **Chapter-8: Legal Environment of Business:** • Indian Company Law • Competition policy and law • Patents &Trademarks • Industrial Policy- an overview • Labour Laws & Social Security, • Environmental Laws. **Chapter-9: Current Issues in Environmental Business:** • Ease of Doing Business • Performance of MSMEs • Make in India • Development of Economic and Social Infrastructure • National Monetization Pipeline (The teacher should include the latest policy of the government) **Practicum:** Students are expected to give a report on how the economic environment has affected the performance of any one of the large Indian Business Houses.	4 8 10
REFERENCES: Francis Cherunilam: Business Environment, Himalaya Publishing House, Mumbai. K. V. Sivayya and VBM Das: Indian Industrial Economy, Sulthan Chand Publications, Delhi. M. Adhikari: Economic Environment of Business, Sulthan Chand and Sons, New Delhi. Raj Agarwal: Business Environment, Excel Publications, New Delhi.		

Pedagogy

Formative Assessment for C1 & C2		
Assessment Occasion/ type	**Marks**	
	C1	**C2**
Internal Test	10	10
Case study / Assignment / Field work / Project work/ Academic Quiz/ Review of the Book/ etc	10	-
Case study / Assignment / Field work / Project work/ Academic Quiz/ Review of the Book/ etc	-	10

Suggestive Template for IAT

Internal Assessment Test BA and MA in Economics

Course Code: Name of the Paper:

Duration: 60 Minutes Total Marks: 10

OPTION-A

Answer any two of the following questions. (Questions for testing conceptual clarity) (5 X 2=10)

1.
2.
3.

OPTION- B

Answer any one of the following questions. (Questions for testing the knowledge of theories and application) (10X1=10)

1.
2.

Note: After the completion of 50% of the syllabus, C1 test has to be conducted followed by this C2 test has to be conducted after completion of the syllabus.

ANNUAL QUESTION PAPER PATTERN (C3)

Maximum Marks: 60

Duration: 2½ hours

PART -A

Answer any five of the following: **5X2 =10**

Sl. No. 1 to 8 questions

PART - B

Answer any six of the following: **6X5 =30**

Sl. No. 9 to 17

PART - C

Answer any two of the following: **2 X10 =20**

Sl. No. 18 to 21

Date Subject Committee Chairperson

JSSCOLLEGEOFARTS,COMMERCE&SCIENCE

(AUTONOMOUS)

B.N.ROAD,MYSURU

DEPARTMENTOFECONOMICS

RevisedSyllabusforUndergraduate(UG)
CBCS Scheme - 2019-2020

JSSCOLLEGEOFARTS,COMMERCEANDSCIENCE
(AUTONOMOUS)
B.N. ROAD, MYSURU-25

DEPARTMENTOFECONOMICS

CourseBA:Syllabus

RestructuredandRevisedSyllabusandSchemefor BAEconomicsunder CBCS - 2019-2020

Sem	Course Code	Course	Teaching Hours / week	L T P	Credit	I.A Marks	Theory Exam	Total Marks
DisciplineSpecificCore(DSC)								
I	Core-1 ELA21021/22/26/23/24	Principlesof MicroEconomics-I	5+1	5-1-0	6	30	70	100
II	Core-II ELB21021/22/26/23/24	Principlesof MicroEconomics-II	5+1	5-1-0	6	30	70	100
III	Core-III ELC21021/22/26/23/24	Principles ofMacroEconomics -I	5+1	5-1-0	6	30	70	100
IV	Core-IV ELD21021/22/26/23/24	Principlesof MacroEconomics-II	5+1	5-1-0	6	30	70	100
DisciplineSpecificElective(DSE)–Anyone								
V	DSE–1A ELE21021/22/26/23/24	Economicsof Development	5+1	5-1-0	6	30	70	100
V	DSE–1B ELE21121/22/26/23/24	MoneyandBanking	5+1	5-1-0	6	30	70	100
V	DSE–1C ELE21221/22/26/23/24	Environmental Economics	5+1	5-1-0	6	30	70	100
DisciplineSpecificElective(DSE)–Anyone								
VI	DSE-1A ELF21021/22/26/23/24	IndianEconomy	5+1	5-1-0	6	30	70	100
VI	DSE-1B ELF21221/22/26/23/24	EconomicHistoryof India-1857-1947	5+1	5-1-0	6	30	70	100
VI	DSE–1C ELF21321/22/26/23/24	PublicFinance	5+1	5-1-0	6	30	70	100

Note:

1. **CreditsPerCourse/PaperperweekinalltheSIXSemesters=6 Credits[L:5 +T:1]**
   [Ofwhich,itis5Creditsfor Lectureand1CreditforTutorials]
2. **WorkLoadPerCourse/Paperperweek**inalltheSIX Semesters**=07Hours[L:5+T:2]**
   [Ofwhich,itis5 Hoursfor Lectureand2 HoursforTutorials]

GenericElective

Sem	Paper Code	Course	Teaching Hours/ week	L T P	Credit	I.A Marks	Theory Exam	Total Marks	Remarks
V	GE-I ELE21321 /22/26/23/ 24	Introductionto Economics	2	2-0-0	2	15	35	50	To benefit those students interestedto study*Basic Economics* and *Indian Economy* irrespective of his / her programme
VI	GE-II ELF21422 /22/26/23/ 24	IndianEconomy	2	2-0-0	2	15	35	50	

SchemeofassessmentforB.AEconomicsunderCBCS-2019-2020

Year	SEM	COURSE CODE	TITLEOFTHEPAPER	CONTINUOUSASSESSMENT				MAX.MARKS			DURATIONOFEXAM
				C1		C2		C3	TH	IA	TH
				TEST	AS/ GD	TEST	SE/ PD				
I	I	Core-1 ELA21021/22/26/23/24	Principlesof MicroEconomics-I	10	5	10	5	70	70	30	3h
	II	Core-II ELB21021/22/26/23/24	Principlesof MicroEconomics-II	10	5	10	5	70	70	30	3h
II	III	Core-III ELC21021/22/26/23/24	Principlesof MacroEconomics-I	10	5	10	5	70	70	30	3h
	IV	Core-IV ELD21021/22/26/23/24	Principlesof MacroEconomics-II	10	5	10	5	70	70	30	3h
III	V	DSE-1A ELE21021/22/26/23/24	EconomicsofDevelopment	10	5	10	5	70	70	30	3h
		DSE-1B ELE21121/22/26/23/24	MoneyandBanking	10	5	10	5	70	70	30	3h
		DSE–1C ELE21221/22/26/23/24	EnvironmentalEconomics	10	5	10	5	70	70	30	3h
		GE-I ELE21321/22/26/23/24	IntroductiontoEconomics	7.5	-	7.5	-	35	35	15	2h
	VI	DSE-1A ELF21021/22/26/23/24	IndianEconomy	10	5	10	5	70	70	30	3h
		DSE-1B ELF21221/22/26/23/24	EconomicHistoryofIndia-1857-1947	10	5	10	5	70	70	30	3h
		DSE–1C ELF21321/22/26/23/24	PublicFinance	10	5	10	5	70	70	30	3h
		GE-II ELF21422/22/26/23/24	IndianEconomy	7.5	-	7.5	-	35	35	15	2h

CoreandDisciplineSpecificElective(DSE)Courses in Economics

SemesterI	SemesterII
CoreEconomicsI: PrinciplesofMicroeconomics-I	CoreEconomicsII: PrinciplesofMicroeconomics-II
SemesterIII	SemesterIV
CoreEconomicsIII: PrinciplesofMacroeconomics-I	CoreEconomicsIV: PrinciplesofMacroeconomics-II
Semester V	Semester VI
DisciplineSpecificElectiveI One of the following: i. DSE-1A:Economicsof Development ii. DSE-1B :MoneyandBanking iii. DSE-1C:Environmental Economics	DisciplineSpecificElectiveII One of the following: iv. DSE-1A:IndianEconomy v. DSE-1B:EconomicHistoryof India 1857-1947 vi. DSE- 1C:Public Finance

GenericElectives

Semester	CourseTitle	Remarks
V	GE-I IntroductiontoEconomics	Benefitsthosestudentsinterestedto study*Basic Economics* and *Indian Economy* irrespective of his / her programme
VI	GE-II IndianEconomy	

TEMPLATE

Subject:ECONOMICS

Sem	Core			DSE			GE		
	No.of Courses	**Credits**	**Total Hours**	**No.of Courses**	**Credits**	**Total Hours**	**No.of Courses**	**Credits**	**Total Hours**
I	1	6	75+15	-	-	-	-	-	-
II	1	6	75+15	-	-	-	-	-	-
III	1	6	75+15	-	-	-	-	-	-
IV	1	6	75+15	-	-	-	-	-	-
V	-	-	-	1	6	75+15	1	2	30
VI	-	-	-	1	6	75+15	1	2	30
Total	**4**	**24**	**360**	**2**	**12**	**180**	**2**	**4**	**60**

ProgrammeOutcome

AftercompletingthegraduationinBA(HEG)thestudentsareable to:

PO1.Critically recognizes the social, political, economic and cultural aspects of History.
PO2.Demonstratethinkingskillsbyanalyzing,synthesizing,andevaluatingthemin relation to their cultural and historical context.
PO3.Correctly extracts evidence fromprimary sources by analyzing and evaluating them in relation to their cultural and historical context.
PO4. Develop an informed familiaritywith multiple cultures.
PO5.Demonstratecriticalreading,writingandthinkingskills. PO6.
Explain, graph, and analyze key economics models.
PO7.Understandcurrenteventsandevaluatespecificpolicyproposals. PO8. To address problem that do not have clear economic solutions.
PO9.Developcriticalandquantitativethinking skills.
PO10. Communicateeffectivelyinwritten,oralandgraphicalformaboutspecific issues.
PO11. Apply economic analysis to everyday problems in real world situations.
PO12.Understand and appreciate relationship between manand Environment
PO13.Read,interpret,andgeneratemapsandothergeographicrepresentations
PO14. To extract, analyze, and present information from a spatial perspective
PO15.Understandphysical-geographicprocesses,global distribution of landformsand ecosystems
PO16.Therole ofphysicalenvironment onhumanpopulation
PO17.Developtheethicalaptitudesanddispositionsnecessarytoacquireandhold leadership positions in industry, government, and professional organizations.

ProgrammeSpecificOutcomesOn

Completion of BA (HEG)students will:

PSO1.ThisProgrammeexertsitsinfluenceonlife anddestinyofHumanbeings. PSO2. It is a stepping stone for one's success in competitive examinations.
PSO3. Understand the background of our religion, customs and Institutions and so on.
PSO4.Understandthepresent Social,political,religiousandeconomicconditionsofthe people.
PSO5.UnderstandtheoreticalandpracticalaspectsofEconomicsand Geography

PSO6.EvaluateEconomicbehaviorinconsonancewithGeographicalfactors

PSO7. Suggest the policy makers about desirable changes to be made in Micro and Macro Economic issues based on geographical factors

PSO8.Gainabilityto understandtheeconomicproblemsinGeographicalindicators PSO9. Able to offer palatable solutions for economic and geographical challenges

PSO10. AttainProficiencytoanalyzetheeconomicdecisionof Government andnon-Govt. entities that correlate with Geographical factors

PSO11.Gainrequisiteknowledgeto evaluate land usepatternanddemographicalprofile

PSO12.Apply GIS for understanding Market situation, Transport problem change in Weather Condition, Cropping Pattern, and Natural Calamities and so on

ProgrammeOutcome

AftercompletingthegraduationinBA(HEP)thestudentsareable to:

PO1.Critically recognizes the social, political, economic and cultural aspects of History.

PO2.Demonstratethinkingskillsbyanalyzing,synthesizing,andevaluatingthemin relation to their cultural and historical context.

PO3.Correctlyextracts evidence fromprimarysources byanalyzing and evaluating them in relation to their cultural and historical context.

PO4. Develop an informed familiaritywith multiple cultures.

PO5.Demonstratecriticalreading,writingandthinkingskills. PO6. Explain, graph, and analyze key economics models.

PO7.Understandcurrenteventsandevaluatespecificpolicyproposals. PO8. To address problem that do not have clear economic solutions.

PO9.Developcriticalandquantitativethinking skills.

PO10.Applyeconomicanalysistoeverydayproblemsinrealworldsituations.

PO11.To extract, analyze, and present information from a spatial perspective.

PO12.Spreadthemessagesofequality,nationality,socialharmonyandotherhuman values.

PO13.Comprehendthebasicstructuresandprocessesofgovernmentsystemsand/or theoretical underpinnings.

PO14.Analyzepoliticalproblems,arguments,information,and/ortheories.

PO15. Apply methods appropriate for accumulating andinterpreting data applicableto the discipline of Political Science.

ProgrammeSpecificOutcomesOn

Completion of BA (HEP)students will:

PSO1.Criticallyrecognizethesocial, political, economicandculturalaspectsofHistory.

PSO2.Demonstrate thinkingskillsbyanalyzing,synthesizing,andevaluatinghistorical information from multiple sources.

PSO3. Correctly extract evidence from primary sources by analyzing and evaluating them in relation to their cultural and historical context.

PSO4. Develop an informed familiarity with multiple cultures.

PSO5.Demonstratecriticalreading,writing,andthinkingskills.

PSO6.Explain, graph, and analyze key economics models.

PSO7.Understandcurrent eventsandevaluatespecificpolicyproposals. PSO8.

To address problem that do not have clear economic solutions.

PSO9.Developcriticalandquantitativethinking skills.

PSO10.Communicateeffectivelyinwritten,oralandgraphicalformabout specific issues.

PSO11. Apply economic analysis to everyday problems in real world situations.

PSO12.Developtheethicalaptitudesanddispositionsnecessarytoacquireandholdleadership positions in industry, government, and professional organizations.

ProgrammeOutcome

AftercompletingthegraduationinBA(KEP)thestudentsareable to:

PO1.Develophumanvaluesandasenseofsocialservice PO2.

Become a responsible and dutiful citizen.

PO3.Abelto enhancecriticaltemper and creativeability

PO4.Applyeconomicanalysisto everydayproblemsinrealworldsituations. PO5.

Explain, graph, and analyze key economics models.

PO6.Understandcurrenteventsandevaluatespecificpolicyproposals. PO7. To

address problem that do not have clear economic solutions.

PO8.Developcriticalandquantitativethinking skills.

PO9.Applyeconomicanalysistoeverydayproblemsinrealworldsituations.

PO10.Toextract,analyze, andpresentinformationfromaspatialperspective.

PO11.Spreadthemessagesofequality,nationality,socialharmonyandotherhuman values.

PO12.Comprehendthebasicstructuresandprocessesofgovernmentsystemsand/or theoretical underpinnings.

PO13.Analyzepoliticalproblems,arguments,information,and/ortheories.

PO14.Apply methods appropriate for accumulatingandinterpreting data applicable to the discipline of Political Science.

ProgrammeSpecificOutcomesOn

Completion of BA (KEP)students will:

PSO1:Know morespecificterminologiesalongwithitsetymology.

PSO2:Knowthechanges inthedifferences informationofsocietyandtheirculture

PSO3:Help to understand different races, Society, and culture.

PSO4.UnderstandtheoreticalandpracticalaspectsofEconomicsandGeography

PSO5. Evaluate Economic behavior inconsonance with Geographical factors

PSO6.Suggestthepolicymakersaboutdesirablechangestobe made in Micro and Macro Economic issues based on geographical factors

PSO7.Actasasteppingstoneforone'ssuccessincompetitiveexaminations

PSO8.CreateappropriateandefficientHistorians,PoliticalLeaders,administratorsand State's man

PSO9.EducateaboutpatriotismtolerationandNationalIntegration.

ProgrammeOutcome

AftercompletingthegraduationinBA(KEG)thestudentsareable to:

PO1.Develophumanvaluesandasenseofsocialservice PO2.

Become a responsible and dutiful citizen.

PO3.Abelto enhancecriticaltemper and creativeability

PO4.Applyeconomicanalysisto everydayproblemsinrealworldsituations. PO5.

Explain, graph, and analyze key economics models.

PO6.Understandcurrenteventsandevaluatespecificpolicyproposals. PO7. To

address problem that do not have clear economic solutions.

PO8.Developcriticalandquantitativethinking skills.

PO9. Apply economic analysis to everyday problems in real world situations.

PO12.Understand and appreciate relationship between manand Environment

PO13.Read,interpret,andgeneratemapsandothergeographicrepresentations PO14.

To extract, analyze, and present information from a spatial perspective

PO15. Understandphysical-geographicprocesses,global distribution of landformsand ecosystems

PO16.The roleofphysicalenvironmentonhumanpopulation.

ProgrammeSpecificOutcomesOn

Completion of BA (KEG)students will:

PSO1:Know morespecificterminologiesalongwithitsetymology.
PSO2:Knowthechanges inthedifferences informationofsocietyandtheirculture

PSO3:Help to understand different races, Society, and culture.

PSO4.UnderstandtheoreticalandpracticalaspectsofEconomicsandGeography. PSO5.

Evaluate Economic behavior inconsonance with Geographical factors.

PSO6.Suggestthepolicymakersaboutdesirablechangestobe made inMicro and Macro Economic issues based on geographical factors.

PSO7.Actasasteppingstone forone'ssuccessincompetitiveexaminations.

PSO8.Gainabilityto understandtheeconomicproblemsinGeographicalindicators. PSO9.

Able to offer palatable solutions for economic and geographical challenges.

PSO10. AttainProficiencytoanalyzetheeconomicdecisionof Government andnon- Govt. entities that correlate with Geographical factors.

PSO11.Gainrequisiteknowledgeto evaluatelandusepatternanddemographical profile.

PSO12.ApplyGISforunderstandingMarketsituation,Transportproblemchange in Weather Condition, Cropping Pattern, and Natural Calamities and so on.

ProgrammeOutcome

AftercompletingthegraduationinBA(HEE)thestudentsareableto:

PO1.Criticallyrecognizethesocial, political,economicandculturalaspectsofHistory.

PO2.Demonstratethinkingskillsbyanalyzing,synthesizing,andevaluatinghistorical information from multiple sources.

PO3. Correctly extract evidence fromprimary sources by analyzing and evaluating them in relation to their cultural and historical context.

PO4. Develop an informed familiarity with multiple cultures.

PO5.Demonstratecriticalreading,writing,andthinkingskills.

PO6.Explain, graph, andanalyzekeyeconomics models

PO7.Understandcurrenteventsandevaluatespecificpolicyproposals

PO8. To address problem that do not have clear economic solutions

PO9.Develop critical and quantitative thinking skills

PO10. Communicate effectively in written, oral and graphical form about specific issues

PO11. Apply economic analysis to everyday problems in real world situations

PO12. Writefocused,organized,well-developed,andtext-basedessaysusingeffective paragraphs.

PO13.Supportaclearthesisstatement,anddemonstratecompetenceinStandardEnglish Language and usage.

PO14.Writearticles,novels,storiestospreadthemessagesofequality,nationality,social harmony and other human values.

PO15. Acquire the ability to engage in independent and life-long learning in a broader context about socio-technological and demographic changes.

PO16. Develop and carry out research projects, and locate, evaluate, organize, and incorporateinformation effectively.

ProgrammeSpecificOutcomesOn

Completion of BA (HEE)students will:

PSO1.Demonstrate thinkingskillsbyanalyzing,synthesizing,andevaluatinghistorical information from multiple sources.

PSO2. Correctly extract evidence from primary sources by analyzing and evaluating them in relation to their cultural and historical context.

PSO3. Develop an informed familiarity with multiple cultures.

PSO4.Demonstratecriticalreading,writing,andthinkingskills.

PSO5.Explain, graph, and analyze key economics models.

PSO6.Understandcurrent eventsandevaluatespecificpolicyproposals. PSO7.

To address problem that do not have clear economic solutions.

PSO8.Developcriticalandquantitativethinkingskills.

PSO9. Communicate effectively in written, oral and graphical form about specific issues.

PSO10. Apply economic analysis to everyday problems in real world situations

PSO11.Writeandedit clear,graceful,grammaticallycorrectprose.

PSO12.Analysenumericaldataandutilizedatabaseformulti-layeredstorytelling.

PSO13.Demonstratepreparationforanentry-levelpositionintheprofessionthrougha portfolio exhibiting their work.

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III–Semester

DSCIII-PrinciplesofMacroeconomics-I

Courseoutcomes

OncompletionoftheCourse, studentswill:

CO1.IdentifyindetailswithexamplesKeyvariablesofMacro Economics. CO2.
Understand in details with examples Concepts of National Income.
CO3.IdentifyindepthMarginalEfficiencyofCapital. CO4.
Specify the details of Concept of Multiplier.
CO5.IdentifythecharacteristicsofKeynesianMacroEconomics.
CO6. Deliberate in depth Liquidity Theory of money.
CO7. IdentifythecharacteristicsofDemandforMoney.
CO8.Identifyindetailswithapplication,ifapplicable,ConceptsofMicroand MacroEconomics.

Course Description:

Thiscourseintroducesthestudentstothebasicconceptsin Macroeconomics,definition,measurement and variables like GDP, consumption, savings, investment and Balance ofPayments.

I. Introduction: **15**

MacroEconomics-Meaning-Definition-Scope-ImportanceandLimitation.
KeyVariablesofMacroEconomics-Income-Output-Expenditure.ConceptsofStockand Flow.
Equilibrium-General and Partial Equilibrium.

II. NationalIncome Accounting: **16**

a) National Income- Definition- Concepts of National Income-GNP-NNP-GDP-NDP-Per-capita Income-Disposable Income-NI at Factor Cost-NI at Market Cost-Nominal and Real Income. Green Accounting.
b) Measurement of National Income: Methods of measuring National Income-Importance-Difficulties.

III. DeterminationofIncomeandEmployment: **17**

a) ClassicalTheoryofEmployment:Say'sLaw ofMarket-AssumptionsandCriticism.

b) Keynesian Theory of Income and Employment:Concept of Effective Demand-Consumption Function APC and MPC-APS and MPS. Investment Function-Induced Investment and Autonomous Investment-Rate of interest and MEC(Marginal Efficiency of Capital)
DeterminationofEquilibrium-ASFandADF– ConceptofMultiplier.

IV. BusinessCycle:

Meaning,Types,PhasesofBusinessCycles-CausesofBusinessCycles-Theoriesof BusinessCycle:SunspotTheory-PsychologicalTheory.ControlofBusinessCycle.

V. MacroEconomicPoliciesoftheGovernment:

MonetaryPolicy-Meaning-Objectives and Instruments-Quantitative and Qualitative methods Fiscal Policy- Meaning-Objectives and Instruments-Tax and Expenditure.Budgetary Measures.

Reference:

Case,Karl Eand Ray CFair,Principles of Economics,Pearson Education,Inc.8th edition, 2007.
Sikdar,Shoumyen,PrinciplesofMacroeconomics,2nd edition,OxfordUniversityPress, India
SamuelsonP.A-Economics(18thEdition,McGrawhill)
MukarjeeSampath-ModernEconomicTheory(NewAgeInternational) H
L. Ahuja-Modern Economic Theory(S. Chand & Company)Mithani.
D.M -Modern Economic Analysis(Himalayan Publication)
McConnelCompbell&StanleyBrue-MicroEconomics(16thEdition,McGraw hill)
K.K.Dwett-ModernEconomicTheory(S.Chand &Company)
S.Sankaran-PrinciplesofEconomics(HimalayanPublication)
M.L.Jhingan-MacroEconomicTheory
M.L.Seth-Macroeconomics(LakshminarayanAgarwal)
G.Mankiw-Macroeconomics(NewAgeInternational)

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IV –Semester

DSCIV:-PrinciplesofMacroeconomics-II

Courseoutcomes

OncompletionoftheCourse, studentswill:

CO1.SpecifyindetailswithexamplesIS-LMAnalysis. CO2.
Learn in depth Supply side Economics.
CO3.Identifythe detailsofRationalExpectation.
CO4.IdentifyindetailswithexamplesConceptifInflation.
CO5.LearntheclassificationandcharacteristicsofBalanceofTrade.
CO6.Specifytheclassificationandcharacteristics ofDisequilibriuminBalanceofPayment. CO7.
Understand the details of Devaluation and its Effects.
CO8.IdentifytheclassificationandcharacteristicsofExchange rate.

Course Description:

This is a sequel to Principles of Macroeconomics that analyses various theories of determination of National Income in detail. It also introduces students to concept of Inflation, its relationship with unemployment and some basic concepts in an open economy.

I. MoneyinModernEconomy& IS-LMAnalysis 17

a) Money –Meaning-DefinitionandFunctions-RoleinModernEconomy.Quantitative Theory Money [Fisher's Equation] and Restatement Theory of Money.
b) IS-LM Analysis: Goods Marketand Money and their Equilibrium-Derivation of IS-LM Functions-IS-LM Model- AS and AD Curve- Critique of IS-LM Model.

II. ModernMacro Economics: 13

a) SupplySideEconomics-BasicpropositionsofsupplysideEconomics-Taxation-Labour supply-Incentives to save andinvestment–The Tax wedge-Tax Revenue and Laffer's curve.
b) Rational Expectations Analysis-Introduction to New Keynesian Theory-Aggregate Supply Function and Aggregate Demand Function. The New Classical Rational Expectations-Model –Policy implication[Lucas Model]

III Inflationand Unemployment: 18

Concept of Inflation-Deflation-Stagflation-Regression-Meaning-Definitions-Types-Determinants-Causes-Effects-InflationaryGap-ControllingofInflation-Relationship between Inflation and Unemployment-Phillip's Curve.

IV. Balanceof Payments: 15

BalanceofPayment-BalanceofTradeandBalanceofPayments-CompositionofBOP-Current Account-Capital account-Official Holdings.
DisequilibriuminBOP-Types-Causes-measurestoCorrectDisequilibriuminBalanceof Payments.

V. ForeignExchangeRate: 12

ExchangeRate-MeaningandTypes-Flexible-Fixed-Managed.DeterminationofExchange Rate-Devaluation and its Effects.

Reference:

Case, Karl E and Ray C. Fair, Principles of Economics, PearsonEducation, Inc..8th edition,2007.

Sikdar,Shoumyen,PrinciplesofMacroeconomics,2nd edition,OxfordUniversityPress, India.

Samuelson P.A-Economics(18th Edition, McGraw hill)

MukarjeeSampath-ModernEconomicTheory(NewAgeInternational) H

L. Ahuja-Modern Economic Theory(S. Chand & Company)Mithani.

D. M -Modern Economic Analysis(Himalayan Publication)

McConnelCompbell&StanleyBrue-MicroEconomics(16thEdition,McGrawhill)

K.K.Dewett-ModernEconomicTheory(S.Chand &Company)

S.Sankaran-PrinciplesofEconomics(HimalayanPublication)

M.L.Jhingan-Macro EconomicTheory

M.L.Seth-Macroeconomics(LakshminarayanAgarwal)

G.Mankiw-Macroeconomics((NewAgeInternational)

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VSemester

DSE-1A:EconomicsofDevelopment

Courseoutcomes

OncompletionoftheCourse, studentswill:

CO1.LearnindepthUnderstandtheconceptofEconomicdevelopment andfactorsaffect Development.
CO2.DeliberateindetailswithexamplesDifferentiateEconomicdevelopment andgrowth. CO3. Identify the characteristics of Demographic Trends.
CO4. Specify indepthHarrod-DomarGrowthModel.
CO5.UnderstandtheclassificationandcharacteristicsofEndogenousGrowththeory. CO6. Identify the details of Poverty Eradication Measures.
CO7.DeliberateindepthAmartyaSenand BhagavathiDebate.

Course Description:

Thiscoursereviewsmajortrendsinaggregateeconomicindicatorsofeconomicdevelopment, factors in economic development and theories of economic development and growth

I EconomicDevelopment: 18

Economic Development –Meaning-definition- Concept of Sustainable Development and Inclusive Development-Economic Growth and Development-Factors affecting Development-Indicators of Economic Development-National Income, Per capita Income, Basic needs approach- PQLI-HDI-GEM-MDPI-Happiness Index.

II FactorsinEconomic Development: 12

CapitalFormation:MeaningandImportance-CapitalOutput Ratio-PhysicalCapital– Technology-Human Capital-Demographic Transition-Institutional factors.

III. GeneralTheoriesofEconomicGrowth 15

Adam Smith,Karl Marx and Schumpeter's Theories of Economic Development.Harrod-Domor Growth Model-Rastow's Growth Theory.

IV. PartialTheoriesof Economic Growth and Development: 12

ArthurLewis-LabourSurplusModel.BigpushTheory-TheoriesofDualistic Development-Balanced v/s Unbalanced Theories- Endogenous Growth Theory.

V. EconomicGrowthandDistributive Justice: 18

Economic Growth and Social Justice: Poverty- Meaning, Types, Causes and Measures. Poverty Eradication Measures-Unemployment- Meaning, Types, Causes and Measures. Measures to reduce Unemployment. Occupational Structure-Organized and Unorganized Sector (with reference to India) Amartya Sen- Bhagavathi Debate.

Reference:

MichaelPTodaroandStephenSmith.EconomicDevelopment,Pearson,11th edition(2011).
UmaKapila,IndianEconomysinceIndependence,AcademicFoundation,19th edition (2009).
UnitedNationsDevelopmentProgramme,HumanDevelopmentReport2010.palgrave Macmillan (2010).
GovernmentofIndia,EconomicSurvey(latest). Government of India, Five Year Plan (latest).
GovernmentofIndia.FinanceCommissionReport (latest).
Dutt Ruddar & Sundaram .K. P. M -Indian Economy
MisraS.K&V.K.Puri-IndianEconomy(HimalayaPublishingHouse) Agarwal A. N -Indian Economy(Vishwa Publications)
P. K.Dhar -IndianEconomy(NewAgeInternational)

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VSemester
DSE-1B:MoneyandBanking

Courseoutcomes

OncompletionoftheCourse, studentswill:

CO1.UnderstandthecharacteristicsofDemandfor Money.
CO2. Specifytheclassificationandcharacteristics ofCapitalMarket. CO3.
Deliberate the details of Theories of Interest.
CO4.Learntheclassificationand characteristicsofFunctionsofCommercialbank. CO5.
Understand the characteristics of Indian Banking System.
CO6. LearnthecharacteristicsofEvaluationandFunctionsofCentralbank. CO7.
Deliberate the details of Monetary Policy.

Course Description:

This course exposes students to the theory and functioning of the monetary and financial sectors of theeconomy.It highlightstheorganization,structureandroleof financialmarketsand institutions.It also discusses interest rates, monetary management and instruments of monetary control, financial and banking sector reforms and monetary system with special reference to India.

I. Money: 12

Concept, Meaning and Definitions, Classifications of Money Functions and its Classification- Importance of Money. Demand for Money and determinants. Supply of money and determinants. Theories of Value of Money- Fisher's and Quantity Theory of Money.

II. MoneyMarketandCapitalMarket: 15

Money Market-Meaning-Structure and Instruments-Characteristics of a Good Money Market. Capital Market- Meaning-Structure and Instruments. Difference between Money Market and Capital Market.

III. InterestRates: 14

Rate of Interest-Meaning-Structure-Functions-short term and Long Term Interest. Theories ofInterest rateDetermination-LiquidityTheoryofInterest-DonPankin Theory-Interest rate in India.

IV CommercialBanks&NBFCs: 16

a)CommercialBanks-Functions-Role-BalanceSheet-*Credit Creation.*
b)IndianBankingSystem-NBFCs:Concept-Structure-Functions-Bankingsectorreforms, Changingroleandstructure.

v. CentralBankingandMonetaryPolicy: 18

a) CentralBank-Evolutionand FunctionsofCentralBank.

b) RBIanditsroleintheDevelopmentofBankingSysteminIndia-RBIandMonetary Policy. Credit control Instruments.

Reference:

F.S.MishkinandS.G.Eakins,FinancialMarketsandInstitutions,PearsonEducation,6th edition,2009

F. J. Fabozzi, F, Modigilani, F. J. Jones, M. G. Ferri, Foundations ofFinancial markets and Institutions, Pearson Education,3rd edition,2009

L.M.BholeandJ.Mahukud,FinancialInstitutionsandMarkets,TataMcGrawHill,5th edition,2011

M. Y.Khan,IndianFinancialSystem,TataMcGrawHill,7thedition,2011.

RBIBulletin,VariouslatestissuesofAnnual Reports,Reports onCurrency andFinance and Reports of the Working Group, IMF Staff Papers.

L.V. Chandler-Money&Banking(S.Chand&Company)

D.M.Mithani-Money&BankingandFinancialSystem(HimalayaPublishinghouse)

R.R.Paul-MonetaryEconomics(KalyaniPublishers)

B. Gupta-MonetaryEconomics(S.Chand&Company)

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VSemester

DSE-1C:EnvironmentalEconomics

Courseoutcomes

OncompletionoftheCourse, studentswill:

CO1. Deliberate in details with examples Pareto Optimality.
CO2.UnderstandthedetailsofMarketfailureandExternalities.
CO3.Understand indetailswithexamplesImplementationofEnvironmentalPolicy CO4.
Identify in details with examples Economics of climate change
CO5.SpecifythedetailsofCost-benefit analysisofEnvironmentalpolicies. CO6.
Deliberate the characteristics of Sustainable Development.
CO7. IdentifythedetailsofEnvironmentalValuationMethodsandApplication. CO8.
Specify in depth Perspectives from Indian experience.

Course Description:

This course introduces students to concepts, methods and policy options in managing the environment using tools of economic analysis. Since several environmental problems are caused by economic activity, for instance, carbon emissions, over-harvesting of renewable resources and airandwater pollutionasa by- productofindustrialactivity. Thiscourseexaminesdifferent approaches to adjusting behavior through economic institution such as markets and incentives.

I. Introduction: 15

Key environmental issues and problems, economic way of thinkingabout these problem, basic concepts from economics; Pareto optimality and market failure in the presence of externalities; property rights and other approaches.

II. EconomicsofNaturalResources: 14

EconomicsofNaturalResources: Types-Importance: Traditional-NaturalResources-Renewable and Non-Renewable Resources: Property Resources; Economics of Climate Change-Meaning-Causes and Effects.

III. TheDesignandImplementationofEnvironmentalPolicy: 16

Overview,Piguviantaxesandeffluentfees,tradablepermits,implementationofenvironmental policies in India and international experience; trans-boundary environmental problems:

IV. EnvironmentalValuationMethodsand Applications: 14

ValuationofEnvironmentalgoodsandservices-theoryandpractice;measurementmethods;Direct andIndirect Application:TravelCostMethod-Cost-benefitanalysis:Contingent Method.

V. SustainableDevelopment: 14

Concepts: measurement; Agriculture Sustainable Development; Industrial Sustainable Development: Rural Sustainable Development; Perspectives from Indian experience.

Reference:

RogerPerman,YueMa,MichaelCommon,DavidMaddisonandJamesMcGilvray,"Natural Resource and Environmental Economics" Pearson Education/Addison.

Charles Kolstad," Intermediate Environmental Economics" Oxford University press 2nd edition.2010.

RobertN.Stavins(ed.),"EconomicsoftheEnvironment:SelectedReadings",W.W.Norton6th edition,2012.

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VSemester
GE-IIntroductiontoEconomics

Courseoutcomes

OncompletionoftheCourse, studentswill:

CO1.AnalyzeMicroEconomicissuesandScarcity,Choice&ProductionPossibilityCurve. CO2.Understand Law of demand, determinants of demand.
CO3.Gainknowledgeabout LawofSupply, determinantsofSupplyand Equilibriumofdemand &supply.
CO4. Have insight into Production function: Law of variable proportion.
CO5.Clarifythe meaning&TypesofvariousCostConceptsandRevenueConcepts. CO6.
Understand to various classification ofMarket.

I. Introduction: 08

Economics-Meaning, Definitions-Need for the study**:** Micro and Macro Economics-Meaning-Importance and Limitations: Basic Problems of an Economy: Problem of Choice: Production Possibility Curve.

II. TheoriesofDemand andSupply: 07

Demand:Meaning-LawofDemand:ExceptionoftheLawofDemand: Factorsdetermining Demand, Supply-Meaning-Law of Supply, Factors determining Supply.

III. Production, CostandRevenueAnalysis: 08

ProductionFunction-returnstoscale-LawofVariableProportions;CostConcepts-Shortrunand Long run Cost Curves; Revenue Concept-TR,AR and MR.

IV. MarketStructure: 07

Market-MeaningandTypesofMarket:PerfectCompetitionMarket-Meaning-Features, Monopoly and Oligopoly-Features.

Reference:

D.M.Mithani-ModernEconomicAnalysis-HimalayanPublishingHouse.
H.L.Ahuja-Advanced Economic Theory
J.K.Mithra-Principles of Economics
K.K.Dewett-ModernEconomicTheory
G.Mankiw-Principles of Economics
MukhaerjeeSampat-ModernEconomTheory

VI Semester

DSE-1A:IndianEconomy

Courseoutcomes

OncompletionoftheCourse, studentswill:

CO1. Understand the characteristics of Indian Agricultural policies.
CO2.IdentifytheclassificationandcharacteristicsofRegionalvariation.
CO3. WritedowntheclassificationandcharacteristicsofNewIndustrialPolicy. CO4.
Specify in depth Public and Private Sector.
CO5. Identify in depth Monetary Policy.
CO6.UnderstandindepthFDIandWTO.
CO7. LearnindetailswithexamplesPublicDebt.
CO8.Identifythe detailsofEffectsofParallelEconomy.

Course Description:

Thiscourseexaminessector-specifictrendsinkeyindicatorsandtheirimplicationsinthepost- Independence period.

I. IndianAgriculture:PoliciesandPerformance 14

Introduction to Indian Economy-Role of Agriculture in India-Agriculture development-Agriculture-Production and Productivity-Agriculture Credit-Agriculture Labour-Agriculture Pricing and Marketing-Land Reforms-Regional Variation. National Agricultural Policy.

II. IndianIndustries:PoliciesandPerformance 15

Role of Industries in India-Importance and Problems of Large Scale and MSMEs in India. Private Sector and Public Sector Industries-Disinvestment Policy. New Industrial Policy. Development of IT Industries.

III. DevelopmentofServiceSectorInIndia 16

a)GrowthofServiceSectorinIndia: Trendsand Issues.Healthand Education.
b)RoleofcommercialbanksinIndianeconomy; ReserveBankofIndiaandMonetary policy; Reforms in the Banking sector(Narasimmam committee only)

IV. India'sForeignTrade:TrendsandPolicies 13

Composition,directions,TrendsinIndia'sForeignTrade.FDIandMNCs.WTOandIndia'sForeign Trade.BalanceofTrade,BalanceofPayments.TradeLiberalization.EXIMPolicy

V. IndianPublicFinance 17

Revenue and expenditure of central and state governments; India's public debt; deficit financing; financial relations between central and state; parallel economy-meaning, causes, extentandconsequences;measurestocontrolit.ConceptofDemonetisation.GST-Current Year UnionBudget

Reference:

UmaKapilaIndianEconomySinceIndependence, AcademicFoundation,19th edition(2009)
Government of India, Economic Survey (latest).
GovernmentofIndia,FiveYear Plan(latest).
Michael P Todaro and Stephen Smith. Economic Development, Pearson, 11th edition (2011).
UnitedNationsDevelopment Programme,HumanDevelopment Report2010.palgraveMacmillan (2010).
RBI-Handbook of Statistics on Indian Economy
GovernmentofIndia.FinanceCommissionReport (latest).
Dutt Ruddar & Sundaram.K.P.M-Indian Economy
MisraS.K&V.K.Puri-IndianEconomy(HimalayaPublishingHouse)
Agarwal A.N-Indian Economy(Wishva Publications)
P.K.Dhar-IndianEconomy(NewAgeInternational)

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VI Semester
DSE-1B:EconomicHistoryofIndia1857-1947

Courseoutcomes

OncompletionoftheCourse, studentswill:

CO1.LearnindepthIndianEconomyinthepre -Britishperiod. CO2.
Specify in depth Estimation of NationalIncome in India.
CO3.IdentifythecharacteristicsofAgriculturemarketsandInstitutions-credit.
CO4.Understand indetailswithexamplesEvaluationofEntrepreneurialandIndustrialStructure. CO5.
Learn the details of Government and Fiscal policy.

Course Description:

This course analyses key aspects ofIndian economic development during second half ofBritish rule and investigatesthe placeofIndianeconomyinthewider colonialcontext. Thiscourse linksdirectly to the course on India's development after independent in 1947.

I. Introduction:ColonialIndia:BackgroundandIntroduction 15

Overview of colonial Economy: Meaning of Colonialism: British Rule and Exploitation of India-The British Rule and India's Underdevelopment-State Policies and Economic Underdevelopment: Colonial Exploitation: forms and Consequences: Colonialism and Modernization: Nature of Indian Economy.

II. Macro Trends: 16

National Income: Estimates in India-Trends, Limitations. Population: Size and GrowthRate: Demographic Transition: Causes and Measurement of Rapid Growth of Population Occupational Structure: Occupational distribution of Labour Force in India: Historical Experience of Structural Change.

III. Agriculture: 17

Agrarian structure: Productivity and Efficiency: land relations; Cropping Patten-Irrigation: Agricultural markets and institutions-Credit. Commerce and technology; trends in performance and productivity; famines.

IV. Railwayand Industry: 13

Railways; the de-industrialization debate; evolution of entrepreneurial and industrial structure; Nature of industrialization in the interwar period; constraints to industrial breakthrough; labor relations.

v. Economyand StateintheImperialContext: 14

The imperialprioritiesandtheIndianeconomy;drainofwealth;internationaltrade, Capital, flows and the colonial economy- changes and continuities; government and fiscal policy.

Reference:

Lakshmi Subramaniam, History of India-1707-1857, Orient Blackswan (2010)
TirthankarRoy,TheEconomicHistoryofIndia1857-1947,OxfordUniversity(2011)
J.Krishmamurthy, Occupational Structure, The Cambridge
IrfanHabib,IndianEconomy1858-1914,(2006)

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VI Semester
DSE-1C:PublicFinance

Courseoutcomes

OncompletionoftheCourse, studentswill:

CO1.UnderstandtheclassificationandcharacteristicsofPublicEconomicsandPublicFinance. CO2. Understand in details with examples Test of maximum social Advantage.
CO3. UnderstandindepthTaxandnonTaxRevenue.
CO4.Identifythe characteristicsofCentralandStatefinancialRelations.
CO5.DeliberatetheclassificationandcharacteristicsofCentralandStatefinancialRelations.

Course Description:

This course gives a non-technical overview of governmentfinances with special reference to India.It will look into the efficiency and equity aspects of Taxation of the centre, states and the local governments and the issues of fiscal federalism and decentralization in India. The course will be useful for students aiming towards careers in the government sector, policy analysis, business and journalism.

I. Introduction: 13

Meaning, Nature and Scope of Public Finance, differences between Public Economics and Public Finance. Importance of the study Public Economics-Role of Public Finance in Developing Countries.

II. PrinciplesofPublic Economics: 15

Principles of maximum social advantage, Principle of allocation of resources; Test of maximum social advantage; Pareto's welfare Theory; Social welfare functions of modern governments; Distinction between private and public goods; Market imperfection; Externalities.

III. PublicRevenue,ExpenditureandDebt: 17

a) PublicRevenue-TaxandNon-TaxRevenue-CannonofTaxation.
b) PublicExpenditure-PrinciplesofPublicExpenditureand Wagner'sLawof Increasing state Activities.
c) PublicDebt-Meaning-Causes-BurdenandRedemption.

IV. IssuesInIndianPublicFinance: 16

a) Workingofmonetaryandfiscalpolicies
b) CurrentIssuesofIndianTaxSystem.
c) CentralandStatefinancialRelations.
d) Stateand LocalFinance.

V. Budget: **14**

ClassificationofBudgets:Programmeperformancebudget;Budgetarydeficits-Revenue andfiscaldeficits;Zerobasedbudgeting;Fiscalpolicy-meaning,objectivesandInstruments

Reference:

Musgrave, R. A. and P. B. Musgrave, Public Finance in Theoryand Practice, Mc-Graw Hill, 1989
MaheshPurohit,"ValueAddedTax:ExperienceofIndiaandotherCountries'GayatriPublications, 2007
KaushikBasu,and A.Maertens(ed).TheOxfordCompaniontoEconomicsinIndia, Oxford University Press, 2007
M.M.Sury-GovernmentBudgetinginIndia,Commonwealthpublishers,1990.
Shankar Acharya,'ThirtyYearsoftaxreform' inIndia, EconomicandPoliticalWeekly, May2005.
Report of the 13th Finance Commission - Government of India
Economicsurvey- GovernmentofIndia(latest)
StateFinances:AStudyofBudgets,Reserve Bank ofIndia(latest).
H.L.Bhatia-PublicFinance(SulthanChand &Sons)
S.K. Singh-PublicFinanceinTheory&Practice(HimalayanPublications)
K.P. M.Sundaram&K.K.Andley-PublicFinance(SulthanChand&Sons)
B.P.Tyagi-PublicEconomics(HimalayanPublications)

ELF21422/22/26/23/24

VISemester

GE-IIIIndianEconomy

Courseoutcomes

OncompletionoftheCourse, studentswill:

CO1.IdentifyindetailswithexamplesHumanResource.
CO2. Learn the characteristics of Population policy.
CO3. Identify the details of Role of Agriculture.
CO4.UnderstandthedetailsofRuralDevelopment.
CO5. Understand in depth Disinvestment.
CO6.DeliberatetheclassificationandcharacteristicsofForeignTrade.

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I. Introduction: 10

Features of Indian Economy; Concepts of National Income -GNP-NNP-GDP-NDP- Percapita Income-Disposable Income- Green GDP; of Population Explosion: India's Population Policy; Poverty: Definition; Poverty and Inequality; Poverty Alleviation Schemes; Unemployment: Definition and Types: Employment Guarantee Schemes(MGNERGA).

II. AgricultureSector: 08

Role ofAgriculture;Cropping Pattern-Land Reforms-GreenRevolution- FoodSecurity;Sources of Agricultural Credit-Co-Operatives Banks, Regional Rural Banks, NABARD, Commercial Banks; Agricultural Marketing-Problems and remedies; Agriculture and WTO.

III. IndustryandTertiarySector: 12

Role of Industries; Industrial Policy since 1991; MSMEs-Role and Problems; Large Scale Industries; Disinvestment in Public Sector undertakings: Emergence of IT Industry.
Role of Commercial Banks in Indian Economy; Reserve Bank of India: Functions and Credit Control Methods: Reforms in the Banking Sector (Narasimmam Committee only): Foreign Trade- Trends, Composition, directions of Trade-India's Balance of Payments; ForeignExchange Rate.

Reference:

DuttRuddar&SundaramK.P.M-IndianEconomy(S. Chand &Co,NewDelhi)
KapilaUma,IndianEconomysinceIndependence, AcademicFoundations,New Delhi Misra
S.K & V.K Puri - Indian Economy (Himalaya Publishing House)
S. Sankaran- IndianEconomy(MarghamPublications)
MohanRakesh(Edition),FactsoftheIndianEconomy,OUP,NewDelhi
VaidyanathanA.India'sEconomicReformsandDevelopment,OxfordUniversity PressNew Delhi
AgarwalA.N-IndianEconomy(VishvaPublications)
M.C.Vaish-IndianEconomy(NewAge International)
P. K. Dhar- Indian Economy (New Age International)
EconomicSurvey(Recent) –Govt.ofIndiaand Karnataka Data
Sources: Hand Book of statistics of Indian Economy
CensusReport &NSSO Report.

JSSCOLLEGEOFARTS,COMMERCEANDSCIENCE

(AUTONOMOUS)

B.N.ROAD,MYSORE-25

DEPARTMENTOFECONOMICS

MODELQUESTIONPAPERFORDSC&DSE B.A.ECONOMICS

I,II,III,IV,V&VISemester (CBCS Scheme)

Time:3 Hours **Max.Marks–70**

PART-A

I. Answer any Five of the following questions. 5x2=10

1)

a) ----------

b) ----------

c) ----------

d) ----------

e) ----------

f) ----------

g) ----------

PART-B

II. Answeranyfourofthefollowingquestions. 4x5=20

2. ----------

3. ----------

4. ----------

5. ----------

6. ----------

7. ----------

PART-C

III. Answeranyfourofthefollowingquestions. 4x10=40

8. ----------

9. ----------

10. ----------

11. ----------

12. ----------

JSSCOLLEGEOFARTS,COMMERCEANDSCIENCE

(AUTONOMOUS)

B.N.ROAD,MYSORE-25

DEPARTMENTOFECONOMICS

MODELQUESTIONPAPERFORGENERICELECTIVE

B.A.ECONOMICS

V&VISemester

(CBCSScheme)

Time:2Hours **Max.Marks–35**

PART-A

I. AnsweranyFiveofthefollowingquestions. 5x2=10

1. ----------
2. ----------
3. ----------
4. ----------
5. ----------
6. ----------
7. ----------

PART-B

II. AnsweranyThreeofthefollowingquestions. 5x3=15

8. ----------
9. ----------
10. ----------
11. ----------
12. ----------

PART-C

III. AnsweranyOne ofthefollowingquestions. 10x1=10

13. ----------
14. ----------
15. ----------

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE

(Autonomous)

OOTY ROAD, MYSURU- 570 025

DEPARTMENT OF ELECTRONICS

Curriculum for I and II Semester BSc/BSc (Honours) Degree under NEP- from the Academic year 2021-22

Physics, Electronics

AND

Curriculum for Choice Based Credit System

Physics, Mathematics, Electronics

2021-22

Programme Outcome (Under NEP)

After completing the graduation in the Bachelor of Science the students are able to:

PO1	Acquire the knowledge of Basic and Advanced topics related to the field of Electronics
PO2	Apply the knowledge of Logic thinking and basic Science for solving Electronics related problems.
PO3	Ability to perform Electronics Experiments and analyse and interpret data.
PO4	Ability to design and manage Electronic Systems or Processes that conforms to a given specification within ethical and economic constraints.
PO5	Ability to identify, formulate, solve and analyse the problems in various sub disciplines of Electronics.
PO6	Ability to use Modern Tools/Techniques in solving problems in the field of Electronics..

Programme Specific Outcome (Under NEP)

Bachelor of Science with Electronics as one of the optional subject

PSO1	Find career opportunities.
PSO2	Develop competence to write competitive examinations.
PSO3	Develop proficiency in the analysis of complex physical problems.
PSO4	Create a hypothesis and appreciate how it relates to broader theories.
PSO5	Demonstrate skills in the use of Computers for control, data acquisition, and data analysis in experimental investigations.
PSO6	Apply appropriate troubleshooting techniques to Electronic circuits / systems and perform test procedures

Scheme of Evaluation:

- **The evaluation weightage for theory papers in DSC, DSE and OE courses**

Course	Theory			Total
	C1	C2	C3	
DSC	20	20	60	100
DSE	20	20	60	100
OE	20	20	60	100

- **Scheme for C1 and C2 Evaluation for Theory component of DSC/DSE/OE**

Sl. No.	Activity	C1	C 2
1	Test	10 marks	10 marks
2	Seminar/Book Review/Report on Data Sheets of Electronic Components, etc.		10 marks
3	Assignment/Mini Project Work/Case Study/ Report on Industry Visit, etc.,	10 marks	
Total		**20 marks**	**20 marks**

Scheme of Evaluation for Practicals

- The evaluation weightage for Practicals in DSC, DSE courses:

Course	Practicals				Total
	C1	C2	Record	C3	
DSC	10	10	05	25	50
DSE	10	10	05	25	50

- The student will be evaluated on the basis of skill, comprehension, and recording the results
- The student has to compulsorily submit the practical record for evaluation during C1, C2, and C3.
- A candidate appearing for the first time should submit a duly signed and certified practical record.

- **Scheme of assessment of C3 component in Practical Examination**

Division	Marks
Experiment	22
Viva	03

Scheme for Experiment Part assessment in Practical Examination

Division	Marks
Write up of the experiment - Circuit diagram , Tabular column, formula & Nature of Graph	06
Circuit connections	06
Taking and Recording Readings	05
Calculations and Plotting of Graph	04
Accuracy of Result	01
TOTAL	**22**

Programme Structure for Electronics as one of the Core and Elective Courses under NEP-2020

Sem	Course type	Course Code	Title of the Course	Credits	Teaching hrs/Week
I	DSC Theory	**FSA 44033**	Electronic Devices and Circuits	4:0:0	04
	DSC Lab	**FSA 44033**	Electronic Devices and Circuits Lab	0:0:2	04
	OE 1.1	**FSA 860**	Fundamentals of Electronics and Domestic Wiring	3:0:0	03
	OE 1.2	**FSA 870**	Domestic Equipment Maintenance	3:0:0	03
II	DSC Theory	**FSB 44033**	Analog and Digital Electronics	4:0:0	04
	DSC Lab	**FSB 44033**	Analog and Digital Electronics Lab	0:0:2	04
	OE 2.1	**FSB 860**	Fundamentals of Semiconductor Devices	3:0:0	03
	OE 2.2	**FSB 870**	Renewable Energy and Energy Harvesting	3:0:0	03
	OE 2.3		PCB Design and Fabrication	3:0:0	03

Semester- I - Electronic Devices and Circuits

Total Teaching Hours: 60
Course Credits: L: T: P = 4:0:0
4 Hours/Week

Course Objectives:

The objectives of the Course are to enable the student to understand

1. Principle of operation of passive components
2. Basics principles of network theorems
3. Analysis of Electronic circuits
4. Construction, operation and applications of semiconductor diode, BJT and special Purpose devices
5. Number systems, Boolean laws and methods of simplifications of Boolean expressions

Course Outcomes:

At the end of this course, students will be able to-

1. Explain the principles and behaviour of basic semiconductor devices.
2. Analyse basic networks using network theorems.
3. Apply the concepts to realize the circuits. As per the requirement
4. Build simple electronic circuits used in various applications
5. Evaluate the critical internal parameters of semiconductor devices for the given standard device models.
6. Demonstrate the working of analog and digital circuits as per the specifications

Unit - 1

Electronic Components: Passive components – R, L, and C, and their properties, V-I relation, mutual and self-inductance, Transformer and its working, Definition and list of Active components, Concept of Voltage and Current Sources, Electric Energy and Power. (Qualitative only).

Network Theorems: KCL, KVL and node analysis of circuits, Superposition, Thevenin's, Norton's, Maximum Power Transfer, and Reciprocity Theorems, inter-conversion between Thevenin's and Norton equivalent circuits, (For Circuits with DC Source)

Network Analysis: DC and AC analysis of RC and RL circuits, RLC Series and Parallel Resonant Circuits.

PN-junction Diode: Ideal and practical diodes, Formation of Depletion Layer, mention of diode equation, I-V characteristics, DC load line, Static and Dynamic resistance, Zener diode and its IV Characteristics, Reverse saturation current, Zener and avalanche breakdown.

Rectifiers: Half-wave and Full-wave centre-tap and bridge rectifiers, expressions for output voltage, PIV, ripple factor and efficiency, Operation with and without shunt capacitor filter. (Relevant Numericals wherever applicable). **16 Hours**

Unit - 2

Applications of Diode: Clippers, Clampers and Voltage Multipliers (Qualitative analysis only)

Voltage Regulator: Block diagram of regulated power supply, Zener diode as voltage regulator – circuit diagram, load and line regulation, Fixed and Variable IC Voltage Regulators (78xx, 79xx, LM317).

Special Semiconductor Devices: Construction, working principle, characteristics, symbol and applications of Varactor diode, Schottky diode, and Tunnel diode, Solar Cell.

Display Devices: Construction, working principles, characteristics, symbol, and applications of LED and LCD, operation of 7-segment display, common anode and common cathode type 7-segment display. (Relevant Numericals wherever applicable) **16 Hours**

Unit - 3

Bipolar Junction Transistor: Construction and working of NPN transistor, CE, CB and CC configurations (mention only), Input and Output characteristics of a transistor in CE mode - Regions of operation of BJT (active, cut off and saturation), leakage currents (mention only), Current gains α , β and their inter-relations, dc load line and Q point.

Applications of Transistor: Circuit and working principles of Transistor as an amplifier and switch.

Transistor Biasing: Fixed and Voltage Divider Bias. Thermal runaway, mention of stability and stability factor, Transistor as a two-port network, h-parameter equivalent circuit for CE configuration.

Amplifier: Small signal analysis of single-stage CE amplifier using h-parameters, Frequency Response, Input and Output impedances, Current and Voltage gain.

Multi-stage Amplifiers: Types of coupling of amplifiers, Two-stage RC Coupled Amplifier – circuit, working and its Frequency Response, loading effect, GBW product.

Power Amplifiers: Class A, B and C Power Amplifiers (qualitative).

(Relevant Numericals wherever applicable) **16 Hours**

Unit - 4

Number System: Decimal, Binary, Octal and Hexadecimal number systems, base conversions. Representation of signed and unsigned binary numbers, Binary arithmetic - addition, subtraction by 1's and 2's complement method, BCD code (8421, 2421, Excess-3), Gray code - Gray to binary interconversion, parity error checking, single-bit error correction codes.

Boolean Algebra: Constants, variables, operators, SOP and POS form, canonical form, conversion form SOP to POS and Vice-versa, Boolean laws, Duality Theorem, De Morgan's Theorem.

Logic gates: AND, OR, NOT, Derived logic gates (NAND, NOR, XOR & XNOR). Universal property of NOR and NAND gates. Simplification and realization of Boolean expressions using gates. (Relevant Numericals wherever applicable) **16 Hours**

Reference Books:

1. Robert L Boylestad, and Louis Nashelsky, "Electronic Devices & Circuit Theory," 11th Edition, Pearson Education India, 2018.

2. Ravish R Singh, "Network Analysis and Synthesis," 1st Edition, MGH, 2018.

B.Sc. Electronics Curriculum – NEP-2020, University of Mysore, Karnataka Page 10

3. Robert L Boylestad, "Introductory Circuit Analysis," 15th edition, Pearson, 2015.

4. R. S. Sedha, "A Text book of Applied Electronics," 7th edition., S. Chand and Company Ltd., 2011.

5. A. P. Malvino, and, David J Bates, "Electronics Principles," 7th Edition, TMH, 2011.

6. David A. Bell, "Electronic Devices and Circuits," 5th Edition, Oxford Uni. Press, 2015.

7. Thomas L. Floyd, "Digital Fundamentals," 11th Edition, Pearson Education, 2015.

8. A.P. Malvino, D. P. Leach, and Saha, "Digital Principles and Applications," 8th Edition, TMH, 2014.

9. K. R. Venugopal, K. Shaila, "Digital Circuits and Systems," 1st Edition, TMH, 2011.

Electronic Devices and Circuits Lab

Course Credits: L:T: P = 0:0:2

Total Teaching Hours: 60

Teaching Hours/Week: 4 Hours/Week

Part – A :

1. Verification of Thevenin's, Norton's, and Maximum Power Transfer Theorems
2. Study the I-V Characteristics of p-n junction and Zener diodes.
3. Study of Half and full wave rectifiers without and with shunt capacitor filter and to find the Ripple factor for different values of load resistance.
4. Study of Zener diode as a voltage regulator using bridge rectifier with shunt capacitor filter and to find the Load and Line regulation.
5. Study of clipping and clamping circuits.

Part – B:

6. Study of Transistor characteristics in CE configuration – determination of h-parameters.
7. Study of Voltage divider bias circuits.
8. Study of single stage CE amplifier and to draw its frequency response and to determine the input and output impedances in mid-band.
9. Study of Series and Parallel Resonance circuits.
10. Verification of truth tables of OR, AND, NOT, NAND, NOR, XOR and XNOR gates using Respective ICs and Realization of basic gates using universal gates.
11. Binary to Gray and Gray to Binary code conversion and parity checker using XOR IC 7486.

Open Electives Course – 1.1

Fundamentals of Electronics and Domestic Wiring

L: T: P = 3:0:0
Total Teaching Hours: 48
Teaching Hours/Week: 3 Hours/Week

Course Objectives

The objectives of the Course are to enable the student to understand

1. Ability to gain the knowledge of basic electronics and electronic components.
2. Ability to analyse various components behaviour in AC and DC circuits.
3. Ability to get the knowledge of electrical wiring and safety precautions.
4. Provide students with learning experiences that develop broad knowledge and understanding of key concepts of electrical and electronics.
5. Provide students with skills that enable them to get employment in various organisations, industries, and turn as entrepreneurs.

Unit – 1:

Introduction to Electronics: Evolution of Electronics, Definition and expression for of Charge, Current, Voltage, Potential Difference, Power, Energy. Coulombs Law, Ohm's Law.

Electronic Components: Definition and list of passive and active components.

Resistors: Definition, application, and mention of types of resistors, colour coding of resistors, series and parallel combinations.

Capacitors: Definition, application and mention of types capacitors, series and parallel combinations, factors affecting capacitance, colour coding of capacitors.

Inductors: Definition, application, and mention of types of inductors, series and parallel combinations. Self and mutual inductance, factors affecting inductance. **12 Hours**

Unit – 2:

Kirchhoff's laws: KCL and KVL, voltage divider rule and current divider rule, open and short circuits.

Network Theorems (DC analysis only): Thevenin's theorem, Norton's theorem and maximum power transfer theorem, Superposition Theorem (Qualitative Approach with statements and steps involved in solving) as applied to simple T-network.

DC power supplies: Block diagram and working, Applications.

Cells and Batteries: Primary and Secondary cells, Mention of types of batteries, series and parallel combination of batteries.

Lead Acid Battery: Construction, Internal resistance, Efficiency and capacity of a battery, condition of a fully charged and discharged lead acid battery. **12 Hours**

Unit – 3:

A. C. Fundamentals: Definition and waveform of ac signal. Definition of Amplitude, Frequency, Time period, RMS value, average value, Phase and phase angle difference of sinusoidal signal. Sinusoidal signal applied to resistor, capacitor and Inductor, waveforms and phasor diagram for each. Expression for capacitive and inductive reactance. Circuit diagram and working of series and parallel resonance circuits, expression for resonance frequency.

Transformers: Definition, construction, working principle and application, step-up and step-down transformers. **12 Hours**

Unit – 4:

Domestic Wiring: Introduction, Types of Domestic Wiring, Cleat Wiring, Wooden/PVC Casing and Capping Wiring, Toughened Rubber Sheath (TRS or CTS) or Batten Wiring, Conduit Wiring, Specifications of Wires, Size of Conductor, Distribution Board, Types of Cables, Lighting Control Circuits, Earthing System, Fuses and HRC Fuses, Calculation of Fuse Rating.

Switches: Definition and application of switch, Brief note on SPST, SPDT, DPST and DPDT, electromagnetic relay, MCB, ELCB, RCCB, Toggle switch, push button, joystick, selector, limit, proximity switches. **12 Hours**

Reference Books:

1. C L Wadhwa, "Basic Electrical Engineering," 4th Edition, New Age International Publisher, 2007.
2. Robert Boylstead, "Introductory circuit analysis," 5th edition, PHI, 2010.
   Robert Boylstead and Louis Nashelsky, "Electronic Devices and circuit theory," 9th
3. Edition, PHI, 2013.
4. B. L. Theraja and A. K. Theraja, "ABC of Electrical Engineering," S Chand Publishers,
5. New Delhi, 2014.
6. S. K. Bhattacharya, "Basic Electrical and Electronics Engineering," Pearson Education India, 2012.
7. I. J. Nagrath, "Electronic Devices and Circuits," PHI Learning Pvt. Ltd., 2007.
8. V. Mittle and Arvind Mittle, "Basic Electrical Engineering," McGraw Hill Companies, 2005.
9. Mitchel E. Schultz, "Basic Electronics," 10th Edition, TMH, 2010.

Open Electives Course -1.2

Domestic Equipment Maintenance

L:T:P = 3:0:0
Total Teaching Hours: 48
Teaching Hours/Week: 3 Hours/Week

Course Objectives

The objectives of the course are

1. To enable the students to understand the working principle of domestic equipments.
2. Identify the common faults that occur in the domestic equipment.
3. Able to carry out minor repairs in the equipments.
4. Understand the technical specifications of the equipments.

Unit-1

Microwave Oven: Working, parts, Common faults and their troubleshooting: Microwave does not heat, runs then stops, buttons do not work, plate do not spin, bulb does not turn ON during operation, sparking inside, shuts OFF after few seconds. Demonstrate the working of microwave oven.

Geyser: Construction and working, parts and types. Common faults and their troubleshooting: Dripping geyser overflow, overheating, steam or hot water escaping from overflow, water leaking through the ceiling, no hot water, water not hot enough, poor hot water pressure. Demonstrate the working of Geyer. **12 Hours**

Unit – 2

Induction Cooker: Construction and working, parts and types. Common faults and their troubleshooting: Cooker fuse blown, cooker buttons not working, cook top shuts off while cooking, food not get cooked or heated properly, overheating and uneven heating, display keep flashing, weird noises, crackling, fan noise, humming sound, clicking. Demonstrate the working of induction cooker. **12 Hours**

Unit – 3

Refrigerator: Working, electrical wiring diagram, types of refrigerator. Common faults and their troubleshooting: Fridge not cooling, fridge not defrosting, leaking water, freezing food light not working, freezer is cooled but fridge stays warm, dead refrigerator, not enough cooling, keeps running, leakage, makes noise. Replacement procedure for: seal (gasket), evaporator fan motor, PTC relay, thermostat, compressor, bulb. Demonstrate the working of refrigerator.

12 Hours

Unit – 4

Air Conditioner: Working, electrical wiring diagram, types. Common Faults and their troubleshooting: Faults in following parts of AC: Filter, thermostat, refrigerant leaks, breakers, capacitors, compressor, evaporator coils, condenser coils, warm contactor. General faults : AC unit has an odour, shuts ON and OFF repeatedly, does not blow cold air, repeatedly tripping a circuit breaker, indoor unit is leaking water inside the room, outdoor unit is making an unusually loud sound, room is not getting cold enough, AC not turning ON. Demonstrate the working of air conditioner. **12 Hours**

Reference Books:

1. R. G. Gupta, "Electronic instruments and systems: Principles, maintenance and troubleshooting," TMH, 2001.

2. R. S. Khandpur, "Troubleshooting Electronic Equipment: Includes Repair & Maintenance," TMH, 2013.

3. G. C. Loveday, "Electronic fault diagnosis," Pearson Education, 1994

Semester- II - Analog and Digital Electronics

L: T: P = 4:0:0
Teaching Hours/Week: 4 Hours/Week
Total Teaching Hours: 60

Course Objectives:

The objectives of the Course are to enable the student to understand

1. Principle of operation active devices like, BJT, FET, Op-Amp, UTJ, SCR, etc.,
2. Understand different applications of op-amp.
3. Analysis of Electronic circuits.
4. Construction, operation and applications oscillators.
5. Digital Logic Families and their comparison.
6. Understand, analyse and simply combinational and sequential digital logic circuits.

Course Outcomes

At the end of this course, students will be able to

1. Explain the working principles of semiconductor devices like JFET, MOSFET, UJT, SCR, Diac and Triac.
2. Design and build the circuits to understand the applications of op-amp.
3. Demonstrate and understand the working of combinational and sequential logic circuits

Unit – 1:

JFET: Construction, working, Symbol, and I-V characteristics of p-channel and n-channel JFET, mention of different parameters and their relation in JFET, Comparison of BJT and JFET.

MOSFET: Construction, working, Symbol, drain and transfer characteristics of E-MOSFET, D-MOSFET, VMOS, UMOS. MOS Logic and its switching action, NMOS Inverter, CMOS and its characteristics, CMOS logic, Circuit and working of CMOS inverter, Construction and working of IGBT. Comparison of MOSFET, CMOS, and IGBT.

UJT: Construction, working, Symbol, I-V characteristics, equivalent circuit and parameters of UJT. Mention of equivalent circuit and I-V characteristics, working principles of UJT based Relaxation Oscillator.

SCR: Construction, working, Symbol, I-V characteristics, and two-transistor equivalent circuit of SCR, working principles of half-wave and full-wave controlled rectifiers.

Diac and Triac: Construction, working, Symbol, I-V characteristics and applications of Diac and Triac. Working principle of Triac as an AC-voltage controller.

(Relevant Numericals wherever applicable) **16 Hours**

Unit – 2

Operational Amplifier: Basics of Differential Amplifier, Block diagram of Op-Amp, Characteristics of an Ideal and Practical Op-Amp, Open and closed loop inverting and non-inverting amplifiers, concept of virtual ground, Derivation for voltage gain, definition and expression for op-amp parameters – input/output impedance, offset voltage, CMRR, Slew Rate, Frequency Response.

Applications of Op-amp: Concept of feedback, negative and positive feedback, advantages of negative feedback (Qualitative Study). Inverting and non-inverting amplifiers, Summing and Difference Amplifier, Differentiator, Integrator, Comparator, and Zero-crossing detector.

Filters: Definition and types of filter, active verses passive filters, First and Second order active low pass, high pass and band pass Butterworth filters.

Oscillators: Definition and working principle of oscillator, concept of negative feedback, Barkhausen criterion for sustained oscillations, Colpitt's and crystal oscillators, RC-Phase Shift and Wien-bridge oscillator (no derivation for each)

IC 555 Timer: Introduction, Block diagram, Circuit diagram and working of Astable and Monostable multivibrator circuits. (Relevant Numericals wherever applicable) **16 Hours**

Unit – 3

Logic Families: Pulse characteristics, Logic Families- classification of digital ICs. Characteristics of logic families, circuit description of TTL NAND gate with totem pole and open collector. TTL IC terminology, CMOS NAND Logic, comparison of TTL and CMOS families.

Combinational Logic Circuits: Minimisation techniques using K-maps - SOP and POS, Minterm, Maxterm, SSOP, SPOS, Simplification of Boolean expressions, K-Map for 3 and 4 variables.

Arithmetic Logic Circuits: Half Adder, Full Adder, Half Subtractor, Full Subtractor, 4 – bit parallel binary adder, 2 – bit and 4 – bit magnitude comparator.

Encoder and Decoder: Decimal to BCD priority encoder. Decoders: - 2:4 decoder using AND gates, 3:8 decoder using NAND gates, BCD to decimal decoder, BCD to 7-Segment decoder.

Multiplexer and Demultiplexer: 4:1 and 8:1 multiplexer, 1:4 and 1:8 demultiplexer, Realization of Full adder and Full Subtractor using Multiplexer and Decoder.

DAC and ADC: DAC with binary weighted resistor and R-2R resistor ladder network, Successive approximation based ADC and the mention of their performance characteristics.

(Relevant Numericals wherever applicable) **16 Hours**

Unit – 4

Sequential Logic Circuits: SR Latch, RS, D and JK Flip-Flops. Clocked (Level and Edge Triggered) Flip-Flops. Pre-set and Clear operations. Race-around conditions in JK Flip-Flop. Master- Slave JK and T Flip-Flops. Applications of Flip-Flops in semiconductor memories, RAM, ROM and types.

Shift Registers and Counters: Types of Shift Registers - Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers (4-bits only), Synchronous verses asynchronous counters, Ring and Johnson counters, 4-bit ripple counter, modulo-n counters, 4-bit Up-Down counter, 4-bit Synchronous counter, design of Mod 3, Mod 5 and decade Counters using K-maps. **(16 Hours)**

Reference Books:

1. Robert L Boylestad, and Louis Nashelsky, "Electronic Devices & Circuit Theory," 11th Edition, Pearson Education India, 2018.
2. R. S. Sedha, "A Text book of Applied Electronics," 7th edition., S. Chand and Company Ltd., 2011.
3. David A. Bell, "Electronic Devices and Circuits," 5th Edition, Oxford Uni. Press, 2015.
4. R. A. Gayakwad, "Op-Amps and Linear Integrated Circuit," 4th Edition, Pearson Education, 2000.
5. David A. Bell, "Operational Amplifiers and Linear ICs," 3rd Edition, Oxford University Press, 2011.
6. Thomas L. Floyd, "Digital Fundamentals," 11th Edition, Pearson Education, 2015.
7. A.P. Malvino, D. P. Leach, and Saha, "Digital Principles and Applications," 8th Edition, TMH, 2014.
8. K. R. Venugopal, K. Shaila, "Digital Circuits and Systems," 1st Edition, TMH, 2011.

Analog and Digital Electronics Lab

Course Credits: L: T: P = 0:0:2

Total Teaching Hours: 60

Teaching Hours/Week: 4 Hours/Week

PART- A

1. Study the JFET characteristics and obtain the frequency response and calculate band width of single stage JFET amplifier.
2. Study of inverting and non-inverting amplifier, adder, Subtractor, and averaging amplifier using Op-amp
3. Study of differentiator and integrator using op-amp for different input waveforms.
4. Design and study Colpitt's and RC phase shift oscillator using op-amp.
5. Obtain the frequency response of first order low-pass and high-pass filters using op-amp.
6. Study of Astable and Monostabe multivibrators using IC 555 timer.

PART- B

1. Study of Half and Full Adder, half and full Subtractor using NAND gates.
2. Study of 4 - bit parallel binary adder and Subtractor using IC.
3. Study of Clocked RS, D and JK Flip-Flops using NAND gates.
4. Study of BCD to decimal decoder using IC, Encoders and priority encoders.
5. Study of Multiplexer and Demultiplexer using ICs.
6. Study of 4-bit asynchronous counter using JK Flip-Flop.
7. Study of 4-bit Shift Register – SISO, modification to ring counter using IC.
8. Study of Digital to Analog Converter using binary weighted resistor method

Open Electives Course -2.1

Fundamentals of Semiconductor Devices

L: T: P = 3:0:0
Total Teaching Hours: 48
Teaching Hours/Week: 3 Hours/Week

Course Objectives:

The objectives of the Course are to enable the student to understand

1. Ability to gain the knowledge of Semiconductors devices.
2. Ability to get the applications of semiconductor devices.
3. Provide students with learning experiences that develop broad knowledge and understanding of semiconductor devices and its applications.

Unit – 1

Introduction to Semiconductors: Structure of a matter, conductors, insulators and semiconductors with examples to each, Energy band diagrams, intrinsic and extrinsic semiconductors. Definition of doping, dopant, donor, and acceptor, p-type and n-type semiconductors and their comparisons.

Diode: Construction, working, symbol, I-V characteristics and mention of application of pn junction diode. Ideal verses practical diodes, mention of different types of diodes and their symbolic representations.

Zener Diode: Construction, working, symbol, I-V characteristics and mention of application of zener diode, Zener and avalanche breakdown.

LED: Construction, working, symbol, and mention of application of LED, seven segment display and its applications. **12 Hours**

Unit – 2

Rectifiers: Circuit diagrams, working and waveforms of half wave, full wave canter tap and bridge rectifiers. Mention of ripple factor and efficiency to each.

Filters: Definition of filter, circuit diagram and working of rectifiers with and without shunt capacitor filter. Mention of ripple factor with and without filter.

Voltage Regulator: Definition and applications, Circuit diagram and working of zener diode,voltage regulator, load and line regulation. Block diagram of regulator power supply and its applications.

Wave-shaping Circuits: circuit diagram and working of positive, negative clippers and clampers.

12 Hours

Unit – 3:

BJT: Construction, working principle, symbol of NPN bipolar junction transistor, Mention of CE, CB, CC configurations, Definition of α, β and and their interrelations, Characteristics of a transistor in CE mode. Circuit diagram and working principle of transistor as a switch.

JFET: Construction, working principle, symbol of N channel FET, Difference between P and N channel FET, comparison of FET with BJT.

MOSFET: Construction, working and symbol of depletion type and enhancement type MOSFET.

(12 Hours)

Unit - 4

Transistor Biasing: Need for biasing, DC load line, operating point. Circuit diagram and working of Voltage divider bias circuit.

Amplifier: Circuit diagram and working of single stage CE amplifier, frequency response, definition of gain, bandwidth, lower and higher cut-off frequency, application of amplifiers. Block diagram and working of Multistage amplifier and expression for gain.

Oscillator: Definition and concept of positive and negative feedback, Barkhausen's criterion for sustained oscillation, Circuit diagram and working of RC phase shift oscillator using transistor.

(12 Hours)

Reference Books:

1. Robert Boylstead, "Introductory circuit analysis," 5th edition, PHI, 2010.

2. Robert Boylstead and Louis Nashelsky, "Electronic Devices and circuit theory," 9th Edition, PHI, 2013.

3. B. L. Theraja and A. K. Theraja, "ABC of Electrical Engineering," S Chand Publishers, New Delhi, 2014.

4. R.S. Sedha, "A Text book of Electronics," S Chand and Co., Multicolour, 3rd edition, 2012.

Open Elective Course -2.2

Renewable Energy and Energy Harvesting

L:T:P = 3:0:0
Total Teaching Hours: 48
Teaching Hours/Week: 3 Hours/Week

Course Objectives:

The objectives of the course are

1. To enable the students to understand the importance of non-conventional energy systems
2. Understand the method of energy harvesting using solar energy, wind energy, hydro energy, etc.
3. Know the principle of operation of piezoelectric effect and its use in energy harvesting
4. Get the knowledge on electromagnetic energy harvesting methods

Unit-1

Fossil fuels and Alternate Sources of energy: Fossil fuels and nuclear energy, their limitation, need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity. **(12 Hours)**

Unit-2

Solar energy: Solar energy, its importance, storage of solar energy, solar pond, non-convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models, equivalent circuits, and sun tracking systems. **(12 Hours)**

Unit-3

Wind Energy harvesting: Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies.
Ocean Energy: Ocean Energy Potential against Wind and Solar, Wave Characteristics, and Statistics, Wave Energy Devices. Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power, Ocean Bio-mass.
Geothermal Energy: Geothermal Resources, Geothermal Technologies. **(12 Hours)**

Unit-4

Hydro Energy: Hydropower resources, hydropower technologies, environmental impact of hydro power sources.

Piezoelectric Energy harvesting: Introduction, Physics and characteristics of piezoelectric effect, materials and mathematical description of piezoelectricity, Piezoelectric parameters and modelling piezoelectric generators, Piezoelectric energy harvesting applications.

Electromagnetic Energy Harvesting: Linear generators, physics mathematical models, recent applications. **(12 Hours)**

Reference Books:

1. B.H. Khan, "Non-conventional energy sources," 2nd Edition, TMH, 2017.
2. Suhas P Sukhative, "Solar energy," 8th Edition, TMH, 2008.
3. Godfrey Boyle, "Renewable Energy, Power for a sustainable future," 3rd Edition, Oxford University Press, 2012.
4. D.P.Kothari, "Renewable Energy Sources and Emerging Technologies," 2nd Edition, PHI, 2011.
5. Jayakumar, P., "Solar Energy Resource Assessment Handbook," Renewable Energy Corporation Network for the Asia Pacific, 2009.
6. John R. Balfour, "Introduction to Photovoltaic System Design," 1st Edition, Jones and Bartlett Publishers, 2011.
7. http://en.wikipedia.org/wiki/Renewable_energy

Open Elective Course -2.3

PCB Design and Fabrication

L:T:P = 3:0:0
Total Teaching Hours: 48
Teaching Hours/Week: 3 Hours/Week

Course Outcomes

Upon the completion of this course, students will demonstrate the ability to:

1. Understand basics of PCB designing.
2. Apply advance techniques, skills and modern tools for designing and fabrication of
3. PCBs.
4. Apply the knowledge and techniques to fabricate Multilayer, SMT and HDI PCB.
5. Understand concepts of Packaging.

Unit -1:

Introduction to Printed circuit board: Fundamental of electronic components, basic electronic circuits, Basics of printed circuit board designing: Layout planning, general rules and parameters, ground conductor considerations, thermal issues, check and inspection of artwork.

Design rules for PCB: Design rules for Digital circuit PCBs, Analog circuit PCBs, high frequency and fast pulse applications, Power electronic applications, Microwave applications.

(**12 Hours)**

Unit -2

Introduction to Electronic design automation (EDA) tools for PCB designing: Brief Introduction of various simulators, SPICE and PSPICE Environment, Selecting the Components Footprints as per design, Making New Footprints, Assigning Footprint to components, Net listing, PCB Layout Designing, Auto routing and manual routing. Assigning specific text (silkscreen) to design, creating report of design, creating manufacturing data (GERBER) for design. (**12 Hours)**

Unit -3

Introduction to printed circuit board production techniques: Photo printing, film- master production, reprographic camera, basic process for double sided PCBs photo resists, Screen printing process, plating, relative performance and quality control, Etching machines, Solders alloys, fluxes, soldering techniques, Mechanical operations. (**12 Hours)**

Unit – 4

PCB design for EMI/EMC: Subsystem/PCB Placement in an enclosure, Filtering circuit placement, decoupling and bypassing, Electronic discharge protection, Electronic waste; Printed circuit boards Recycling techniques, Introduction to Integrated Circuit Packaging and footprints, NEMA and IPC standards,

PCB Technology Trends: Multilayer PCBs. Multi wire PCB, Flexible PCBs, Surface mount PCBs, Reflow soldering, Introduction to High-Density Interconnection (HDI) Technology.

(12 Hours)

Reference Books:

1. R.S Khandpur, "Printed Circuit Boards - Design, Fabrication, Assembly and Testing," 1st Edition, TMH, 2017.
2. Walter C. Bosshart, "Printed Circuit Boards- Design and Technology," McGraw Hill Education,1983.
3. Clyde F. Coombs, "Printed Circuits Handbook," 6th Edition, McGraw Hill Education, 2007.
4. Kraig Mitzner, "Complete PCB Design Using OrCAD Capture and PCB Editor," 2nd Edition, Academic Press, 2019.
5. Rao R. Tummala, "Introduction to System-on-Package (SOP): Miniaturization of the Entire System," McGraw Hill, 2008.
6. Mark I. Montrose, "EMC and the Printed Circuit Board-Design, Theory and Layout

JSS COLLEGE OF ARTS, COMMERCE & SCIENCE, MYSURU

Pattern of Question Paper for DSC/DSE/OE

Time: 3 Hours Max. Marks: 60

1. Answer any **TEN** of the following. 10 x 2 = 20

a)
b)
c)
d)
e)
f)
g)
h)
i)
j)
k)
l) .

Unit – 1

6 + 4 = 10

2.

a) Long answer type question for 6 marks

b) Short answer type question or Numericals for 4 marks

OR

3)

a) Long answer type question for 6 marks

b) Short answer type question or Numericals for 4 marks

Unit – 2

6 + 4 = 10

4

a) Long answer type question for 6 marks

b) Short answer type question or Numericals for 4 marks

OR

5)

a) Long answer type question for 6 marks

b) Short answer type question or Numericals for 4 marks

Unit – 3

6 + 4 = 10

6)

a) Long answer type question for 6 marks

b) Short answer type question or Numericals for 4 marks

OR

7)

a) Long answer type question for 6 marks

b) Short answer type question or numerical for 4 marks

Unit – 4

6 + 4 = 10

8

a) Long answer type question for 6 marks

b) Short answer type question or Numericals for 4 marks

OR

9)

a) Long answer type question for 6 marks

b) Short answer type question or Numericals for 4 marks

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CBCS SCHEME

PROGRAMME CODE: BSc-04

Credit Pattern for Courses

Sem	Course Type	Course code	Course Title	L:T:P	Total Credit
III	DSC3: Theory	DMC26004	Communication Electronics	4:0:0	6
	DSC3: Practical- III	DMC26104	Communication Electronics	0:0:2	
IV	DSC4: Theory	DMD26004	Microprocessor and microcontrollers	4:0:0	6
	DSC4: Practical-IV	DMD26104	Microprocessor and microcontrollers	0:0:2	
V	DSE 1A : Theory	DME26004	**Digital Signal Processing**	4:0:0	5
	DSE1A: Practical-V	DME26104	Practical 5: Digital Signal Processing	0:0:1	
	DSE1B: Theory	DME26204	Electronic Instrumentation	4:0:0	5
	DSE1B: Practical-VI	DME26304	Practical 6: Electronic Instrumentation	0:0:1	
	SEC1A: Theory	DME26404	**Electrical circuits and network skills**	2:0:0	2
	SEC1B: Theory	DME26604	Computer networks	2:0:0	2
VI	DSE2A: Theory	DMF26004	**VERILOG & VHDL**	4:0:0	5
	DSE2A: Practical-VII	DMF26104	VERILOG & VHDL	0:0:1	
	DSE2B: Theory	DMF26204	Photonic Devices and Power Electronics	4:0:0	5
	DSE2B: Practical-VIII	DMF26304	Photonic Devices and Power Electronics	0:0:1	

L: Lecture, T: Tutorial, P: Practicals

Scheme for Examination and Assessment

Course type	IA C1		IA C2		SEE C3		Exam duration	
	Th	Pr	Th	Pr	Th	Pr	Th	Pr
DSC	15	7.5	15	7.5	70	35	3h	3h
DSE	15	7.5	15	7.5	70	35	3h	3h
SEC	7.5	-	7.5	-	50	-	2h	

SCHEME OF VALUATION FOR PRACTICAL EXAMINATION

- A candidate appearing for the first time should submit a duly signed and certified practical record
- Each candidate has to perform one experiment in the specified duration of two hours for ***THIRY FIVE marks***
- Practical record has to be valued for ***FIVE m*arks** by examiners at the time of examination
- IA for ***FIFTEEN marks*** in practical is awarded by two tests in the lab

I. ANALOG & DIGITAL EXPERIMENTS:

Sl no	Component	Marks
1	Write up of the experiment	10
2	Conducting experiment	10
3	Result	05
4	Viva-voce	05
5	Practical record	05
TOTAL		**35**

II. FOR PROGRAMMING EXPERIMENTS:

Sl no	Component	Marks
1	Program Writing	10
2	Entering /Coding	10
3	Execution	05
4	Practical record	05
5	Viva	05
TOTAL		**35**

Programme Outcome

Bachelor of Science in Physics, Mathematics, Electronics

After completing the graduation in the Bachelor of Science the students are able to:

PO1: Demonstrate proficiency in Mathematics and the Mathematical concepts needed for a proper understanding of Physics.

PO2: Demonstrate the ability to justify and explain their thinking and/or approach.

PO3: Develop state-of-the-art laboratory and professional communication skills.

PO4: Apply the scientific method to design, execute, and analyze an experiment.

PO5: Explain scientific procedures and their experimental observations.

PO6. Understand the value of Mathematical proof.

PO7: Demonstrate proficiency in writing and understanding proofs.

PO8: Apply mathematical problems and solutions in aspects of science and technology.

PO9: Gain experience to investigate the real world problems.

PO10: Apply mathematical ideas and models to problems.

PO11: Apply appropriate troubleshooting techniques to electronic circuits / systems and perform test procedures.

PO12: Assist, Assemble, modify and test electronic circuits in accordance with job requirements.

PO13: Communicate effectively in technical and non-technical environments.

Programme Specific Outcome

Bachelor of Science in Physics, Mathematics, Electronics

After completing the graduation in the Bachelor of Science the students are able to:

PSO1: Find career opportunities.

PSO2: Develop competence to write competitive examinations.

PSO3: Develop proficiency in the analysis of complex physical problems.

PSO4: Use mathematical or other appropriate techniques to solve complex physical problems.

PSO5: Create a hypothesis and appreciate how it relates to broader theories.

PSO6: Demonstrate skills in the use of Computers for control, data acquisition, and data analysis in experimental investigations.

PSO7: Apply knowledge of Physics, Mathematics and Electronics fundamentals to the solve problems in Electronic circuits & communication systems.

PSO8: Apply appropriate troubleshooting techniques to Electronic circuits / systems and perform test procedures.

DSC3: DMC26004

SEMESTER III
COMMUNICATION ELECTRONICS

Credits: Theory – 04,
Practical – 02 Theory: 60 Lectures

COURSE OUTCOME:

After completion of the course the student is able to

CO1: Understand the classification and characteristics of analog communication systems

CO2: Identify the classification and characteristics of pulse modulation systems

CO3: Specify the classification and characteristics of digital communication systems

CO4: Specify the classification and characteristics of satellite communication systems

CO5: Identify the classification and characteristics of mobile communication systems

Unit-1

Electronic communication:

Introduction to communication – means and modes. Block diagram of an electronic communication system. Brief idea of frequency allocation for radio communication system in India (TRAI). Electromagnetic communication spectrum,band designations and usage. Channels and base-band signals. Concept of Noise – External Noise – Atmospheric noise, Extraterrestrial noise, Industrial noise. Internal noise –Thermal agitation Noise, Shot Noise, Transit- time Noise, Miscellaneous Noise. Signal-to-Noise (S/N) ratio.

Analog Modulation – Amplitude modulation:

Modulation-types of modulation Need for modulation, Amplitude Modulation, modulation index – expression for modulation index, Analysis of AM wave, Frequency spectrum of AM wave, Power Relation, Current Calculation, Modulation by several sine waves. Generation of AM (Emitter Modulation),

Single Side Band Generation- Balanced Modulator and suppression of sidebands using filter method.

Amplitude Demodulation (diode detector), (15 Lectures)

Unit-2

Analog Modulation contd:

Frequency Modulation (FM) modulation index, Analysis of FM Wave and frequency spectrum Phase Modulation (PM), equivalence between FM and AM, Generation of FM using VCO,

FM detector (slope detector),

Receivers:

Characteristics of a Radio Receiver, Block diagram of AM & FM super heterodyne receiver

Analog Pulse Modulation:

Channel capacity, Sampling theorem, Basic Principles-PAM, PWM, PPM, modulation and detection technique for PAM only, Multiplexing. (15 Lectures)

Unit-3

Digital Pulse Modulation:

Need for digital transmission, Pulse Code Modulation, Digital Carrier Modulation Techniques, Sampling, Quantization and Encoding. Concept of Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK), and Binary Phase Shift Keying (BPSK).

Satellite Communication

Introduction, need for satellite communication, orbital Parameters, Kepler's Laws, Types of Orbits, Geosynchronous satellite orbits, geostationary satellite, advantages of geostationary satellites. Antenna Look Angles, Satellite visibility, transponders (C - Band), ground station, simplified block diagram of earth station (15 Lectures)

Unit-4

Mobile Telephony system

Basic concept of mobile communication, frequency bands used in mobile communication, Frequency reuse, Interference- Co-channel interference, Adjacent channel Interference, Cell splitting, Sectoring, Segmentation and Dualization, Roaming and Handoffs, SIM number, IMEI number, need for data encryption, Architecture (block diagram) of mobile communication network. Idea of GSM, CDMA, TDMA and FDMA technologies, GPS navigation system (qualitative idea only) (15 Lectures)

Reference Books:

• Electronic Communications, D. Roddy and J. Coolen, Pearson Education India.

• Advanced Electronics Communication Systems- Tomasi, 6th edition, Prentice Hall.

• Modern Digital and Analog Communication Systems, B.P. Lathi, 4th Edition, 2011, Oxford University Press.

• Electronic Communication systems, G. Kennedy, 3rd Edn., 1999, Tata McGraw Hill.

• Principles of Electronic communication systems – Frenzel, 3rd edition, McGraw Hill.

• Communication Systems, S. Haykin, 2006, Wiley India.

• Electronic Communication system, Blake, Cengage, 5th edition.

• Wireless communications, Andrea Goldsmith, 2015, Cambridge University Press.

DSC3: DMC26104

PRACTICAL 3

COMMUNICATION ELECTRONICS

1. To study an Amplitude Modulator using Transistor.
2. To study envelope detector for demodulation of AM signal.
3. To study FM – Generator.
4. To study AM Transmitter and Receiver
5. To study FM Transmitter and Receiver
6. To study Time Division Multiplexing (TDM)
7. To study Pulse Amplitude Modulation (PAM).
8. To study Pulse Width Modulation (PWM).
9. To study Pulse Position Modulation (PPM).
10. To study ASK modulators.
11. To study PSK modulators.
12. To study FSK modulators.
13. IF amplifier.
14. RF amplifier.

(Minimum of Eight experiments to be conducted)

DSC 4: DMD26004

SEMESTER IV

MICROPROCESSOR AND MICROCONTROLLER LAB

Credits: Theory – 04
Practical – 02 Theories: 60 Lectures

COURSE OUTCOME:

After completion of the course the student is able to

CO1: Understand the architecture of 8085 microprocessors

CO2: Write down the instruction set and simple programs of 8085 microprocessors.

CO3: Understand the architecture and instruction set of 8051microcontrollers

CO4: Specify the characteristics of embedded system

.**Unit-1**

8085 Microprocessor:

Block diagram of Digital Computer, Microcomputer Organization, Bus organization of 8085, Memory – types of memory , Input /Output

Architecture:

Main features of 8085. Block diagram. Pin-out diagram of 8085. Control and Status Signals, Power supply and Clock Frequency. Architecture –ALU, Flags & Registers and Timing and Control unit.

8085 Programming:

Instruction format-Word sizes, Opcode format Instruction classification, Data transfer, Timing diagram of MOV and MVI, Arithmetic, logical and branch instructions, Simple Programs

(15 Lectures)

Unit-2

8051 microcontroller:

Introduction and block diagram of 8051 microcontroller, Overview of 8051 family, comparison between Microprocessor and Microcontroller. Pin diagram of 8051, I/O port pins description and their functions. Architecture of 8051 – Block diagram, Oscillator and clock, Program Counter and Data Pointer, A & B CPU registers, flags and PSW, Internal memory, Internal RAM, Internal ROM, Stack and Stack pointer, Special function registers and their addresses. Timers & Interrupts.

(15 Lectures)

Unit-3

8051 Programming:

8051 Addressing modes – Immediate, Register, Direct and Indirect addressing modes. Indexed addressing mode- MOVC & MOVX instructions.

Arithmetic instructions – Incrementing and Decrementing, Addition, Subtraction, Multiplication and Division, Decimal Arithmetic.

Logic Instructions – Byte level and Bit level logical instructions, Rotate and Swap instructions (15 Lectures)

Unit-4

JUMP, LOOP & CALL instructions - Loop and Jump instructions, Call instructions.

8051 interfacing with 8255 – Programming 8255, mode selection of 8255, DAC interfacing

Introduction to embedded system:

Embedded systems and general purpose computer systems. Architecture of embedded system. Classifications, applications of embedded systems. (15 Lectures)

Reference Books:

- Microprocessor Architecture Programming & applications with 8085, 2002, R.S.Goankar, Prentice Hall.
- Embedded Systems: Architecture, Programming & Design, Raj Kamal, 2008, Tata McGraw Hill.
- The 8051 Microcontroller and Embedded Systems Using Assembly and C, M.A.Mazidi, J.G. Mazidi, and R.D. McKinlay, 2nd Ed., 2007, Pearson Education India.
- Microprocessor and Microcontrollers, N. Senthil Kumar, 2010, Oxford University Press.
- 8051 microcontrollers, Satish Shah, 2010, Oxford University Press.
- Embedded Systems: Design & applications, S.F. Barrett, 2008, Pearson Education India.
- Introduction to embedded system, K.V. Shibu, 1st edition, 2009, McGraw Hill.
- Embedded Microcomputer systems: Real time interfacing, J.W. Valvano 2011,Cengage Learning

DSC 4: DMD26104

PRACTICAL IV

MICROPROCESSOR AND MICROCONTROLLER LAB

Section-A: Programs using 8085 Microprocessor

1. Addition and subtraction of numbers using direct addressing mode.
2. Addition and subtraction of numbers using indirect addressing mode.
3. Multiplication by repeated addition.
4. Division by repeated subtraction.
5. Finding Largest among a group of numbers.
6. Finding Smallest among a group of numbers.
7. Arranging in an ascending order of a group of numbers.
8. Arranging in descending order of a group of numbers
9. Other programs (e.g. Parity Check, etc.).

Section-B: Experiments using 8051 microcontroller:

1. Binary addition , subtraction , multiplication and division
2. 8 bits multiplication and division.
3. Fibonacci series.
4. Average of a number.
5. Square and Square root of a number.
6. Palindrome.
7. BCD to Binary conversion.
8. Finding the smallest and largest numbers from the given N binary numbers.
9. To find that the given numbers is prime or not.
10. To find the factorial of a number.
11. Write a program to make the two numbers equal by increasing the smallest number and decreasing the largest number.
12. Use one of the four ports of 8051 for O/P interfaced to eight LED's. Simulate binary counter (8 bit) on LED's. 5. Program to glow the first four LEDs then next four using TIMER application.
13. Program to rotate the contents of the accumulator first right and then left.
14. Program to run a countdown from 9-0 in the seven segment LED display.
15. To interface seven segment LED display with 8051 microcontroller and display 'HELP' in the seven segment LED display.
16. To toggle '1234' as '1324' in the seven segment LED display.
17. To generate different types of wave forms using DAC interface
18. Application of embedded systems: Temperature measurement & display on LCD

Note: At least 04 experiments from section A and B to be done

DSE 1A: DME26004

SEMESTER V

DIGITAL SIGNAL PROCESSING

Credits: Theory – 04

Practical – 02 Theory: 60 Lectures

COURSE OUTCOME:

After completion of the course the student is able to

CO1: Identify the details of discrete/digital signals and systems

CO2: Understand the classification and characteristics of frequency domain analysis of discrete time signals.

CO3: Specify with examples DSP filters

Unit-1

Discrete-Tim e Signals and Systems:

Classification of Signals: Continuous-time and Discrete-Time signals, Analog and Digital signals, Periodic and Aperiodic Signals, Energy and Power Signals, Even and Odd Signals. Operations on Dependent and Independent Variables. Continuous- Time System and Discrete-Time Systems: Unit Step Response, Impulse Response and Ramp Response. Exponential signals, exponentially damped sinusoidal signals, pulse signals

Basic Discrete Time signals – Step function, Impulse function, Ramp function, Exponential function, Sinusoidal signals, Exponentially damped sinusoidal signals, Pulse signals

System Properties: Linearity, Causality; Time-Invariance, Memory, Stability and Invertibility. Linear Time Invariant Systems- Convolution Sum. Convolution Integral, Representation for LTI System – two systems in Parallel, Two systems in Cascade. (15 Lectures)

UNIT 2:

The Z-Transform:

Introduction, Definition of Z – transform, Transform and ROC of Finite Duration Sequences – Right Sided Sequence, Left Sided Sequence, Double Sided Sequences.

Z – Transform and ROC of Infinite Duration Sequences- Positive Time Exponential Sequence, Negative Time Exponential Sequence, Double sided Exponential Sequence, ROC & Stability, Properties of ROC . Problems.

Properties of Z-Transform-Linearity, Time Shift or Translation, Multiplication by an Exponential, Multiplication by a Ramp, Convolution (Time-domain), Time-reversal, Convolution (Z-domain), Initial- value theorem, Final value theorem. Transforms of some useful Sequences.

Inverse Z- transform-Partial fraction expansion method, Inverse Z- transform by long division method.

UNIT 3:

Discrete-Time Fourier Transform:

DFT - Introduction. Definition of DFT and IDFT- Lemma, Inverse DFT, Periodicity of X(k) and x(n).

Matrix relation for computing DFT, Matrix relation for Computing IDFT, Using DFT to find IDFT, Concept circular shift and circular symmetry, Properties of DFT – Linearity, Circular time shift, Circular frequency shift.

Fast Fourier Transform (FFT) – Decimation-in-time FFT, Further reduction: Cooley-Turkey Algorithm, In-place computations, Decimation in frequency FFT. (15 Lectures)

UNIT 4:

Filter Concepts: Linear-Phase Filter, Simple FIR Digital Filters, Simple IIR Digital Filters, All pass Filters

Design of IIR Filters:

Introduction, Analog Filter Specifications, Classification of Analog Filters, Butterworth Filters, Frequency transformations / Spectral Transformations, Design of Low pass Butterworth Filters, Digital filters, Backward difference method, Bilinear Transformations, Analog Design using Digital filters, Advantages and Disadvantages of IIR Filters. (15 Lectures)

Reference Books:

- Digital Signal Processing, Tarun Kumar Rawat, 2015, Oxford University Press, India.
- Digital Signal Processing, S. K. Mitra, McGraw Hill, India.
- Principles of Signal Processing and Linear Systems, B.P. Lathi, 2009, 1st Edn. Oxford University Press.
- Fundamentals of Digital Signal processing using MATLAB, R.J. Schilling and S.L.Harris, 2005, Cengage Learning.
- Fundamentals of signals and systems, P.D. Cha and J.I. Molinder, 2007, Cambridge University Press.
- Digital Signal Processing Principles Algorithm & Applications, J.G. Proakis and D.G. Manolakis, 2007, 4th Edn., Prentice Hall.

DSE 1A: DME26104

PRACTICAL V

DIGITAL SIGNAL PROCESSING

1. Verification of properties of a system : linear and convolution
2. Finding DFT of a given sequence - direct method
3. Finding IDFT of a given sequence - direct method
4. Linear convolution using DFT
5. Circular convolution using DFT
6. Solution of simple difference equations
7. Verification of sampling theorem
8. Determination of impulse response of a given system
9. Determination of Frequency response of system to any arbitrary input
10. Design of simple IIR filters – Butterworth
11. DFT using FFT
12. IDFT using FFT

(Note: Minimum of Eight experiments to be done).

DSE 1B: DME26204

SEMESTER V

ELECTRONIC INSTRUMENTATION

Credits: Theory – 04
Practical – 02 Theory: 60 Lectures

COURSE OUTCOME:

After completion of the course a student is able to

CO1: Specify in detail, basic electronic measurement instruments.

CO2: Write down the classification and working of impedance measuring instruments.

CO3: Specify the details of power supply.

CO4: Understand the working and applications of transducers

Unit 1:

Measurements

Accuracy and precision. Significant figures. Error and uncertainty analysis. Shielding and grounding. Electromagnetic Interference.

Basic Measurement Instruments:

DC measurement-ammeter, voltmeter, ohm meter, AC measurement, Digital voltmeter systems (integrating and non-integrating). Digital Multimeter; Block diagram principle of measurement of I, V, C. Accuracy and resolution of measurement.

Measurement of Impedance-

A.C. bridges, Measurement of Self Inductance (Anderson's bridge), Measurement of Capacitance (De Sauty's bridge), Measurement of frequency (Wien's bridge).

(15 Lectures)

Unit 2:

Power supply

Block Diagram of a Power Supply, Qualitative idea of C and L Filters. IC Regulators (78XX and 79XX), Line and load regulation, Short circuit protection. Idea of switched mode power supply (SMPS) and uninterrupted power supply (UPS).

Oscilloscope:

Block Diagram, CRT, Vertical Deflection, Horizontal Deflection. Screens for CRT, Oscilloscope probes, measurement of voltage, frequency and phase by Oscilloscope. Digital Storage Oscilloscopes. LCD display for instruments. (15 Lectures)

Unit 3:

Lock-in-amplifier:

Basic Principles of phase locked loop (PLL), Phase detector (XOR & edge triggered), Voltage Controlled Oscillator (Basics, varactor), lock and capture. Basic idea of PLL IC (565 or 4046). Lock-in-amplifier, Idea of techniques for sum and averaging of signals.

Signal Generators:

Function generator, Pulse Generator, (Qualitative only).

Virtual Instrumentation:

Introduction, Interfacing techniques (RS 232, GPIB, USB), Idea about Audrino microcontroller and interfacing software like lab View). (15 Lectures)

Unit 4:

Transducers:

Classification of transducers, Basic requirement/characteristics of transducers, Active and Passive transducers, Resistive (Potentiometer- Theory, temperature compensation & applications), Capacitive (variable air gap type), Inductive (LVDT) & piezoelectric transducers. Measurement of temperature (RTD, semiconductor IC sensors), Light transducers (photo resistors & photovoltaic cells). (15 Lectures)

Reference Books:

• W.D. Cooper and A. D. Helfrick, Electronic Instrumentation and Measurement Techniques, Prentice Hall (2005).

• E.O. Doebelin, Measurement Systems: Application and Design, McGraw Hill Book - fifth Edition (2003).

• David A. Bell, Electronic Devices and Circuits, Oxford University Press (2015).

• Alan S. Morris, “Measurement and Instrumentation Principles”, Elsevier (Butterworth Heinmann-2008).

• S. Rangan, G. R. Sarma and V. S. Mani, Instrumentation Devices and Systems, Tata Mcgraw Hill (1998).

• Introduction to measurements and instrumentation, 4th Edn., Ghosh, PHI Learning.

DSE 1B: DME26304

PRACTICAL VI
ELECTRONIC INSTRUMENTATION LAB

1. Measurement of resistance by Wheatstone bridge and measurement of bridge sensitivity.
2. Measurement of Capacitance by De Sauty's bridge.
3. To determine the Characteristics of resistance transducer - Strain Gauge (Measurement of Strain using half and full bridge).
4. To determine the Characteristics of LVDT.
5. To determine the Characteristics of Thermistors and RTD.
6. Measurement of temperature by Thermocouples.
7. Design a regulated power supply of given rating (5 V or 9V).
8. To design and study the Sample and Hold Circuit.
9. To plot the frequency response of a microphone.

(Note: Minimum of Eight experiments to be done).

DSE 2A: DMF26004

SEMESTER VI

VERILOG & VHDL

Credits: Theory – 04,
Practical – 02 Theory: 60 Lectures

COURSE OUTCOME:

After completion of the course the student is able to

CO1: Identify the details of Digital logic design flow.

CO2: Learn the characteristics and model the digital circuits using VHDL behavioural modelling

CO3: Deliberate in detail the dataflow and structural modelling in VHDL

CO4: Describe digital circuits utilizing various constructs of Verilog

Unit-1

Digital logic design flow

Review of combinational circuits. Combinational building blocks: multiplexers, demultiplexer, decoders, encoders and adder circuits. Review of sequential circuit elements: flip-flop, latch and register. Finite state machines: Mealy and Moore. Other sequential circuits: shift registers and counter (15 lectures)

Unit-2

Verilog HDL:

Introduction to HDL. Verilog primitive operators and structural Verilog. Behavioural Verilog. Design verification. Modelling of combinational and sequential circuits (including FSM and FSMD) with Verilog Design examples in Verilog. (15 lectures)

Unit-3

VHDL: Basic Language elements

Identifiers, Data Objects, Data types, Operators

Behavioral Modelling

Entity Declaration, Architecture Body, Process statement, Variable assignment statement, Signal Assignment, Wait statement, If statement, Case statement, Null statement, Loop statement, Exit statement, Next statement, Assertion statement, Report statement, More on Signal Assignment statement, other sequential statements. (15 Lectures)

Unit-4

Dataflow Modelling

Concurrent Signal Assignment, Concurrent versus Sequential Signal Assignment, Delta Delay Revisited, Multiple Drivers, Conditional Signal Assignment Statement, Selected Signal Assignment Statement, The UNAFFECTED value, Block Statement, Concurrent Assertion Statement, Value of signal.

Structural Modeling

An example, Component Declaration, Component Instantiation, Other examples. Resolving Signal Values (15 lectures)

Reference Books:

1. LizyKurien and Charles Roth. *Principles of Digital Systems Design and VHDL.*Cengage Publishing. ISBN-13: 978-8131505748.
2. Palnitkar, Samir, *Verilog HDL.* Pearson Education; Second edition (2003).
3. Ming-Bo Lin. *Digital System Designs and Practices: Using Verilog HDL andFPGAs.* Wiley India Pvt Ltd. ISBN-13: 978-8126536948.
4. ZainalabedinNavabi. *Verilog Digital System Design.* TMH; 2ndedition. ISBN-13:978-0070252219.
5. Wayne Wolf. *FPGA Based System Design.* Pearson Education.S. K. Mitra, Digital Signal processing, McGraw Hill, 1998.
6. VLSI design, Debaprasad Das, 2nd Edition, 2015, Oxford University Press.
7. D.J. Laja and S. Sapatnekar, Designing Digital Computer Systems wit.

DSE 2A: DMF26104

PRACTICAL VII

VERILOG AND VHDL LAB

Experiments using Verilog

1. Write code to realize basic and derived logic gates.
2. Half adder, Full Adder using basic and derived gates.
3. Half Subtractor and Full Subtractor using basic and derived gates.
4. Design and simulation of a 4 bit Adder.
5. Multiplexer (4x1) and Demultiplexer using logic gates.
6. Decoder and Encoder using logic gates.
7. Clocked D, JK and T Flip flops (with Reset inputs).
8. 3-bit Ripple counter

Experiments using VHDL

1. Behavioral modeling and simulation of basic gates
2. Structural modeling and simulation of simple Boolean expression
3. Modeling and simulation of adders and subtractors
4. Modeling and simulation of magnitude comparators
5. Modeling and simulation of Flip-flops
6. Modeling and simulation of Shift registers
7. Modeling and simulation of Counters
8. Modeling and simulation of encoders and decoders
9. Modeling and simulation of multiplexers

Note: At least 04 experiments - each from section A and B to be done.

DSE2B: DMF26204

SEMESTER VI

PHOTONIC DEVICES AND POWER ELECTRONICS

Credits: Theory – 04
Practical – 02 Theory: 60 Lectures

COURSE OUTCOME:

After completion of the course the student is able to

CO1: Deliberate the Principles and operations of Photonic devices.

CO2: Deliberate the Principle of operation and characteristics of optical fibers

CO3: Understand the mode of signal prorogation in optical fibres

CO4: Deliberate the characteristics and application of power devices

UNIT 1:

Photonic Devices

Classification of photonic devices. Interaction of radiation and matter, Radiative transition and optical absorption. Light Emitting Diodes- Construction, materials and operation. Semiconductor Laser- Condition for amplification, laser cavity, heterostructureand quantum well devices. Charge carrier and photon confinement, line shape function. Threshold current. Laser diode. Photodetectors: Photoconductor. Photodiodes (p-i-n, avalanche) and Photo transistors,quantum efficiency and responsivity. Photomultiplier tube. (15 Lectures)

UNIT 2:

Solar Cell

Construction, working and characteristics LCD Displays: Types of liquid crystals, Principle of Liquid Crystal Displays,applications, advantages over LED displays.

Introduction to Fiber Optics:

Evolution of fiber optic system- Element of an Optical Fiber Transmission link- Ray Optics-Optical Fiber Modes and Configurations –Mode theory of Circular Wave guides- Overview of Modes-Key Modal concepts- Linearly Polarized Modes -Single Mode Fibers-Graded Index fiber structure.

(15 Lectures)

UNIT 3:

POWER ELECTRONICS

Power Devices:

Need for semiconductor power devices, Power MOSFET (Qualitative).Introduction to family of thyristors. Silicon Controlled Rectifier (SCR)- structure, I-Vcharacteristics, Turn-On and Turn-Off characteristics, ratings, Gate-triggering circuits.Diac and Triac- Basic structure, working and V-I characteristics. Application of Diacasa triggering device for Triac. (15 Lectures)

UNIT 4:

Insulated Gate Bipolar Transistors (IGBT):

Basic structure, I-V Characteristics,switching characteristics, device limitations and safe operating area (SOA).

Applications of SCR:

Phase controlled rectification, AC voltage control using SCR and Triac as a switch. Power Invertors- Need for commutating circuits and their varioustypes, dc link invertors, Parallel capacitor commutated invertors, Series Invertor,limitations and its improved versions, bridge invertors.

(15 Lectures)

Reference Books:

1. J. Wilson & J.F.B. Hawkes, Optoelectronics: An Introduction, Prentice Hall India (1996).
2. S.O. Kasap, Optoelectronics & Photonics, Pearson Education (2009).
3. AK Ghatak& K Thyagarajan, Introduction to fiber optics, Cambridge Univ. Press (1998).
4. Power Electronics, P.C. Sen, Tata McGraw Hill.
5. Power Electronics, M.D. Singh & K.B. Khanchandani, Tata McGraw Hill.
6. Power Electronics Circuits, Devices & Applications, 3rd Edn., M.H. Rashid,Pearson Education.
7. Optoelectronic Devices and Systems, Gupta, 2nd edn., PHI learning.
8. Electronic Devices and Circuits, David A. Bell, 2015, Oxford University Press.

DSE 2B: DMF26304

PRACTICAL VIII

PHOTONIC DEVICES AND POWER ELECTRONICS

1. To determine wavelength of sodium light using Michelson's Interferometer.
2. Diffraction experiments using a laser.
3. Study of Electro-optic Effect.
4. To determine characteristics of (a) LEDs, (b) Photo voltaic cell and (c) Photo diode.
5. To study the Characteristics of LDR and Photodiode with (i) Variable Illumination intensity, and (ii) Linear Displacement of source.
6. To measure the numerical aperture of an optical fiber.
7. Output and transfer characteristics of a power MOSFET.
8. Study of I-V characteristics of SCR.
9. SCR as a half wave and full wave rectifiers with R and RL loads.
10. AC voltage controller using TRIAC with UJT triggering.
11. Study of I-V characteristics of DIAC
12. Study of I-V characteristics of TRIAC.

SEC1A: DME26404

ELECTRICAL CIRCUITS AND NETWORK SKILLS

Credits: 02 Theory: 30 Lectures

Course Outcome:

After completion of the course the student acquires skill to

CO1: Design and trouble shoot the electrical circuits and networks

CO2: Carry-out simple domestic wiring.

UNIT 1:

Basic Electricity Principles:

Discussion of Voltage (AC & DC), Current(AC & DC), Resistance, and Power. Ohm's law. Series, parallel, Series and Parallel combinations of R, L and C. Response of inductors and capacitors with DC or AC sources. Impedance in of Inductor and Capacitor

Electrical Circuits:

DC Circuits - Basic electric circuit elements and their combination in DC circuits. Rules to analyze DC sourced electrical circuits. Current and voltage drop across the DC circuit elements.

AC Circuits - . Simple numericals on network theorms. Real, imaginary and complex power components of AC source. Power factor. Saving energy and money.

Electrical Drawing and Symbols:

Drawing symbols. Blueprints. Reading Schematics. Ladder diagrams. Electrical Schematics. Power circuits. Control circuits. Reading of circuit schematics. Tracking the connections of elements and identify current flow and voltage drop. (15 Lectures)

UNIT 2:

Generators and Transformers:

DC Power sources. AC/DC generators. Basic principle of operation, constructional features. Transformers – Principle of working, Construction and Operation of transformers.

Electric Motors:

Single-phase, three-phase & DC motors - Construction and Working. Speed & power of ac motor. Interfacing DC or AC sources/ Motors to control heaters

Solid-State Devices: Diodes, types of diodes –symbol and applications, Rectifiers - PN junction diode as rectifier (Half wave and Full wave rectifier) construction and working

Electrical Protection:

Relays - Relay as protection device, Fuses and disconnect switches. Circuit breakers. Overload devices. Ground-fault protection. Grounding and isolating. Phase reversal. Surge protection.

Electrical Wiring:

Different types of conductors and cables. Basics of wiring-Star and delta connection. Voltage drop and losses across cables and conductors. Instruments to measure current, voltage, power in DC and AC circuits. Insulation. Solid and stranded cable. Conduit. Cable trays. Splices: wirenuts, crimps, terminal blocks, and solder. Preparation of extension board. (15 Lectures)

Reference Books:

1. Electrical Circuits, K.A. Smith and R.E. Alley, 2014, Cambridge University Press.
2. A text book in Electrical Technology - B L Theraja - S Chand & Co.
3. A text book of Electrical Technology - A K Theraja.
4. Performance and design of AC machines - M G Say ELBS Edn.

https://drive.google.com/file/d/1qzea3KMY6yomll0MIzZpsGnMQe1zCWtp/view?usp=sharing

SEC1B: DME26604

COMPUTER NETWORKS

Credits: 02 Theory: 30 Lectures

COURSE OUTCOME:

After completion of the course the student acquires skill to
CO1: Understand the concepts of network devices
CO2: Understand the terminology and concepts of the OSI model

Unit 1:

Data communication, Components & Basic Concepts

Line configuration- point-to-point, multipoint, Topology – Mesh, Star, Tree, Bus, Ring, and Hybrid Topologies Transmission modes – Simplex, Half Duplex, Full Duplex. Categories of networks – LAN, MAN, WAN, Internet

Transmission Media

Guided media – Twisted pair cable, Co-axial cable, Optical fiber

Multiplexing:

Many to one/one to many, types of multiplexing, Frequency division multiplexing, time division multiplexing, multiplexing applications

Error detection

Types of error, multiple bit error, Burst error,Detection – redundancy, Checksum Error correction – Single bit error correction, Hamming code (15 Lectures)

Unit 2

The OSI Model

Model – layered Architecture, Functions of layers- physical layer, Data link layer, Network layer, Transport layer, Session layer, Presentation Layer, Application layer

Networking and internetworking devices

Repeaters, Bridges- types of Bridges, Routers- Routing concepts, Gate ways

World Wide Web:

Uniform Resource Locator (URL), Browser Architect (15 Lectures)

Text Book:

Introduction to Data Communications & Networking by- BEHROUZ FOROUZAN

Reference Book:

Computer Networks by – ANDREW S TANENBAUM

Pattern of theory Question Paper for DSC/DSE

From the academic year 2019-2020 onwards

Time: 3 hours **Max. Marks: 70**

Credits: 4

Part –A

I. Answer all questions. **1 x 10 = 10**

- Ten questions to be set from the four units of the syllabus.
- Minimum of two questions to be set from each unit.
- Questions can be simple problems also.

Part - B

II. Answer any Four questions. **4 x 5 = 20**

- **Six** questions to be set from four units of the syllabus.
- Minimum of one question to be set from each unit,
- This section can have questions **/** problems.

Part - C

III. Answer any Four questions **4 x 10 = 40**

- **Six** questions to be set from four units of the syllabus.
- Minimum of one question to be set from each unit.
- Questions can have subdivisions.

Model Question Paper for DSC/DSE

Time: 3 hours **Max. Marks: 70**

Part –A

1. Answer all questions. **1 x 10 = 10m**

(a)
(b)
(c)
(d)
(e)
(f)
(g)
(h)
(i)
(j)

Part - B

Answer any Four questions. **4 x 5 = 20**

2.
3.
4.
5.
6.
7.

Part - C

Answer any Four questions **4 x 10 = 40**

8.
9.
10.
11.
12.
13.

Pattern of theory Question Paper for SEC

Time: 2 hours **Max. Marks: 35**

Credits: 2

Part –A

I. Answer all questions. **1 x 05 =05m**

- **Five questions to be set from the two units of the syllabus.**
- **Minimum of two questions to be set from each unit.**
- **Questions can be simple problems also.**

Part –B

II. Answer any Three questions **3x 10 = 30m**

- **Five questions to be set from the two units of the syllabus.**
- **Minimum Two questions/ Problems to be set from each unit.**

Model Question Paper for SEC

From the academic year 2019-2020 onwards

Time: 2 hours **Max. Marks: 35**

Part - A

1. Answer all questions. **5 x 1 = 05m**

(a)
(b)
(c)
(d)
(e)

Part - B

Answer any Three questions. **3 x 10 = 30m**

2.

3.

4.

5.

6.

DEPARTMENT OF ENGLISH (UG)

Syllabus under

NEP - 2020

Choice Based Credit System (CBCS)

2021 – 22

Course Code: FHA02031/32/33/34/35
FSA02031/32/33/34/35/36/37/38/39/40/42/42
FAA020

BA/BSc/BCA
I Semester
English Language
Poetry, Prose & Grammar

3 Credits / 4 hours week

Unit – I: Poetry

1. An Attribute of God	-William Shakespeare
2. Death, The Leveller	- James Shirley
3. Home They Brought Her Warrior Dead	- Lord, Alfred Tennyson
4. Stopping By Woods On A Snowy Evening	- Robert Frost
5. Teach Him If You Can	- Abraham Lincoln
6. Ajamil and The Tigers	- Arun Kolatker

Unit – II: Prose

1. Water: The Elixir of Life	- C V Raman
2. A Day's Wait	- Ernest Hemmingway
3. An Astrologer's Day	- R K Narayan
4. The Clay Mother-in-Law	- A K Ramanujan
5. The Eyes are Not Here	- Ruskin Bond

Unit - III

Grammar

1. Parts of Speech
2. Punctuation
3. Letter Writing (Letter of Application/ Grievance Letter/ Personal Letter)
4. Comprehension

Tutorial Activities

Newspaper Reading, Report Writing, Story Telling, Recitation, Dialogue development, Elocution, Extempore Speech, Conversation Writing

Scheme of Evaluation - Formative Assessment

Assessment Occasion/type	**Weightage in marks**
First Internal Test	10
Second Internal Test	10
First Class Test/ Assignments	10
Second Class Test/Assignments	10
Total	**40**

Course Code: FCA020/ FBA020

B Com/ BBA
I Semester
English Language
Poetry, Prose & Grammar

3 Credits / 4 hours week

Unit – I: Poetry

1. An Attribute of God -William Shakespeare
2. The Village Schoolmaster - Oliver Goldsmith
3. Daffodils - William Wordsworth
4. Ozymandias - P B Shelley
5. The Human Seasons - John Keats
6. The Road Not Taken - Robert Frost

Unit – II: Prose

1. The Golden Touch - Nathaniel Hawthorne
2. The Last Leaf - O. Henry
3. Half A Rupee Worth - R K Narayan
4. The Clay Mother-in-Law - A K Ramanujan
5. The Eyes are not Here - Ruskin Bond

Unit – III: Grammar

1. Parts of Speech
2. Punctuation
3. Letter Writing (Letter of Application/ Grievance Letter/ Personal Letter)
4. Comprehension

Tutorial Activities

Newspaper Reading, Report Writing, Story Telling, Recitation, Dialogue development, Elocution, Extempore Speech, Conversation Writing

Scheme of Evaluation - Formative Assessment

Assessment Occasion/type	**Weightage in marks**
First Internal Test	10
Second Internal Test	10
First Class Test/ Assignments	10
Second Class Test/Assignments	10
Total	**40**

Course Code: FHB02031/32/33/34/35
FSB02031/32/33/34/35/36/37/38/39/40/42/42
FAB020

BA/BSc/BCA
II Semester
English Language
Poetry, One-Act Plays & Grammar

3 Credits / 4 hours week

Unit – I: Poetry

1. The Human Seasons - John Keats
2. On Shakespeare - John Milton
3. The Second Coming - W B Yeats
4. Characters of A Happy Life - Sir Henry Wotton
5. Fidelity - William Wordsworth
6. The Crutches - Bertolt Brecht

Unit – II: One-Act Plays

1. The Pie and The Tart - Hugh Chesterman
2. The Man Upstairs - Hugh Beresford
3. The Never-Never Nest - Cedric Mount

Grammar

1. Subject – Verb Agreement
2. Antonyms
3. Synonyms
4. Articles

Tutorial Activities

Newspaper Reading, Report Writing, Story Telling, Recitation, Dialogue development, Elocution, Extempore Speech, Conversation Writing

Scheme of Evaluation - Formative Assessment

Assessment Occasion/type	**Weightage in marks**
First Internal Test	10
Second Internal Test	10
First Class Test/ Assignments	10
Second Class Test/Assignments	10
Total	**40**

Course Code: FCB020/ FBB020

B Com/ BBA
II Semester
English Language
Poetry, One-Act Plays & Grammar

3 Credits / 4 hours week

Unit – I: Poetry

1. On Shakespeare - John Milton
2. Fidelity - William Wordsworth
3. La Belle Dame Sans Mercy - John Keats
4. Teach Him If You Can - Abraham Lincoln
5. Go Not to The Temple - Rabindranath Tagore
6. Five Ways to Kill A Man - Edwin Brock

Unit – II: One-Act Plays

1. Progress - St. John Ervin
2. The Blue Carbuncle - Michael and Mollie Hardwick
3. The Never-Never Nest - Cedric Mount

Grammar

1. Subject – Verb Agreement
2. Antonyms
3. Synonyms
4. Articles

Tutorial Activities

Newspaper Reading, Report Writing, Story Telling, Recitation, Dialogue development, Elocution, Extempore Speech, Conversation Writing

Scheme of Evaluation - Formative Assessment

Assessment Occasion/type	**Weightage in marks**
First Internal Test	10
Second Internal Test	10
First Class Test/ Assignments	10
Second Class Test/Assignments	10
Total	**40**

Course Code: FHA900 **3 Credits/ 3 hours week**

ENGLISH
OPEN ELECTIVE -1
FUNCTIONAL ENGLISH, GRAMMAR AND STUDY SKILLS

Section I: Functional English Grammar

1. Grammar of Spoken and Written English
2. Basic Sentence Patterns in English – Analysis of Sentence Patterns (SVO, SV, SVOC,SVOA, SVOA/C)
3. Functions of Various Types of Phrases: Noun Phrases, Verb Phrases, Adjective Phrases,Adverbial Phrases, Prepositional Phrases
4. Functions of Clauses: Noun Clause, Adjective Clause and Adverbial Clause andPrepositional Clauses
5. Verbs – Tense and Aspects, Modal Verbs, Functions and Use

Section II: Writing Skills

1. Writing as a Skill – Its Importance, Mechanism of Writing, Words and Sentences, Paragraphas a Unit of Structuring the Whole Text, Analysis of Paragraph
2. Functional Uses of Writing: Personal, Academic and Business
3. Writing Process: Planning a Text, Finding Materials, Drafting, Revising, Editing, FinalisingDraft
4. Models of Writing: Expansion of Ideas, Dialogue Writing, Drafting an Email

Section III: Reading Skills

1. Meaning and Process of Reading
2. Strategies and methods to Improve Reading Skill
5. Sub-skills of Reading: Skimming, Scanning, Extensive Reading, Intensive Reading

Scheme of Evaluation - Formative Assessment

Assessment Occasion/type	**Weightage in marks**
First Internal Test	10
Second Internal Test	10
First Class Test/ Assignments	10
Second Class Test/Assignments	10
Total	**40**

Course Code: FHB900 **3 Credits/ 3 hours Week**

ENGLISH OPEN ELECTIVE -2
SPOKEN ENGLISH FOR CORPORATE JOBS

Section I: English for Front Desk Management 1. Greeting, Welcoming 2. Dealing with Complaints, Giving Instructions or Directions 3. Giving Information: About Various Facilities, Distance, Area, Local Specialities, 4. Consultation and Solution of Problems 5. Accepting Praises and Criticism, Apologizing

Section II: Fluency and Etiquettes 1. Polite sentences and Words
2. Use of Persuading words 3. Intonation and Voice Modulation
4. Developing Vocabulary

Section III: Business Speeches 1. Principles of Effective Speech and Presentations 2. Speeches: Introduction, Vote of Thanks, Occasional Speech, Theme Speech 3. Use of Audio- Visual Aids in Presentations

Section IV: Cross-Cultural Communication 1. Dealing with Language Differences 2. Probing Questions to get information 3. Etiquettes in Cross-cultural Communication

Scheme of Evaluation - Formative Assessment

Assessment Occasion/type	**Weightage in marks**
First Internal Test	10
Second Internal Test	10
First Class Test/ Assignments	10
Second Class Test/Assignments	10
Total	**40**

Course Code: FHA110 **3 Credits/4 Hours Week**

SPECIAL ENGLISH LANGUAGE
I Semester - BA/BSc/BCA/B Com/BBA
Poetry, Prose & Grammar

Unit -I
Poetry

1. Seven Ages of Man - William Shakespeare
2. Death the Leveller - James Shirley
3. Partition - W H Auden
4. Night of the Scorpion - Nissim Ezekiel
5. Playthings - Rabindranath Tagore

Unit – II
Prose

1. On the Rule of the Road - A G Gardiner
2. The Tiger in the Tunnel - Ruskin Bond
3. How I became a Public Speaker - George Bernard Shaw
4. From Decolonizing the Mind - Ngugi wa Thiongo'O
5. The Accompanist - Anita Desai

Unit - III
Grammar

1. Parts of Speech
2. Punctuation
3. Letter Writing (Letter of Application/ Grievance Letter/ Personal Letter)
4. Comprehension

Tutorial Activities
Newspaper Reading, Report Writing, Story Telling, Recitation, Dialogue development, Elocution, Extempore Speech, Conversation Writing

Scheme of Evaluation - Formative Assessment

Assessment Occasion/type	**Weightage in marks**
First Internal Test	10
Second Internal Test	10
First Class Test/ Assignments	10
Second Class Test/Assignments	10
Total	**40**

Course Code: FHB110 **3 Credits/4 Hours Week**

SPECIAL ENGLISH LANGUAGE
II Semester - BA/BSc/BCA/B Com/BBA
Poetry, One-Act Plays & Grammar

Unit - I
Poetry

1. Sonnet 130 - William Shakespeare
2. The Solitary Reaper - William Wordsworth
3. Mending Wall - Robert Frost
4. The Ballad of Father Gilligan - W B Yeats
5. Barter - Sara Teasdale

Unit – II
One-Act Plays

1 The Rising of The Moon - Lady Gregory
2 The Count's Revenge - J H Walsh
3 The King's Warrant - Ronald Gow

Unit III
Grammar & Language Component

1. Subject – Verb Agreement
2. Antonyms
3. Synonyms
4. Articles

Tutorial Activities

Newspaper Reading, Report Writing, Story Telling, Recitation, Dialogue development, Elocution, Extempore Speech, Conversation Writing

Scheme of Evaluation - Formative Assessment

Assessment Occasion/type	**Weightage in marks**
First Internal Test	10
Second Internal Test	10
First Class Test/ Assignments	10
Second Class Test/Assignments	10
Total	**40**

Course Code: FFA020, FDA020, FMA020 **3 Credits/ 3 hours Week**

B Voc
LANGUAGE ENGLISH
Semester - II

Unit – I

Prose

1. Playing the English Gentleman - Mahatma Gandhi
2. Sweets for Angels - R K Narayan
3. Let's Go Home - Kewlin Sio
4. How I became a Public Speaker - George Bernard Shaw
5. Marriage is a Private Affair - Chinua Achebe

Unit – II

Poetry

1. Ozymandias - P B Shelley
2. Matilda - Hilaire Belloc
3. River - A. K. Ramanujan
4. The Road not Taken - Robert Frost
5. If - Rudyard Kipling

Unit III
Grammar

1. Tenses (with focus on use of simple present tense and past tense)
2. Correction of Errors
3. Dialogue Writing: Common situations
4. Short speeches for welcoming, introducing, proposing vote of thanks and Independence Day and Republic Day

Scheme of Evaluation - Formative Assessment

Assessment Occasion/type	**Weightage in marks**
First Internal Test	10
Second Internal Test	10
First Class Test/ Assignments	10
Second Class Test/Assignments	10
Total	**40**

Course code: ELC02021, 022, 023, 024, 025, 026

DMC02001, 002, 003, 004, 005, 006, 007, 008

ECC02001

BA/BSc/BCA
III Semester
English Language (AECC)
Fiction &Grammar

Unit I: <u>Fiction</u>

The Guide - R K Narayan

Unit II: <u>Grammar</u>

1. Question Tag
2. Framing of questions
3. One-word substitutes
4. Words often confused

Tutorial Activities:

Newspaper Reading, Report writing, Story-telling, Recitation, Review of current literature activities, dialogue development, elocution, extreme speech, conversation writing

Course code ENC02001
CDC02001

B Com/BBA
III Semester
English Language (AECC)
Fiction &Grammar

Max. Marks-70 **3**
Credits/Week

Unit I
Fiction

The Financial Expert R K Narayan

Unit II
Grammar

1. Question Tag
2. Framing of questions
3. One word substitutes
4. Words often confused

Tutorial Activities:

Newspaper Reading, Report writing, Story-telling, Recitation, Review of current literature activities, dialogue development, elocution, extreme speech, conversation writin

Course code: ELD02021,022,023,024,025,026

DMD02001,002,003,004,005,006,007,008

ECD02001

BA/BSc/BCA
IV Semester
English Language (AECC)
Drama & Grammar

Unit I: <u>Drama</u>

Othello William Shakespeare

Unit II: <u>Grammar</u>

1. Active and passive voice
2. Linkers
3. Precise Writing
4. Essay Writing

Tutorial Activities:

Newspaper Reading, Report writing, Story-telling, Recitation, Review of current literature activities, dialogue development, elocution, extreme speech, conversation writin

Course code END02001
CDD02001

B Com/BBA
IV Semester
English Language (AECC)
Drama & Commercial Correspondence

Max. Marks-70 **3 Credits/Week**

Unit I

Drama

A Christmas Carols Charles Dickens

Unit II

Commercial correspondence

1. Quotation and Enquire Letters
2. Orders and Complaint letters
3. Circulars
4. Report Writing

Tutorial Activities:

Newspaper Reading, Report writing, Story-telling, Recitation, Review of current literature activities, dialogue development, elocution, extreme speech, conversation writin

Course Code: ELF22424/425

BA VI Semester
GE 2
Drama

Marks: 50 **2 Credits/Week**

Unit- I
Drama

Candida Bernard Shaw

NATIONAL EDUCATION POLICY- 2020

Universities of Karnataka State under NEP-2020 in ENVIRONMENTAL SCIENCE

AECC - ENVIRONMENTAL STUDIES SYLLABUS

Number of Theory Credits	Number of lecture hours	Number of field work hours
2	45	5

	Content of AECC – Environmental Studies	**45 hours**
Unit 1	**Introduction to Environmental Studies**	***45HOURS***
	Multidisciplinary nature of environmental studies Scope and importance; Concept of sustainability and sustainable development.	2
Unit 2	**Ecosystems**	6
	What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies of the following ecosystems: a) Forest ecosystem, c) Desert ecosystem, Aquatic ecosystems (ponds, , lakes, rivers,)	
Unit 3	**Natural Resources: Renewable**	8

	and Non-Renewable	
	land-use change; Land degradation, soil erosion and desertification. Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations. Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state). Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies.	
Unit 4	**Biodiversity and Conservation**	8
	biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value Levels of biological diversity: Genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots. India as a mega-biodiversity nation; Endangered and endemic species of India. Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.	

Unit 5	Environmental Pollution	8
	Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution, Nuclear hazards and human health risks Solid waste management, Control measures of urban and industrial waste	
Unit 6	Environmental Policies & Practices	7
	Climate change, global warming, ozone layer depletion, acid Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD).	
Unit 7	Human Communities and the Environment	6
	Human population growth: Impacts on environment, human health and welfare. Resettlement and rehabilitation of project affected persons; case studies. Disaster management: floods, earthquake, cyclones and landslides. Environmental	

	movements: Chipko, Silent valley, Bishnois of Rajasthan Environmental ethics: Role of Indian and other religions and cultures in environmental conservation	
Unit 8	Field work	5

JSS MAHAVIDYAPEETHA

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE

OOTY ROAD, MYSURU - 570025

Structure & Detailed Syllabus

Four years Multidisciplinary Undergraduate Programme with Multiple Exit options

in

GEOGRAPHY

B.A. / B.Sc. Geography Degree
(Basic/Honours)

2021 –2022

2022 – 2023 onwards

Syllabus & Regulations Governing the Choice-Based Credit System (CBCS)

For the Four-Years (Eight Semesters) Bachelor of Arts / Bachelor of Science (B.A./B.Sc.) Geography Program

Eligibility for Admission:

Candidates who have passed PUC in Science, Commerce, Arts in Karnataka State or any other States in India with equal qualifications are eligible for admission to the course, providedthey have secured minimum of 50% marks in the qualifying examination(PUC/ +2 Level) (45% for SC / ST / Category-I Candidates).

The Candidates not studied Geography as an optional subject in PU/ 10+2 Level need to undergo one week bridge course programme conducted by the Geography department of the concerned Colleges.

Scheme and Duration of the Course:

B.A./B.Sc. Geography Program consists of 8 semesters in four academic years.

Discipline Specific Core (DSC) Courses: (B-3 Model)

First, second, third and fourth semesters will have one DSC course each. Every DSC course has 6 credits including practical component for 2 credits (4 credits for theory and 2 credits for practical).

Fifth and sixth semesters will have two Discipline Specific Core (DSC) courses in each semester for 5 credits including practical component for 2 credits (3 credits for theory and 2 credits for practical).

Seventh and eighth semesters will have three Discipline Specific Core (DSC) courses in each semester. In seventh semester, two DSC courses for 5 credits each including practical component for 2 credits (3 credits for theory and 2 credits for practical) and one DSC course has 3 credits without practical component. Whereas in eighth semester, one course will have a practical component for 2 credits apart from theory for 3 credits and the remaining two DSC courses for 3 credits each without practical component. Totally, the program has 14 DSC courses.

Open Elective (OE) Courses:

Open Elective Course (OE) refers to Elective courses/papers in a non-core subject across all disciplines. First, second, third and fourth semesters will have one OE course in each semester. Every OE course has 3 credits with no practical component. OE courses are offered by the department for other disciplines and the candidates have to choose one OE from the pool in each semester. The OE courses enhance the geographical knowledge and help students in learning Geographical thinking and make them geographic literates. There are totally 4 OE courses inthe program.

Vocational Courses:

Fifth and Sixth semesters will have one vocational course for 3 credit in each semester. The candidates have to choose any one vocational course from the pool in each semester.

Internship:

In sixth semester internship course for 2 credits is prescribed which is mandatory in nature. Each student is expected to prepare a report on Internship and shall make a presentation during the examination. The candidates are expected to complete this course between the Fifth and sixth semester under the supervision of a teaching faculty of the concerned department. These courses can enable students to obtain the required technicalknowledge along with practical skill

Discipline Specific Elective (DSE) Courses:

Fifth, Seventh and eighth semesters will have DSE courses. In Fifth semester one DSE course, in seventh semester two DSE courses and in Eighth semester two DSE course for credit of 3 each need to be studied by a student apart from the Research methodology course in seventh semester for 3 credits and Research project course for six credits in eighth semester. All the DSE courses have 3 credits with no practical component (100 marks).

Research Methodology and Research Project:

The seventh semester will have research methodology course for 3 credits (60+40=100 marks) and in eighth semester students have to take up a research project course for 6 credits (100+100=200 marks). If a candidate is not interested to opt for the Research Project in the eighth semester such candidates can choose two more DSE course of 3 credits each from the given pool or can opt for Internship programme for 6 credits.

It is mandatory to select research project for six credits in Eighth semester and Research Methodology course in Seventh Semester for a candidate willing to pursue PhD program.

There shall be University examination at the end of each semester. The course pattern and the scheme of examinations are as follows:

Duration of the Course:

The duration of the B.A./B.Sc. Geography Program shall extend over 8 semesters (Four academic years) of 16 weeks or more, each with a maximum of 90 actual working days of instruction in each semester.

Course pattern:

The number of credits per semester may vary from 20 to 25, an average of 23 credits per semester and a total of around 186 credits for the program. The credits shall be based on the number of instructional hours per week, generally 1 credit per hour of instruction in theory and 1 credit for 2 hours of practical or project work or internship per week. The courses offered in the programme covers the Discipline Specific Core (DSC), Discipline Specific Elective (DSE), Open Elective (OE) Vocational courses and Internship.

Medium of instruction:

The medium of instruction shall be English / Kannada.

Attendance:

The course shall be treated as an independent unit for the purpose of attendance. A student shallattend a minimum of 75% of the total instruction hours in a course including assignments and seminars in each semester. The student who fails to secure 75% attendance in a course shall be required to repeat that semester.

Internal Assessment:

Marks for internal assessment shall be awarded on the basis of Attendance, conducting internal Tests, assigning Case Studies and Assignments / Seminars and other activities. The internal assessment marks shall be notified on the department / college notice board for the information of the students and it shall be communicated to the Registrar (Evaluation) within a stipulated time prescribed by the university.

All DSC, DSE theory and Vocational courses shall have internal assessment for 40 Marks.

The practical, Internship and Skill Enhancement courses shall have internal assessment for 25 marks each, including the 10 marks for the practical record.

Research Project shall have internal assessment for 100 marks.

The outline for continuous assessment activities for C1 and C2 components of a course shall be as under

Activities	**C1 Component**	**C2 Component**	**Total Marks**
Session test	10 marks	10 marks	20
Seminars/ presentation/activities	10 marks		10
Case study/assignment/field work/project work etc.		10 marks	10
Total	**20**	**20**	**40 marks**

Board of Examiners (BOE):

Board of examiners constituted by the University shall consist of a Chairman, internal and external members out of which at least one shall be from the Department / College offering the course and at least two external members from other universities. The board shall scrutinize the question papers and shall forward for the approval of university.

Results:

A candidate should obtain a minimum of 40% marks in each course in the University examination including internal assessment marks. The candidates who have passed in all the semesterexaminations are eligible for the award of B.A./B.Sc. Honors Degree in Geography. If the candidates chooses Geography as major along with any social science stream subjects as minor, like Sociology, Political Science, History, Economics, etc, such candidates can be awarded B.A. Degree and for those studied geography as major with any science subjects as minor such candidates shall be awarded B.Sc. Honors in Geography.

Carryover:

A candidate who fails in a lower semester examination may go to the higher semester, however, the resultof the candidates who have passed the VIII semester examination but not passed the lower semester examinations shall be declared as NCL (not completed lower semester examinations). Such candidates shall be eligible for the award of degree only after completion of all the lower semester examinations.

Question Paper Pattern:

The Theory exam shall be conducted for 60 Marks and it consists of 3 Sections namely Section A, Section B, Section C with internal choices. (Short, Medium and Long answer questions).

Section A - Each question carries 3 marks and student has to answer 4 out of 6 questions.

Section B - Each question carries 6 marks and student has to answer 3 out of 5 questions, and

Section C - Each question carries 10 marks and student has to answer 3 out of 4 questions.

Model Curriculum

Name of the Degree Program:	B.A. / B.Sc. (Basic / Honours) Degree in Geography
Discipline Core:	Geography
Total Credits for the Program:	186
Starting year of implementation:	2021-2022

Program Outcomes:

By the end of the program the students will be able to:

(Refer to literature on outcome based education (OBE) for details on Program Outcomes)

PO1: Relating to Knowledge

By the end of the program the students will be able to:

Give explanation of relevant terms and concept of geography including definitions.

Give better explanation about relevant principles, theories and models in geography.

Show clear knowledge relating to man and environmental process and factors.

PO2: Understanding and application

By the end of the program the students will be able to:

Identify the importance of spatial scale and time scale.

Know the complex and interactive nature of physical and human environments.

Identify the importance of the resemblances and variance between places, environments andpeople.

Comprehend how processes bring changes in systems, distributions and environments.

PO3: Students Skills

By the end of the program the students will be able to:

Interpret a variety of types of geographical data and sources and recognise their limitations.

Communicate geographical evidence, ideas and arguments.

Use geographical data to identify trends and patterns.

Use diagrams and sketch maps to demonstrate geographical aspects.

Demonstrate skill of analysis and synthesis of geographical information

PO4: Students Evaluation

By the end of the program the students will be able to:

Critically evaluate geographical principles, theories and models

Assess the effects of geographical processes and change on physical and human environments.

Assess how the viewpoints of different groups of people, potential conflicts of interest andother factors interact in the management of physical and human environments.

Evaluate the relative success of failure of initiatives.

Syllabus Aims:

The aims of the syllabus describe the B.A. / B.Sc program in geography at 5th, 6th, 7th & 8th Level. These aims outline the educational context in which syllabus content should be viewed. Many of these aims may be delivered by the use of suitable case-studies, through application of geographical skills and practical field visits.

The BA./ B.Sc Geography syllabus aims to enable students to:

- Know the significance of scale in studying geography
- Know the processes functioning at various scales within physical and human environments
- Improve a sense of space, place and location
- Develop consciousness of the relevance of geography to understanding and solving contemporary environmental problems
- Realisation of the main fundamentals of physical geography and human geography and the interconnectedness between them
- Explain the causes and effects of change over space and time on physical and human environments
- Develop an gratefulness of the nature, value, limitations and importance of different approaches to analyse and explanation in geography
- Increase the knowledge of, and ability to use and apply, appropriate skills and techniques including fieldwork
- Improve a logical approach in order to present a structured, coherent and evidence-basedargument
- Develop a concern for accuracy and objectivity in extracting, recording, processing, presenting, analysing and interpreting geographical data.

Curriculum Structure for Undergraduate Program B.A. / B.Sc. Geography

Name of the Degree Program:	B.A./B.Sc.	Total Credits for the Program:	186
Discipline/Subject:	Geography	Starting year of implementation:	2021-2022

Program Articulation Matrix for Core Courses:

Semester	Title /Name of the course	Program outcomes that the course addresses	Pre-requisite course(s)	Pedagogy	Assessment
I	Principles of Geomorphology	PO-1, PO-2, PO-4	No Pre-requisite course(s)	Interactive Lectures, Case Studies	In-course & End Course Assessment
II	Introduction to Climatology	PO-1, PO-2, PO-4	No Pre-requisite course(s)	Interactive Lectures, Case Studies	In-course & End Course Assessment
III	Fundamentals of Human Geography	PO-1, PO-3, PO-4	No Pre-requisite course(s)	Interactive Lectures, Case Studies, Seminar	In-course & End Course Assessment
IV	India: Resources and Sustainability	PO-2, PO-3	No Pre-requisite course(s)	Interactive Lectures, Case Studies, Quiz	In-course & End Course Assessment
V	Population Resource & Dynamics	PO-1, PO-2, PO-4	No Pre-requisite course(s)	Inquiry-based learning, Interactive Lectures	In-course & End Course Assessment
	Fundamentals of Remote Sensing	PO-1, PO-3	Cartography & Spatial Statistics	Blended learning, Interactive Lectures, MOOCs	In-course & End Course Assessment
VI	Environmental Geography	PO-1, PO-2, PO-4	No Pre-requisite course(s)	Investigative Case-Based Learning, Seminar	In-course & End Course Assessment
	Fundamentals of Geographic Information System	PO-1, PO-3	Basics of Cartography	Blended learning, Interactive Lectures, MOOCs	In-course & End Course Assessment
VII	Advanced Geomorphology	PO-2, PO-4	Principles of Geomorphology	Blended learning, Interactive Lectures, MOOCs	In-course & End Course Assessment
	Advanced Climatology	PO-2, PO-4	Introduction to Climatology	Blended learning, Interactive Lectures, MOOCs	In-course & End Course Assessment
	Conceptual Development in Geography	PO-2, PO-3, PO-4	No Pre-requisite course(s)	Interactive Lectures, Group Activity	In-course & End Course Assessment
VIII	Sustainable Soil Resource Management	PO-1, PO-2, PO-4	Principles of Geomorphology	Cooperative Learning, Interactive Lectures, MOOCs	In-course & End Course Assessment
	Agriculture & Food Security	PO-1, PO-2, PO-4	No Pre-requisite course(s)	Blended learning, Interactive Lectures, MOOCs	In-course & End Course Assessment
	Principles of spatial models in Geography	PO-1, PO-2, PO-4	No Pre-requisite course(s)	Blended learning, Interactive Lectures, MOOCs	In-course & End Course Assessment
	Research Project / Internship (6)	PO-2, PO-3, PO-4	Research Methodology	Process-Oriented Guided Inquiry Learning (POGIL),Problem or Project Based	In-course & End Course Assessment, Final report

Program Articulation Matrix for Open Elective (OE)

Semester	Title of the course	PO that the course addresses	Pre-requisite course(s)	Pedagogy	Assessment
I	Introduction Physical Geography	PO-1, PO-2, PO-3	No Pre-requisite course(s)	Interactive lectures, Blended learning	In-course & End Course Assessment
	Fundamentals of Remote Sensing	PO-1, PO-2, PO-3	No Pre-requisite course(s)	Interactive lectures, Blended learning	In-course & End Course Assessment
II	Human of Geography	PO-1, PO-2	No Pre-requisite course(s)	Inquiry-based learning, Interactive Lectures	In-course & End Course Assessment
	Basics of Geographic Information Systems	PO-1, PO-2, PO-3	Fundamentals of Remote Sensing	Interactive lectures, Blended learning	In-course & End Course Assessment
III	Geography of India	PO-1, PO-2	No Pre-requisite course(s)	Interactive lectures, Blended learning	In-course & End Course Assessment
	Application of GIS & Remote Sensing	PO-1, PO-2, PO-4	Fundamentals of Remote Sensing, Basics of GIS	Interactive lectures, Blended learning	In-course & End Course Assessment
IV	Geography of Karnataka	PO-1, PO-2	No Pre-requisite course(s)	Interactive lectures, Blended learning	In-course & End Course Assessment
	Population & Settlement Geography	PO-1, PO-2	No Pre-requisite course(s)	Interactive lectures, Blended learning	In-course & End Course Assessment

Program Articulation Matrix for Vocational Courses:

Semester	Title of the course	PO that the course addresses	Pre-requisite course(s)	Pedagogy	Assessment
V	Geo-surveying	PO-1, PO-3	No Pre-requisite course(s)	Interactive lectures, Blended learning, ,Hands on experience	In-course & End Courses assessment
	Statistical Techniques in Geography	PO-1, PO-3	No Pre-requisite course(s)	Interactive lectures, Blended learning, Hands on experience	In-course & End Courses assessment
VI	Open Source GIS: Applications	PO-1, PO-3	No Pre-requisite course(s)	Interactive lectures, Blended learning, Hands on experience	In-course & End Courses assessment
	Digital Cartography and Mobile Mapping	PO-1, PO-3	No Pre-requisite course(s)	Interactive lectures, Blended learning, Hands on experience	In-course & End Courses assessment

Program Articulation Matrix for Discipline Specific Elective (DSE):

Semester	Title Of the course	PO that the course addresses	Pre-requisite course(s)	Pedagogy	Assessment
V	Regional Geography of Karnataka	PO-1	No Pre-requisite course	Blended learning, Investigative Case-Based Learning, Seminar	In-course & End Coursesassessment
	Tourism Geography	PO-1	No Pre-requisite course	Inquiry-based learning, Interactive Lectures, case studies	In-course & End Courses Assessment
VII	Regional planning and Development	PO-1	No Pre-requisite course(s)	Interactive Lectures, cas e studies	In-course & End Courses Assessment
	Settlement Geography	PO-1	No Pre-requisite course(s)	Interactive Lectures, case studies	In-course & End Courses Assessment
	Bio geography	PO-1	No Pre-requisite course(s)	Interactive Lectures, case studies	In-course & End Courses Assessment
	Climate Change: Vulnerability & Adaptation	PO-1	No Pre-requisite course(s)	Interactive Lectures, case studies	In-course & End Courses Assessment
VIII	Sustainable Rural development	PO-1	Regional Planning Development	Blended learning, Interactive Lectures, MOOCs	In-course & End Coursesassessment
	Urban geography	PO-1, PO-2, PO-4	Settlement Geography	Blended learning, Interactive Lectures, MOOCs	In-course & End Coursesassessment
	Geography of Health & Wellbeing /	PO-2, PO-4	Principles of Geomorphology and Bio-geography Introduction to Climatology Fundamentals of Human Geography	Blended learning, Investigative Case-Based Learning, Seminar	In-course & End Coursesassessment
	Natural Resource Management	PO-1, PO-2, PO-4	Regional Planning and Development Fundamentals of Human Geography	Cooperative Learning, Group Activity, Interactive Lectures, MOOCs	In-course & End Coursesassessment
	Geopolitics	PO-1, PO-2, PO-4	Fundamentals of Human Geography	Inquiry-based learning, Interactive Lectures, case studies	In-course & End Coursesassessment
	Transport Geography	PO-1, PO-2, PO-4	No Pre-requisite course(s)	Cooperative Learning, Group Activity, Interactive Lectures, MOOCs	In-course & End Coursesassessment

B.A. / B.Sc. (Basic / Honours) Degree in Geography Contents of Courses in the Program

Course Type					
Semester	Discipline Specific Core (DSC)	Open Elective (OE) /(3)	Vocational Courses (3)	Discipline Specific Elective (DSE)(4)	Research/Other Courses
I	Principles of Geomorphology	1. Introduction Physical Geography 2. Fundamentals of Remote Sensing	Nil	Nil	
II	Introduction to Climatology	1. Human of Geography 2. Basics of Geographic Information Systems	Nil	Nil	
III	Fundamentals of Human Geography	1. Geography of India 2. Application of GIS & Remote Sensing	Nil	Nil	
IV	India: Resources and Sustainability	1. Geography of Karnataka 2. Population & Settlement Geography	Nil	Nil	
V	Population Resource & Dynamics* Fundamentals of Remote Sensing ***course for those opting Geography as Minor**	Nil	1. Geo-Surveying / 2. Statistical Techniques in Geography	1. Regional Geography of Karnataka/ 2. Tourism Geography	
VI	Environmental Geography* Fundamentals of Geographic Information System ***course for those opting Geography as Minor**	Nil	1. Open Source GIS: Applications 2. Digital Cartography and Mobile Mapping	Nil	Internship

VII	Advanced Geomorphology Advanced Climatology Conceptual Development in Geography	Nil	Nil	1.Regional planning and Development 2.Settlement Geography 3.Bio geography 4.Climate Change: Vulnerability & Adaptation	Research Methodology
VIII	Sustainable Soil Resource Management Agriculture & Food Security Principles of Spatial Models in Geography	Nil	Nil	1.Sustainable Rural development 2.Urban geography 3.Geography of Health & Wellbeing / 4.Natural Resource Management 5.Geopolitics 6.Transport Geography	Research Project

Course Pattern and scheme of Examination for BA/BSc Geography Programme as per NEP2020

Semester	Course Type	Course Name	Credits T = Theory P = Practical			Instruction Hour Per Week		Total No. of Hours/ Semester		Marks for Exam		Marks for IA			Duration of Exam (in Hours)	
			T	P	Total	Theory	Practical	T	P	Theory	Practical	T	P	Total	Theory	Practical
I	GEOG DSC T1.1	Principles of Geomorphology	4	2	6	4	4	52	52	60	25	40	25	150	2	2
	GEOG OE T1.1	1. Introduction Physical Geography 2.Fundamentals of Remote sensing	3	-	6	3	-	42	-	60	-	40	-	100	2	-
II	GEOG DSC T2.1	Introduction to Climatology	4	2	6	4	4	52	52	60	25	40	25	150	2	2
	GEOG OE T2.1	1. Human of Geography 2. Basics of Geographic Information Systems	3	-	3	3	-	42	-	60	-	40	-	100	2	-
III	GEOG DSC T3.1	Fundamentals of Human Geography	4	2	6	4	4	52	52	60	25	40	25	150	2	2
	GEOG OE T3.1	1. Geography of India 2. Applications of GIS & Remote Sensing	3	-	3	3	-	42	-	60	-	40	-	100	2	-
IV	GEOG DSC T4.1	India: Resources and Sustainability	4	2	6	4	4	52	52	60	25	40	25	150	2	2
	GEOG OE T4.1	1. Geography of Karnataka 2. Population & Settlement Geography	3	-	3	3	-	42	-	60	-	40	-	100	2	-

V	GEOG DSC T5.1	Population Resource & Dynamics	3	2	5	3	4	42	52	60	25	40	25	150	2	2
	GEOG DSC T5.2	Fundamentals of Remote Sensing	3	2	5	3	4	42	52	60	25	40	25	150	2	2
	GEOG VOC P5.1	Vocational – 1 1. Geo-Surveying / 2. Statistical Techniques in Geography	3	-	3	3	-	42	-	60	-	40	-	100	2	-
	GEOG DSE T5.1	1. Regional Geography of Karnataka 2. Tourism Geography	3	-	3	3	-	42	-	60	-	40	-	100	2	-
VI	GEOG DSC T6.1	Environmental Geography	3	2	5	3	4	42	52	60	25	40	25	150	2	2
	GEOG DSC T6.2	Fundamentals of Geographic Information System	3	2	5	3	4	42	52	60	25	40	25	150	2	2
	GEOG VOC P6.1	Vocational – 2 1. Open Source GIS: Application 2. Digital Cartography and Mobile Mapping	3	-	3	3	-	42	-	60	-	40	-	100	2	-
	GEOG INTP 6.1	**Internship**	-	-	2	4	-	52	-	25	-	25	-	50	2	-

Semester	Course Type	Course Name	Credits T = Theory P = Practical			Instruction Hour Per Week		Total No. of Hours/ Semester		Marks for Exam		Marks for IA			Duration of Exam (in Hours)	
			T	P	Total	Theory	Practical	T	P	Theory	Practical	T	P	Total	Theory	Practical
VII	GEOG DSC T7.1	Advanced Geomorphology	3	2	5	3	4	42	52	60	25	40	25	150	2	2
	GEOG DSC T7.2	Advanced Climatology	3	2	5	3	4	42	52	60	25	40	25	150	2	2
	GEOG DSC T7.3	Conceptual Development in Geography	3		3	3		42		60		40		100	2	
	GEOG DSE T7.1 GEOG DSE T7.2 (ANY TWO)	1.Regional planning and Development	3		3	3		42		60		40		100	2	
		2.Settlement Geography	3		3	3		42		60		40		100	2	
		3.Bio geography	3		3	3		42		60		40		100	2	
		4.Climate Change: Vulnerability & Adaptation	3		3	3		42		60		40		100	2	
	GEOG RM T7.3 **(Compulsory)**	RESEARCH METHODS IN GEOGRAPHY	3		3	3		42		60		40		100	2	
VIII	GEOG DSC T8.1	Sustainable Soil Resource Management	3	2	5	3	4	42	52	60	25	40	25	100	2	2
	GEOG DSC T8.2	Agriculture and food security	3		3	3		42		60		40		100	2	
	GEOG DSC T8.3	Principles of Spatial Models in Geography	3		3	3		42		60		40		100	2	
	GEOG RSPP8.1	**RESEARCH PROJECT**			6					100		100		200	2	
	GEOG DSET8.1 GEOG DSET8.2 (ANY TWO) **(any2 additional course For Non Research Project candidates)**	1.Sustainable Rural development	3		3	3		42		60		40		100	2	
		2.Urban geography	3		3	3		42		60		40		100	2	
		3.Geographyot Health & Wellbeing/	3		3	3		42		60		40		100	2	
		4.Natural Resource Management	3		3	3		42		60		40		100	2	
		5.Geopolitics	3		3	3		42		60		40		100	2	
		6.Transport Geography	3		3	3		42		60		40		100	2	

Program Structure for the B.A./B.Sc. Geography (Basic / Honours) Degree

Semester	Discipline Specific Core (DSC) (Credits) (L+T+P)	Discipline Specific Elective (DSE) / Open Elective (OE) (Credits) (L+T+P)	Ability Enhancement Compulsory Courses (AECC),Languages (L+T+P)		Skill Enhancement Course (SEC)			Total Credits
					Skill-based (Credits) (L+T+P)	Value-based (Credits) (L+T+P)		
I	DSC-A1 Principles of Geomorphology (4+2) DSC-B1 (4+2)	OE-1.1 Introduction Physical OE-1.4 Fundamentals of Remote Sensing (3)	L1-1 (3), L2-1 (3) (3+1+0 each)	Nil	SEC-1: Digital Fluency (2) (1+0+2)	Physical Educationfor Fitness (1) (0+0+2)	Health & Wellness (1) (0+0+2)	25
II	DSC-A2 Introduction to Climatology (4+2) DSC-B2 (4+2)	OE-2.1 Human Geography / OE-2.2 Basics of Geographic Information Systems (3)	L2-1 (3), L2-1 (3) (3+1+0 each)	Environmental Studies (2)	Nil	Physical Education - Yoga (1) (0+0+2)	NCC/ NSS/R&R (S&G)/ Cultural (1) (0+0+2)	25
Exit option with Certificate (50 Credits)								
III	DSC-A 3 fundamentals ofHuman Geography (4+2) DSC-B3 (4+2)	OE-3.1 Geography of India / OE-3.2 Application of GIS & Remote Sensing (3)	L1-3 (3), L2-3 (3) (3+1+0 each)	Nil	SEC-2: Artificial Intelligence (2) (1+0+2)	Physical Education - Sports Skills(1) (0+0+2)	NCC/ NSS/R&R (S&G)/ Cultural (1) (0+0+2)	25
IV	DSC-A4 India: Resources and Sustainability DSC-B4 (4+2)	OE-4.1 Geography of Karnataka /OE-4.2 Population & Settlement Geography	L1-4 (3), L2-4 (3) (3+1+0 each)	Constitution of India (2)	N il	Physical Education – Games (1) (0+0+2)	NCC/ NSS/R&R (S&G)/ Cultural (1) (0+0+2)	25
Exit option with Diploma (100 Credits)								
Choose any one Discipline as Major, the other as the Minor								
V	DSC-A5 Population Resource &Dynamics * (3 + 2) DSC-A6 Fundamentals of Remote Sensing (3+2) DSC-B5 (3+2) *for minor candidates	DSE1 1. Geography of Karnataka/ 2. Tourism Geography Geography Vocational – 1 (3) Voc 1.1 Geo-Surveying Voc 1.2 Statistical Techniques in Geography	Nil	Nil	SEC-3: Such as Cyber Security (2) (1+0+2)	Physical Education – Games (1) (0+0+2)	NCC/ NSS/R&R (S&G)/ Cultural (1) (0+0+2)	24

VI	DSC-A7 Environmental Geography* (3 + 2) DSC-A8 Fundamentals of Geographic Information Systems (3+2) DSC-B6 (4) *for minor candidates	Vocational – 2 (3) Voc 2.1 Open Source GIS: Applications Voc 2.2 Digital Cartography and Mobile mapping **Internship (2)**	Nil	Nil	SEC-4: Professional Cmmunication (2)	Physical Education – Games (1) (0+0+2)	NCC/ NSS/R&R (S&G)/ Cultural (1) (0+0+2)	23
Exit option with Bachelor of Arts, B.A. / Bachelor of Science, B.Sc Basic Degree (144 Credits)								
VII	DSC-A9 Advanced Geomorphology (3+2) DSC-A10 Advanced Climatology (3+2) DSC-A11 Conceptual Development in Geography(3)	DSE-2 and DSE-3 (**Any two**) 1.Regional planning and Development 2.Settlement Geography 3.Bio geography 4.Climate Change: Vulnerability & Adaptation **Research Methods in Geography (3)**	Nil	Nil	Nil	Nil	Nil	22
VIII	DSC-A12 Sustainable Soil Resource Management (3+2) DSC-A13 Agriculture & FoodSecurity (3) DSC-A14 Principles of Spatial Models in Geography(3)	DSE-4 (**AnyTwo**) DSE -5 1. Sustainable Rural development 2. Urban geography 3. Geography of Health & Wellbeing / 4. Natural Resource Management 5. Geopolitics 6. Transport Geography **Research Project (6)/Internship** (any two additional DSE courses or Internship programme can be opted by students if Research Project is not selected)	Nil	Nil	Nil	Nil	Nil	21
Award of Bachelor of Arts Honours, / Bachelor of Science Honours Degree (186 Credits)								

Technical Skills and possible jobs after each exit during and after the program

Semester	Exit Level	Credits	Technical Skills	Possible Jobs
Ii	Certificate	50	• Map Interpretation • Geomorphic Analysis • Climate Data Analysis & Interpretation	• Field Surveyor • Weather Data Analyst
IV	Diploma	100	• Cartography • Statistics Analysis	• Field Surveyor • Cartographer
VI	Degree	142	• Cartography • GIS and Image Analysis • Tourism Management	• GIS Field Surveyor • GIS Trainee • Nature Conservation Officer • School Teacher
VIII	Degree with Honors	186	• GIS & Image Analysis • Resource Management • Town Planning • Tourism Management	• Sustainability Consultant • Tourism officer • Transport planner • Cartographer • GIS Engineer • Environmental consultant • Geography Teacher • Geography Researcher

BA/ B.Sc. With Geography as a minorIn the 3rd year

V Semester

Course Type					
Semester	Discipline Specific Core (DSC)	Open Elective (OE) /(3)	Vocational Courses (3)	Discipline Specific Elective (DSE)(4)	Research/ Other Courses
I	Principles of Geomorphology	1. Introduction to Physical Geography/ 2. Fundamentals of Remote Sensing	Nil	Nil	
II	Introduction to Climatology	1. Human of Geography/ 2. Basics of Geographic Information Systems	Nil	Nil	
III	Fundamentals of Human Geography	1. Geography of India 2. Application of GIS & Remote Sensing	Nil	Nil	
IV	India: Resources and Sustainability	1. Geography of Karnataka 2. Population & Settlement Geography	Nil	Nil	
V	1.Population Resource & Dynamics	Nil	Nil	Nil	
VI	1.Environmental Geography	Nil	Nil	Nil	

B.A/B.Sc Semester 1

Title of the Course: Principles of Geomorphology

Code: GEOGDSC T1.1

Number of Theory Credits	Number of lecture hours/ semester	Number of practical Credits	Number of practical hours/ semesters
4	**52 or 56**	**2**	**52 or 56**

Course Outcomes:

1. After the completion of this course, students should be able to:
2. Define the field of Geomorphology and to explain the essential principles of it.
3. To outline the mechanism of dynamic nature of the Earth's surface and interior of theEarth.
4. To illustrate and explain the forces affecting the crust of the earth and its effect on it.
5. To understand the conceptual and dynamic aspects of landform development

Course Objectives:

This course aims to:

1. To define the concepts in Geomorphology and Physical Geography
2. To introduce various concept to understand cycles of the solid Earth surface
3. To understand the dynamic nature of the Earth's surface, various processes, and landforms.
4. To study the impact human on geomorphic system.

Content of Theory Course 1	52/56Hrs
Unit – 1 Geomorphology	13/14
Introduction to geography: physical and human geography Introduction to Geomorphology: meaning, nature, development, and scopePrinciples of Geomorphology Geological Time Scale Distribution of continents and oceans	
Unit – 2 Systems and Cycles of the Solid Earth	13/14
Internal structure of the earth Alfred Wegener's continental drift Theory of Isostacy: Views of Pratt and Airy Convectional current theory and concept of sea floor spreading Theory of Plate Tectonics: plate boundaries, subduction, Case Studies: Volcano, Earthquake: reporting of latest incidents Case Studies: Volcano, Earthquake: reporting of latest incidents	
Unit – 3 The Dynamics of Earth	13/14
Earth's Movements: Endogenetic and Exogenetic forces, Sudden and Diastrophic movements- Epeirogenetic and Orogenetic Movements-Process of folding and faulting Vulcanicity and earthquake Rocks: Characteristics, types, importance, and rock cycle Weathering: meaning, types and controlling factors Mass Movement: meaning, controlling factors, types-landslides, rock-falls	

Unit – 4 Evolution of Landforms	13/14
Evolution of Landforms Landforms: meaning, types and factors controlling landforms developmentSlope development: concept and types Concept of Cycle of Erosion–W.M. Davis and W. Penck Agents of Denudation: river; drainage patterns, groundwater, Sea waves, Windand Glaciers and resultant landforms. Application of geomorphology: in India and Karnataka (Regional planning, Urban planning and transportation, Mining, Hazard management, Agriculture and Environmental management).	

References

1. Ahmed E. (1985) Geomorphology, Kalyani Publishers, New Delhi.
2. Bloom A.L. (1978) Geomorphology: A Systematic Analysis of Late CenozoicLandforms Prentice – Hall of India, New Delhi.
3. Brunsden D. (1985) Geomorphology in the Service of Man: The Future ofGeography, Methnen, U.K.
4. Chorley, R.J., Schumm, S. A. and Sugden, D.E. 1984: Geomorphology, Methuen,London
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9. Homes A. (1965) Principles of Physical Geology, 3rd Edition, ELBSS Edn.
10. Hugar M R Physical Geography part 1(Kannada Version)
11. Kolhapure and S S Nanjan, Physical Geography (Kannada Version)
12. Nanjannavar S S: Physical Geography (Kannada Version)
13. P Mallappa, Physical Geography (Kannada Version)
14. Ranganath Principles of Physical Geography (Kannada Version)
15. Strahler A.N. (1968) The Earth Sciences, Harper & Row Intl. Edn, New York
16. Thornberry W.D. (1969) Principles of Geomorphology 2nd Edition, Wiley Intl. Edn. &Wiley, 1984.
17. Verstappen H. (1983) Applied Geomorphology, Geomorphological Surveys forEnvironmental Develop- ment, Elsevier, Amsterdam

Reference Websites

1. http://www.solarviews.com/eng/earth.htm
2. http://www.moorlandschool.co.uk/earth/tectonic.htm
3. https://www.usgs.gov/
4. https://www.ksndmc.org/

Pedagogy

Formative Assessment	
Assessment Occasion/type	**Weightage in Marks**
Case Studies	30%
Assignment	20%
CIA	50%
Total	100%

GEOGDSC P1.1 **Geomorphology Practical**

CREDIT:02

Content of Practical Course 1: List of Experiments to be conducted

Exercise-1: Identification of Rocks and Minerals. Mineral samples: Iron ore, Bauxite ore and Manganese. Rock Samples: Granite, Basalt, Lime Stones, Sandstone, quartzite, and marble.

Exercise-2: Extraction and interpretation of Geomorphic information from Topographicalmaps

Exercise-3: Preparation of contour map from toposheet, Construction of Relief Profiles-serial, Super imposed, Projected & Composite.

Exercise-4: Slope Analysis - Slope Maps (Wentworth method) Slope calculation and conversion (isotan and isosin) and aspect maps & Hypsometric curve and integral

Exercise-5: Drainage Morphometry: delineation of watershed, stream ordering and Morphometric analysis: mean stream length, drainage density and drainage frequency. **Field Work**: Measurement of channel cross-sections in the field, Geomorphic map of channel bed, Study of erosional and depositional features in the field.

Case Study: students must be taken to observe local land formation and degradation and write areport on their effectiveness.

B.A. / BSc Semester 1

Title of the Course: GEOGOE T1.1 - 1. Introduction to Physical Geography

Number of Theory Credits	Number of lecture hours/ semester
3	42 - 45

Course Outcomes:

1. Students will be able to understand the fundamental concepts in Earth Sciences
2. Understands basic terminology used to describe physical processes and landscapeforms.
3. Describe elements of the atmosphere and the oceans

Course Objectives:

This course aims to

1. Study basic principles of the Earth Sciences
2. Understand the landforms, atmospheric elements and structure and basics ofoceanography

Content of Theory Course 1	42/45Hrs
Unit – 1	11
Origin, Shape and Size of the Earth, Movement of the Earth- Rotation and Revolution, Effects of the movement of Earth,Coordinates -Latitude, Longitude and Time. Structure of the Earth,	
Unit – 2	11
Rocks - types,significance, Weathering – types. Agents of Denudation - River, Glacier, Wind and Under Ground water. Volcanicity, Earthquakes and Tsunamis	
Unit – 3	11
Structure and Composition of Atmosphere,Weather and Climate. Atmospheric Temperature, Heat Budget of the atmosphere Atmospheric Pressure, Winds and Precipitation	
Unit – 4	12
Distribution of Land and Sea, Submarine Relief of the Ocean, Temperature and Salinity of Sea Water. Ocean Tides, Waves and Deposits, Ocean currents - Atlantic, Pacific and IndianOceans. Marine Resources: Biotic, mineral and energy resources	

References

1. B.S. Negi (1993) Physical Geography. S.J. Publication, Meerut
2. D.S. Lal (1998) Climatology. Chaitnya publishing house, Allahabad
3. K. Siddhartha (2001) Atmosphere, Weather and Climate. Kisalaya publication, NewDelhi
4. R.N. Tikka (2002) Physical Geography. Kedarnath Ramnath & co, Meerut.
5. Willian D. Thornbury (1997) Principle of Geomorphology. New Age International (PvtLtd.) New Delhi.

Pedagogy

Formative Assessment	
Assessment Occasion/type	**Weightage in Marks**
Quiz	30%
Assignment	20%
CIA	50%
Total	100%

B.A. / BSc Semester 1

Title of the Course: OE 1.1.2 Fundamentals of Remote Sensing

Code: GEOGOE T1.1.2

Number of Theory Credits	**Number of lecture hours/ semester**
3	**42 - 45**

Course Outcomes:

1. This course is to make understand the basic concepts of Remote Sensing and toimpart necessary skills of remote sensing analysis, and image interpretation to thestudents. So that, students acquire employable skills in remote sensing.
2. Students will learn how to handle and process the satellite images for understandingof biophysical phenomena of the earth system.

Course Objectives:

1. To congregate the basic concepts and fundamentals of physical principles of remotesensing
2. To create a firm basis for successful integration of remote sensing in any field ofapplication.
3. To study basics of digital image processing and image interpretation techniques.
4. To study the applications of the remote sensing to solve the real-world problems.

Content of Theory Course 1	**52/56Hrs**
Unit – 1 Introduction	11
Definition of Remote Sensing, developmental stages, Laws of Physics, electromagnetic waves, spectrum, regions, wavelength, frequencies, and applications. Types-Satellites, Sensors, Payloads, Orbits, telemetry of satellites.	
Process and types of Remote Sensing	11
Process of remote sensing, interaction of radiation with atmosphere and targets, atmospheric noises, attenuation in radiance, resolutions of remote sensing, optical remote sensing, visible region of the spectrum, thermal remote sensing, microwaveremote sensing, Hyperspectral remote sensing, LiDAR, and other remote sensing Platforms.	

Unit – 3 Image Classification and Interpretation	11
Satellite products and its spectral characteristics, composite images, band ratios; Land use land cover classification schemes-Anderson and NRSC; Visual image interpretation, elements, stages of interpretation and interpretation keys. Image classification- supervised, unsupervised, and principal component analysis (PCA) and accuracy assessment.	
Unit – 4 Applications of Remote Sensing	12
Disaster Management, Meteorological Studies, Agricultural and Irrigation Studies, Forestry Studies, Hydrological Studies, Natural Resource, Oceanic and Coastal mapping, Soil resource mapping, Urban and Rural Mapping and Management.	

References

1. Image processing and GIS for remote sensing: techniques and applications; Second Edition (2016) - Liu, Jian-Guo, Mason, Philippa J
2. Introduction to Remote Sensing and Image Interpretation (2003); Lillesand T.M.
3. Introduction to Remote Sensing, Fifth Edition (2011); James B. Campbell, Randolph H.Wynne
4. Introductory Digital Image Processing: A Remote Sensing Perspective, Fourth Edition(2015) - John R. Jensen
5. Practical handbook of remote sensing, First Edition (2016) - Lavender, Andrew, Lavender, Samantha
6. Remote Sensing and GIS, Second Edition (2011), Bhatta, B.
7. Remote sensing and image interpretation (2015); Chipman, Jonathan W., Kiefer, Ralph W., Lillesand
8. Remote Sensing of the Environment: An Earth Resource Perspective (Prentice HallSeries in Geographic Information Science) - Second Edition (2006), John Jensen

1. https://onlinecourses.nptel.ac.in/noc19_ce41/preview

Pedagogy

Formative Assessment	
Assessment Occasion/type	**Weightage in Marks**
Quiz	30%
Assignment	20%
CIA	50%
Total	100%

B.A. / BSc Semester 2

Title of the Course: Introduction to Climatology

CODE: GEOGDSC T2.1

Number of Theory Credits	Number of lecture hours/ semester	Number of practical Credits	Number of practical hours/ semesters
4	52 or 56	2	52 or 56

Course Outcomes:

After the completion of this course, students should be able to

1. define the field of climatology and to understand the atmospheric composition and structure.
2. to outline the mechanism and process of solar radiation transfer to earth surface and toex- plain the temperature distribution and variation according to time and space.
3. to illustrate and explain the air pressure system, wind regulating forces and the formationof the Atmospheric Disturbance.
4. to understand and compute the air humidity as well as to explain the process of Condensation and formation of precipitation and its types.

Course Objectives:

This course aims to:

1. to define the field of climatology and components of the climate system
2. to introduce various dimensions of climatology like structure and composition.
3. to understand the global atmospheric pressure, temperature, and wind system.
4. to study the concept of atmospheric moisture and its types

Content of Theory Course 1	52/56Hrs
Unit – 1 Composition and Structure of the Atmosphere	14
Nature and Scope of Climatology, Atmospheric Sciences; Climatology and Meteorology Origin and structure of the Atmosphere: Troposphere, Stratosphere, Mesosphere, Ionosphere, Exosphere and their characteristics. Composition of the atmosphere Weather and Climate	
Unit – 2 Atmospheric Temperature	14
Insolation: Definition, Mechanism, Solar Constant. Factors affecting the Insolation: Angle of incidence, length of the day, Sunspots,Distance between the earth and the sun, effect of the atmosphere. Heating and cooling process of the atmosphere-Radiation, Conduction,convection, and advection. Temperature: meaning and Influencing Factors on the Distribution ofTemperature Distribution of the temperature: Vertical, Horizontal, and Inversion of temperature. Global Energy Budget: Incoming shortwave solar radiation, Outgoing Longwave Terrestrial radiation, Albedo. Net Radiation and Latitudinal Heat Balances.	
Unit – 3 Atmospheric Pressure and Winds	14

Atmospheric Pressure: Influencing factors on atmospheric pressure.Vertical and Horizontal Distribution of the atmospheric pressure and Pressure Belts, Pressure Gradient. Tri-cellular-Hadley, Ferrel's and Polar Cells. Winds: influencing factors, Types - planetary, seasonal, local wind Variable winds-Cyclones and anti-cyclones. Air-Masses and Fronts: Definition, Nature, Source Regions, Classification.	
Unit – 4 Atmospheric Moisture	14
Humidity: Sources, influencing factors and types-Absolute, Relative and Specific. Hydrological cycle: process of evaporation, condensation. Clouds and its types Precipitation and its forms. Climate Change: Causes and consequences, recent issues-floods, drought,	

References

1. Lal, D. S. (1998). Climatology. Allahabad: Chaitanya Publishing House.
2. P Mallappa, Physical Geography (Kannada Version)
3. Ranganath Principles of Physical Geography (Kannada Version)
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15. Trewartha, G.T. (1980): An Introduction to Climate; McGraw Hill, New York, 5thedition, (International Student Edition)

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2. https://mausam.imd.gov.in/
3. https://www.weatheronline.in/
4. https://earthexplorer.usgs.gov/
5. https://www.nhc.noaa.gov/satellite.php

Pedagogy

Formative Assessment	
Assessment Occasion/type	**Weightage in Marks**
Quiz	30%
Assignment	20%
CIA	50%
Total	100%

GEOGDSC P2.1- **Climatology Practical CREDITS: 2**

Content of Practical Course 1: List of Experiments to be conducted

Conduct all exercises with Goal, Procedure, devices, and findings.

Exercise 1: Understanding Structure and functions of the Indian Meteorological Department (IMD).

Exercise 2: Collection of climatic data from IMD website.

https://mausam.imd.gov.in/bengaluru/

Exercise 3: Plotting of downloaded climatic data using graphical methods-

Elementary Instrumental Observation:

Exercise 4: Centigrade and Fahrenheit thermometer for measuring temperature.

Exercise 5: Mercurial Barometer and Aneroid Barometer for measuring atmosphericpressure

Exercise 6: Wind Vane and cup-anemometer.

Exercise 7: Wet and Dry bulb thermometer for measuring humidity

Exercise 8: Rainguage- Dial type for measuring rainfall Exercise 3: Rainfall Trend Analysis.

Exercise 9: Interpretation of Indian Daily Weather charts.

Exercise 10: Deriving water balance chart, Actual and potential evapotranspiration

Note: Students are expected to download weather charts of the four seasons.

B.A. / BSc Semester 2

Title of the Course: 1 Introduction to Human Geography
CODE: GEOGOE T2.1.1

Number of Theory Credits	Number of lecture hours/ semester
3	42 - 45

Course Outcomes:

1. Students will learn how human, physical, and environmental components of theworld interact.
2. Students will be familiarized with economic processes such as globalization, tradeand their impacts on economic, cultural and social activities.
3. The student will describe what geography and human geography are.
4. Understand population dynamics and migration.

Course Objectives:

This course aims to

1. Understand the basics concepts of human geography
2. Study population attributes and dynamic nature of it
3. Introduce economic, cultural, and trade activities and their impact on thedevelopment of the region

Content of Theory Course 1	45Hrs
Unit – 1 Introduction to Human Geography	11
Nature and scope, Development Environmental Determinism and Possiblism, Neo determinism (stop and godeterminism) Approaches to human geography: Exploration and Descriptive approach, regionalanalysis Approach, Areal Differentiation Approach, Spatial organization Approach.Modern approaches: Welfare or Humanistic Approach, Radical Approach, Behavioral Approach, Post Modernism in geography Fields and sub fields in Human geography	
Unit – 2 Geographical Analysis of Population	11
Distribution and Growth of Population Density of population: meaning and Types: Arithmetic Density and PhysiologicalDensity. Regional distribution of Density of Population. Population Movement: Migration, Raventein's Law of Migration, Factors of population Migration, Economic Push and Pull factors, Cultural Push and Pull Factors, Environmental Push and Pull Factors. Migration Types: Immigration and Emigration, Internal and International Migration	
Unit – 3 Cultural Patterns and Processes	11
Concept of Culture, Material and Non material culture Cultural Regions, cultural Traits and Complexes, cultural Hearths, cultural Diffusion. Languages of the World: Types, Classification and Distribution. Religions: Types and Classification. Distribution. Universalizing Religions: Christianity, Islam, Buddhism. Ethnic Religions: Hinduism, the Chinese religion, Shintoism, Judaism. The Major tribal population of the world.	

Unit – 4 Human Economic Activities, Development and Settlements	12
Primary Economic Activities – Agriculture, Types: Primitive Subsistence, Intensive subsistence, Plantation Agriculture, Extensive Commercial grain cultivation, MixedFarming, Dairy Farming Secondary Activities: Manufacturing, classification – based on size – Small Scale and Large scale. Based on Raw material – Argo-based, Mineral based,Chemical Based and Forest based. Industrial Regions of the world. Tertiary Activities: Types: Trade and commerce, Retail Trading services, Wholesaletrading. Transport and communications: Factors, communication services – Telecommunication. Services: Informal and Non formal sector. Information technology and service. Human Settlements: Factors, Classification, Types and Patterns: Rural, Urban. Compact or Nucleated and Dispersed settlements. Rural settlement Patterns: linear,rectangular, circular, star shaped, T shaped.	

References

1. Hartshorne, T. A., & Alexander, J. W. (2010). Economic Geography. New Delhi: PHI Learning.
2. Knox, P., Agnew, J., & McCarthy, L. (2008). The Geography of the World Economy. London: Hodder Arnold.
3. Lloyd, P., & Dicken, B. (1972). Location in Space: A Theoretical Approach to Economic Geography. New York: Harper and Row.
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5. Smith, D. M. (1971). Industrial Location: An Economic Geographical Analysis, NewYork: John Wiley and Sons.

Pedagogy

Formative Assessment	
Assessment Occasion/type	**Weightage in Marks**
Quiz	30%
Assignment	20%
CIA	50%
Total	100%

B.A. / BSc Semester 2

Title of the Course: 2. Basics of Geographic Information Systems (GIS)
CODE: GEOGOE T2.1.2

Number of Theory Credits	Number of lecture hours/ semester
3	39 or 42

Course Outcomes:

1. Students are trained to adapt the theoretical concepts in a practical way through the mathematical models of geography.
2. Students will have the hands-on training on various modes of spatial and non-spatialdata collection, data storage, data analytics, data interpretation and data display through the thematic maps.
3. Students are exposed on spatial thinking to solve the geographical problems withrange of proven mathematical and statistical models.
4. Students can employ in various corporate and government organisation where theydeal to solve geographical problems.

Course Objectives:

This course aims to:

1. Understand the concept and techniques of the Geographic Information Systems.
2. Define the GIS data types and structures.
3. Study geo processing and visualization concepts and techniques in GIS.

Content of Theory Course 1	52/56Hrs
Unit – 1 Introduction	10
Emergence of GI Science, Milestone and Developmental stages in GIS, Definition, scope, role of GIS in digital world; Components, functionalities, merits and demerits, global market, interdisciplinary domains, and its integration with GIS.	
Unit – 2 Geodesy and Spatial Mathematics	10
Cartesian coordinates, latitude, longitudes, formats of angular units, geographical coordinates, Datum: WGS84, vs NAD32. UTM, Aerial Distance measurement using Geographic and projected coordinates, Area, Perimeter, length by coordinates andvarious international measures.	
Unit – 3 GIS Data and Scale	10
Spatial Data and its structures; sources and types of data collection; data errors, topology of data and relationship. Large Scale vs Small Scale, generalization; precision and accuracy of data-logical consistency and non-spatial data integration	
Unit – 4 Geoprocessing and Visualization	12
Spatial and Non-Spatial Queries, proximity analysis, Preparation of Terrain andSurface models. Hotspot and density mapping. Types of maps, thematic maps and Its types, relief maps, flow maps and cartograms. Tabulations: Graphs and Pivottables	

References

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2. Geographic Information Systems and Cartographic Modelling - Tomlin, C.D. (1990)
3. Geographic Information Systems and Environmental Modelling - Clarke, C., K. (2002)
4. Geographic Information Systems and Science - Paul A. Longley, et. al. (2015)
5. Geographic Information Systems: A Management Perspective - Aronoff, S. (1989)
6. GIS - Fundamentals, Applications, and Implementations - Elangovan, K. (2006)
7. Introduction to Geographical Information Systems - Chang, Kang-Tsung (2015)
8. Mathematical Modeling in Geographical Information System, Global PositioningSystem and Digital Cartography - Sharma, H.S. (2006)
9. Remote Sensing and GIS - Bhatta, B. (2011)
10. Spatial analysis and Location-Allocation Models - Ghosh, A. and G. Rushton (1987)

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2. ITC Netherlands, Principles of GIS https://webapps.itc.utwente.nl/librarywww/papers_2009/general/principlesgis.pdf
3. Geographical Information Systems: Principles, Techniques, Management and Applications https://www.geos.ed.ac.uk/~gisteac/gis_book_abridged/

Pedagogy

Formative Assessment	
Assessment Occasion/type	**Weightage in Marks**
Quiz	30%
Assignment	20%
CIA	50%
Total	100%

University of Mysore

B.A. / B.Sc. (Geography) Degree

(Basic / Honours)

Scheme & Syllabus - NEP-2020Second Year

Semester	Course code	Course title	Teaching hours	Hours / week	Examination Pattern- Max & min marks/ paper		Duration of Examination in Hrs	Total Marks	Credits
					Exam	IA			
III	DSC T 3.1	Fundamentals of Human Geography	56	4	60	40	2	100	4
	DSC P 3.1	Fundamental Techniques in Human Geography	56	4	25	25	2	50	2
	OE 3.1	Geography of India	42	3	60	40	2	100	3
	OE 3.2	Application of GIS and Remote sensing	42	3	60	40	2	100	3

semester	Course code	Course title	Teaching hours	Hours / week	Examination Pattern- Max & min marks/ paper		Duration of Examination in Hrs	Total Marks	Credits
					Exam	IA			
IV	DSC T 4.1	India: Resources and Sustainability	56	4	60	40	2	100	4
	DSC P 4.1	Representation of Indian Geographical features and resources.	56	4	25	25	2	50	2
	OE 4.1	Geography of Karnataka	42	3	60	40	2	100	3
	OE 4.2	Population and settlement Geography	42	3	60	40	2	100	3

B.A. / B.Sc. honors Programme

Semester III

Title of the Course: Fundamentals of Human Geography **CODE:** DSC T 3.1

Number of Theory Credits	Number of lecture hours/semester
4	56

Course Outcomes:

1. Students will earn Basic concepts, approaches and development of Human Geography.
2. Learn how human interact with environmental components of the world and also learn how human beings and environment mutually influences one another.
3. Students will be familiarized with cultural and economic processes at different scales such as globalization, trade, cultural and social activities.
4. The student will be able differentiate between geography and human geography.
5. Understand population dynamics and human settlements.

Course Objectives:

This course aims to

1. Understand the basics concepts and approaches of human geography
2. Study the nature and distribution of cultural elements and their process and to appraise the mutual interaction between People and places.
3. To examine the population attributes and dynamic nature of them.
4. To study different types of economic activities and their adaptation with the environment and their impact on the development of the regions.

Module –1: Introduction to Human Geography	14
Nature and scope, Development and Branches of Human Geography, Themes in Geography: Location, Place, Human-Environment Interaction, Movementand Region. Man- Environment Relation: Environmental Determinism and Possiblism, Neo-Determinism (stop and go determinism) Approaches to Human geography: Exploration and Descriptive Approach, Regional Approach,Areal Differentiation Approach, Spatial organization Approach. Modern Approaches: Welfare or Humanistic Approach, Radical Approach, Behavioral Approach, Post Modernism in geography.	
Module –2: Cultural patterns and Processes	14
Concept of culture, Material and Non-material Culture, Cultural traits and Cultural regions. Meaning and Definition of races, Classification of races, Main characteristics (traits) and Broadracial groups of the world and their distribution. Languages: Classification and Distribution of languages. Religion: Types, Classification, and Distribution of religions: Hinduism, Christianity, Islam andBuddhism. **Assignment:** Each student is expected to prepare a brief report on the cultural composition of their own locality/ place/ village/ ward/town or neighborhoods through field investigation and also can use published data.	

Module –3: Population and Settlements	14
Distribution and Growth of Population; Factors affecting population Distribution. Density of Population: Meaning and Types; Arithmetic Density, Physiological Density andAgricultural density, Regional Distribution of Density of Population; Carrying capacity and Sustainability, Concept of Settlements, Origin and evolution of Human settlements, Factors of settlements, originand distribution, types and pattern of settlements, Rural and Urban settlements, Trends and Patterns of World Urbanization. **Field Activity:** Students should study and identify the factors influencing on the origin and growth of the settlement and each student is expected to identify patterns of settlements by visiting nearest settlement. The students are advised to carry topographical map of the place during field visit.	
Module–4: Economic Activities	14
Concept and Classification of Economic activities; Factors affecting Economic Activities. Primary Economic Activities – Agriculture, Types: Primitive Subsistence, Intensive Subsistence, Plantation Agriculture, Extensive Commercial grain Cultivation, Mixed Farming,Dairy Farming. Secondary Activities: Manufacturing, Classification – 1. Based on size – Small Scale and Largescale.2. Based on Raw Material – Agro-based, Mineral based, Chemical Based and Forest based. Industrial Regions of the world. Tertiary Activities: Types: Trade and Commerce, Retail Trading Services, Wholesale Trading.Transport and communications: Factors, Communication Services – Telecommunication. Services:Informal and Non formal sector. Information technology and service. **Case Study:** Students have to visit a village/a town nearby and observe the economic activities and understand different classes and identify the most dominant economic activities..	

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1) De Blij H. J.,Alexander B Murphy, Erin H Fouberg, (2006) Human Geography: people, Place and culture, Abe books Published by Wiley ISBN 10: 0471679518 / ISBN 13: 9780471679516
2) Sarah Bendarz, Mark Bockenhauer, Fredrik Hiebert, 2020, Human Geography: A Spatial Perspective;.NatlGeographics School Pub Inc.
3) Majid Hussein 2018 Human Geography, Rawat Publication (Fifth Edition)
4) David Dorrell, Josesph Henderson, Todd Lindley and Georgeta Cannor (2019) Introduction to Human Geography, University System of Georgia, https://ung.edu/university-press/books/introduction-to-human-geography.php
5) Hartshorne,T.A., & Alexander,J.W.(2010).Economic Geography. New Delhi: PHI Learning.
6) Nellson, Gabler Vining (1995) Human Geography, People, Cultures and Landscapes
7) Ranganath (2002) Principles of Human Geography (Kannada Version) Vidyanidhi, Gadag
8) Rubenstein J.M (2016). An Introduction to Human Geography, Macmillan Publishing Company, New York
9) Knox,P.,Agnew,J.,&McCarthy,L.(2008).The Geography of the World Economy.London: HodderArnold.
10) Lloyd,P.,&Dicken,B.(1972).Location in Space: A Theoretical Approach to Economic

Geography. NewYork: Harper and Row.
11) Siddhartha,K.(2000).Economic Geography: Theories, Process and Patterns, NewDelhi: Kisalaya Publications.
12) Smith,D.M.(1971).Industrial Location: An Economic Geographical Analysis, New York: John Wiley and Sons.

B.A./ B.Sc. honors Programme

Semester III

Title of the Course: Fundamental Techniques in Human Geography, CODE: DSC P 3.1

Number of Theory Credits	Number of lecture hours / semester
2	56

Course Outcomes:

1. Students will learn the geographical concepts such as scale, map, projections, distance, direction, and learn how these features are used in map production and area visualization.
2. Studentswillbefamiliarizedwith different methods of computing population growth, understanding the techniques of nearest neighbor analysis.
3. Thestudentwillbe able understand the factors affecting settlement development and economic activities therein.

CourseObjectives:

This course aims to

1. Understand the application of the cartography in mapping of population
2. Study population growth models
3. Introduce how economic, cultural, and trade activities impact on the development of the settlement

Content of the Practical Course		
Exercise 1	**Maps:** Definition, Elements of map: scale, direction, map projection, conventional signs and symbols, legend, Types of map: **1. Based on scale**: A. large scale: cadastral maps, Topographic maps, B. Small scale: wall maps, atlas maps, maps 2. **Based on purpose and content**: Physical Maps, Political Maps,Thematic Maps. Uses of Maps.	08
Exercise 2	**Map Scales:** Definition of Scale, Methods of representing Scales: Statement Method, Graphical Method, Ratio Method (R F).	08
Exercise 3	**Conversion of Scale**: Verbal to RF, RF to Verbal, Verbal to Graphical. Exercises on Measuring Distances on Map and converting map distance to ground distance.	08
Exercise 4 and 5	**Map Projections:** Meaning and Purpose, Latitudes and Longitudes, Classification of Map Projections and their general properties: Conical Projections, Cylindrical Projections, Zenithal Projections. UTM Projections. Choice of Map Projection.	08
Exercise 6	Drawing of conical projection with One Std. Parallel and Two Std. Parallels,	08

Exercise 7	Drawing of Cylindrical Equal Area Projection.	06
Exercise 8	Drawing of Zenithal Polar Gnomonic Projection.	06
Exercise 9	Introduction to UTM Projection, uses and importance.	4

References:

1. Dr.L.R.Singh (2010), Fundamentals Of Practical Geography, Sharda Pustak Bhavan, Allahabad, India.
2. Pijushkanti Saha, Partha Basu (2013) Advanced Practical Geography
3. Ashis Sarkar (2015) Practical Geography: A Systematic Approach, Orient Black swan Pvt Ltd.
4. Rana Pb Singh Rl Singh(2018), Elements of Practical Geography. Kalyani Publishers
5. Dent B.D., 1999. Cartography: Thematic Map Design, (Vol. 1), McGraw Hill
6. Gupta K.K and Tyagi V.C., 1992. Working with Maps, Survey of India, DST, New Delhi.
7. Mishra R.P. and Ramesh A., 1989. Fundamentals of Cartography, Concept Publishing.
8. Monk house, F.J. and Wilkinson, H.R., 1971. Maps and Diagrams. Methuen and Co. Ltd., London. K.
9. Singh, R.L., 2005. Elements of Practical Geography. Kalyani Publishers, New Delhi. India.

B.A. /B.Sc. Honors Programme

III Semester (Open Elective)

Title of the Paper: Geography of India **Code:OE3.1**

Number of Theory Credits	Number of lecture hours / semester
3	42

Course Outcomes:

1. This is intended to ensure the Students of other discipline to gain geographical knowledge about India.
2. Prepare them to think geographically about our nation and to enhance the pride of our Nation.

Course Objectives:

After the completion of this course the Students are expected to

1. Have an understanding of the Physical, ecological, economic, demographic and cultural characteristics of our nation.
2. By that they can apply geographical knowledge and skills in deeper understanding of the Core Subjects.

Module	Content	Hours
Module -1 Physical Bases		12
	Location, Size and Extent, Political Divisions Relief Features-Northern Mountains, Northern Great Plain,The Peninsular Plateau and Coastal Plain and Islands Climate: Seasons – Summer Season, South-West Monsoon,Retreating Monsoon Season, Winter Season, Drainage system- Rivers of North India, Rivers of SouthIndia, Vegetation - Types and Distribution- Afforestation programs	
Module – 2 Irrigation and Agriculture		10
	Irrigation: Need for Irrigation and Types Agriculture: Significance and Types- Intensive and ExtensiveFarming, Subsistence and Mixed Farming Major Crops- Production and Distribution : Rice, Wheat Cotton ,Sugar cane and Tea Development of Agriculture- Green Revolution	
Module - 3 Minerals, Power and Industries		10
	Mineral and Power Resources-Types and Significance Production and Distribution: Iron Ore, Manganese Production and Distribution: Coal, Petroleum, Hydro Electricity Major industries- Iron and Steel, Cotton textile, Sugar. Major industrial regions of India Special Economic Zones	
Module -4 Transport, Communication and Human Population		10
	Roadways, Railways, Airways Waterways. Important Ports: Calcutta, Chennai, Mumbai and New Mangalore. Indian Space Programme. Growth of Population Distribution and Density of Population Population Composition – Sex Ratio, Literacy Problems of Population	
	Total	42

References:

1. Gopal Singh : Geography of India, Atmarama and Sons, New Delhi.
2. Hussain M,2014, Geography of India, Tata McGraw-Hill Education- New Delhi
3. ICAR: Cropping pattern in India,1974.
4. Mathur,S.M.: Physical Geology of India, NBT1991.
5. Ranganath : Regional and economic Geography of India (Kan.Ver) VidyanidhiPrakashana, Gadag,2020.
6. Mallppa P : Economic Geography of India (Kan. Ver.) K V Lalitha Publishers

7. Ranjit Thirtha, 1996, Geography of India, Raniat, Jaipur.
8. Khullar D.R.2000, India a Comprehensive Geography ,Kalyani Publishers,Ludhiana.
9. Sharma T C,2012, Economic Geography of India, Rawath Publications, Delhi
10. Tiwari R.C 2006, Geography of India, Prayag Pustak Bhawan, Allahabad,
11. Pritivish Nag &Smita Sengupta, 1992, Geography of India, Concept Publishing Company, New Delhi.
12. Ranganatha, 2007, Geography of India, Vidhyanidhi Prakashan, Station Road, Gadag-01.
13. Phani Deka &Abani Bhaga bati,1992, Geography: Economic and Regional, Wiley Eastern Limited,AnsariRaod, Daryaganj, N. Delhi-01.

Websites:

1. http://www.mapsofindia.com/geography/
2. https://agricoop.nic.in/en
3. https://www.resourcedata.org/dataset/rgi-ministry-of-minerals-energy-and-water-resources
4. https://dpiit.gov.in/
5. http://rfrfoundation.org/nadi-ko-jano/
6. https://jalshakti-ddws.gov.in/

B.A. /B.Sc. Honors Programme

III Semester (Open Elective)

Title of the course: Application of GIS and Remote sensing **OE.3.2 Credits: 3**

Number of Theory Credits	Number of lecture hours / semester
3	42

Course Outcomes:

1. This is intended to ensure the Students of other discipline should understand fundamentals of remote sensing and Geographical Information system.
2. prepare them to think geographically and Apply this knowledge to their respective field of enquiry for spatial and other kinds of planning.

Course Objectives:

After the completion of this course the Students are expected to

1. Have an understanding of the Geo-spatial tools and their significance and utilization.
2. Utilize different tools and techniques of remote sensing and GIS for addressing various problems which are both natural and societal in nature.
3. By that they can apply geographical knowledge and skills in deeper understanding of the Core Subjects.

Module	Content	Hours
Module - 1	Remote Sensing; Concept, Definition, Evolution of Remote Sensing, Process of Remote sensing, EMR; Wave length, Frequency, Electromagnetic Spectrum; Bands, Atmospheric window, Interaction of EMR with atmosphere and surface. Spectral signature.	12
Module - 2	Remote Sensing Platforms, Orbit, Active and Passive Remote Sensing, Indian remote sensing satellites and launch vehicle's,	10

	Application of Remote Sensing in Agriculture, Disaster management, Urban studies, Coastal management and EIA.	
Module - 3	Geographic information System; Definition, Development of GIS, Components of GIS, Data types; Spatial and Non-spatial data, Raster and Vector data models, Data Sources, errors, Data input methods; Manual and Automated.	10
Module 4	Data Analysis; Buffer Analysis and its applications, Overlay functions, Query, Network Analysis, GIS Applications in urban monitoring & planning, Disaster Mitigation, Forestry, Wetland monitoring.	10

References:

1. Lilles and Thomas M. & Kiefer Ralph: Remote Sensing and Image Interpretation Third Edition John Wiley
2. Campbell John B.: Introduction to Remote Sensing Taylor &Francis
3. Floyd F. Sabins : Remote Sensing and Principles and Image Interpretation
4. Manual of Remote Sensing: American Society of Photogrammetry and Remote Sensing.
5. George Joseph: Fundamentals of Remote Sensing; Universities Press India Pvt Ltd, Hyderabad, India
6. Editors: John D. Bossler; John R. Jensen; Robert B. McMaster; Chris Rizos, 2001. Manual of Geospatial Science and Technology, November 2001, Vol 1 Part 1andII.
7. Paul M. Mather, 1999. Computer Processing of Remotely sensed Images: An Introduction. John Wiley
8. Aronoff, S. (1991). Geographic Information Systems: A Management Perspective, WDL Publications, Ottawa, Canada.
9. Chang, Kang-Tsung (2006). Introduction to geographic information systems. Boston: McGraw-Hill Higher Education.
10. Longley, P. A., Goodchild, M. F., Maguire, D. J., &Rhind, D. W. (2005). Geographic information systems and science. John Wiley & Sons.
11. Bernhardsen, T. (2002). Geographic information systems: an introduction. John Wiley & Sons.
12. Ian Heywood, Sarah Cornelius and Steve Carver (2010). An introduction to geographical information systems. Prentice Hall - Pearson Education limited.
13. Chang, Kang-tsung (2002). Introduction to Geographic Information Systems, McGraw-Hill Companies, Inc
14. Chrisman, N. (1997): Exploring Geographic Information systems, John Wiley & Sons., New York
15. The ESRI Guide to GIS Analysis, by Andy Mitchell, ESRI Press, 1999, 188 pp.

B.A./B.Sc. honors programme

Semester IV

Title of the Course: India- Resources and Sustainability **CODE:** DSC 4.1

Number of Theory Credits	Number of lecture hours / semester
4	56

Course Outcomes:

1. Students will learn about the physical setting of India.
2. Students will be familiarized with the water and Agricultural Resources of India and they will understand the importance of these resources in the national development and prosperity.
3. The student will be able understand the factors affecting, location and distribution of Industries and different modes of Transport.

Course Objectives:

This course aims to

1. Understand the physical setting of India.
2. Study water and agricultural resources of India.
3. Study the nature of transport and communication, Industries and population growth.
4. Introduce how economic, cultural, and trade activities impact on the development

Module -1	**Physical Setting**:	14
	Location, Size and Extent. Major Physiographic Regions - Northern Mountains, Northern Great Plains, Peninsular Plateau and Coastal Plains and Islands) and their Characteristics; Climate: Seasonal Weather Characteristics, Climatic Zones. Mechanism and Characteristics of Indian Monsoons. Tropical Cyclones and Western Disturbances. Floods and Droughts Drainage System. Soil: Types, Erosion and Conservation. Vegetation: Types, Distribution, Afforestation programs, National Parks, Wildlife Sanctuaries, and Biosphere reserves.	
Module -2	**Water and Agricultural Resources**:	14
	Water resources of India, Surface and Groundwater, Water Demandand Utilization. Irrigation: Sources, Types and Intensity. Issues and Challenges: Water Resources Scarcity, Water Conservation and Management. Watershed Management, Rainwater Harvesting, Recycle and Reuse of water. Interlinking of Rivers, National Water Policies, National Water Mission, Jalashakti	

	Abhiyaan. Command Area Development and Water Management. Central Water Commission and Water Tribunal and their role. 2.5 Agriculture: Land Use and Cropping Pattern – Meaning and Concepts, Land Use and Cropping Patten in India, Agro-climatic Regions, Green Revolution – Causes and Effects, Hunger Index and Malnutrition; Food security and right to food to achieve Zero hunger and Good Health and Wellbeing..	
Module -3 Industries, Transportation and Communication:		14
	Locational factors of industries, Major Industrial Regions and their characteristics, Classification of Industries: Agro-based, Mineral-based, Forest-basedand Animal-based industries. Special Economic Zones: Industrial / Economic Corridor. Transport & Communication: Significance, Growth and Development – Road ways, Railways, Waterways, Airways and Pipeline Networks and their Complementary and Competition. Communication: Means of Communication and their Significance **Assignment:** Selecting a region students have to study the locational factors nearby industry and prepare a report.	
Module -4 Human Resources:		14
	Growth, Distribution and Density of Population. Composition of Population: Age, Sex, Rural-Urban PopulationComposition. Migration: Meaning, Factors, Types, Causes and Consequences. Human Development in India: Measures, Levels of Developmentbased on HDI **Field Study**: Selecting a region / district students have to examine the levels of Human Development using HDI and prepare a report.	

References:

1. Majid Husain (2020) Geography of India, McGraw Hill Publishers
2. R.C. Tiwari (2016) Geography of India, Provolika Publications, Allahabad
3. D.R.Khullar (2019) India: A Comprehensive Geography ,Kalyani Publishers
4. R.L.Singh (1993) India: A Regional Geography, National Geographical Society of India, New Delhi.
5. Dr Deep Shikha (2016) Geography of India - A Text Book;
6. AlkaGautam (2009) Geography of India, Sharada pustak bhawan, University Road, Allahabad – UP.
7. Sharma TC &Coutinho O (2005) : Economic and Commercial geography of India, Vikas Publishing House ltd., New Delhi-14
8. Pritivish Nag & Smita Sengupta (1992) Geography of India, Concept Publishing Company, New Delhi.
9. Ranganath (2007) Geography of India, Vidhyanidhi Prakashan, Station Road, Gadag-01

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2. https://mausam.imd.gov.in/

3. https://tourism.gov.in/
4. https://www.resourcedata.org/dataset/rgi-ministry-of-minerals-energy-and-water-resources
5. https://dpiit.gov.in/
6. https://agricoop.nic.in/en
7. https://www.fao.org/soils-portal/en/

B.A./B.Sc. honors Programme

Semester IV

Title of the Course: Representation of Indian Geographical features and Resources.
Code: DSC P-4.1

Number of Theory Credits	Number of lecture hours / semester
2	56

Course Outcomes:

After the completion of this course, students should be able to

1. Understand holistically about the geography of India and plotting resources on Indian outline map.
2. Interpret and apply the concepts on resource distribution of India and related economic activities
3. Demonstrate the economic development through the connectivity of transport and communication.

Course Objectives:

This course aims to

1. Understand the basics geographical setting of India
2. Study physiographic divisions with drainage, soil and vegetation of India.
3. Gets exact information regarding mechanism of monsoon and its impact.

Content of the Practical Course		
Ex.No.1	Mapping exercises on Indian outline Map: International Boundaries, Mountain peaks, Passes, Glaciers and important Physical Divisions of India, Rivers, National Biospheres and National Parks, Dams and Reservoirs, Lakes and Water Bodies, Islands, National Waterways, Ports and Harbours, National High ways, Important Airports, Industrial Corridors, Important Coastal Zones and Beaches, Ecologically Sensitive areas, Important industrial zones, Special Economic Zones, Resource centres and Mining, Cultural Regions, Tribal Areas. **Note:** Each student is expected to complete at least 3 mapping exercises from the above topics which should cover brief description on: Location (Latitude and longitude, state, district, place,) geographic/environmental/ ecological/ political/ economic significance of the place/ location. Minimum 10 locations shall be involved in each exercise.	10
Ex.no.2 and 3,	Mapping Temperature and Rainfall Distribution of India / Karnataka using Isopleth method.	10
Ex.no.4 and 5	Mapping of Agro-climatic zones of India, Flood Prone and Drought Prone Areas,	8

Ex. No.6 and 7	Mapping of Cropping Pattern and Crop intensity of India/ Karnataka. Weaver's Method, Bhatia's Method. Calculation and mapping of Irrigation intensity.	10
Ex.no.8	Human Development Index: Concept, Calculation and Mapping	6
Ex.no.9	Gender Development Index: Concept, Calculation and Mapping	6
Ex.no.10	Human Poverty Index: Concept and Calculation and Mapping	6

Reference:

1) Hartshorne,T.A.,&Alexander,J.W.(2010).EconomicGeography.NewDelhi:PHILearning.
2) Knox,P.,Agnew,J.,&Mc Carthy, L.(2008).The Geography of the World Economy. London: Hodder Arnold.
3) Lloyd,P.,&Dicken,B.(1972).LocationinSpace:ATheoreticalApproachtoEconomicGeography. New York: Harper and Row.
4) Siddhartha,K.(2000).EconomicGeography:Theories,ProcessandPatterns,NewDelhi:KisalayaPublications.
5) Smith,D.M.(1971).Industrial Location: An Economic Geographical Analysis, New York: John Wiley and Sons.

B.A. / B.Sc. Honors Programme

Semester IV (Open Elective)

Title of the Course : GEOGRAPHY OF KARNATAKA **Code: OE.4.1 Credits:3**

Number of Theory Credits	Number of lecture hours / semester
3	42

CourseOutcomes:

After the completion of this course, students should be able to

1. Understand the physical, economic and socio-demographic aspects of Karnataka state in a broader sense.
2. Understand the resource base of the state i.e., forests, soils, minerals, water and climate, and its impact on the socio-demographic and economic development of different regions of Karnataka in terms of agriculture, industries, transportation and other fields of human activities.
3. Understand the development of irrigational projects and industrial projects and special Economic zones (SEZ's)

Course Objectives:

This course aims to

1. Understand the site and situation of Karnataka
2. Intellectual connect to the resources and economic activities of Karnataka
3. Assess demographic composition of Karnataka state

Module	Content	Hours
Module -1	**Physical Background**	12
	Location, size and Administrative divisions. Physiographic Divisions: Coastal Regions, Malnad Regions and Maidan Regions. Weather and Climate: Seasons, Distribution of Rainfall and Temperature, Climatic regions, Drought prone areas in Karnataka. Drainage Systems: Major Drainage Systems in Karnataka. East flowing rivers and West flowing rivers. Natural Vegetation: Types of vegetation, Distribution offorests in Karnataka, Protection and Conservations. Reserve Forests and Protected Forests in Karnataka, National Parks and Bird Sanctuaries in Karnataka.	
Module -2 Soil, irrigation and Agriculture:		10
	Soil: Types and Distribution, Regional Issues of Soil Quality and Management. Water Resources: Distribution of Water Resources, Irrigation –Sources of irrigation, Multipurpose River Valley Projects. River Water Disputes with the neighbouring states. Agriculture regions of Karnataka. Major Food Crops – Paddy,Ragi, Maize, Pulses. Commercial Corps – Cotton, Sugarcane, Tobacco, Coffee, Spices, Livestock and Fishing. **Assignment**: Students need to visit local fields and get to knowhow soil conservation plans are prepared and submit report	
Module - 3 **Minerals, Energy and Manufacturing:**		10
	Major Mineral resources of Karnataka and their Regionalization. Iron ore, Manganese, Gold, Bauxite Energy Resources: Types and their Distributions. Conventional and Non-Conventional Sources. Industries: Textile Industries, Iron and Steel Industries, Sugar Industries. Industrial Regions and Special Economic Zones of Karnataka.,	
Module – 4 Transport, Information &Communication Technology and Population		10
	Transportation: Types of Transportation, Distribution of Transportation. Growth and Distribution of Information Technology in Karnataka. **Population** Growth, Distribution and Density of Population. Population Composition – Sex Ratio, Literacy. Human Development in Karnataka (HDI)	

Reference:

1. Ranganath (2015), Geography of Karnataka, Publisher: Mysore Book House

2. S.S.Nanjannavar (2016), Geography of Karnataka, Prabhu publications
3. R. N. Tikka (2002),Physical Geography
4. MisraR.P(1969) Geography of Mysore State
5. SarmahDipak (2019), Forest of Karnataka-A Paronomic View, Notion Press
6. Director, Census Reports Published by Govt. of Karnataka
7. Karnataka State Gazetteer Volume- I & II

Websites:

1. https://ksrsac.karnataka.gov.in/
2. https://ksdma.karnataka.gov.in/english
3. https://raitamitra.karnataka.gov.in/english
4. https://www.karnatakatourism.org/tourism-department/

BA/BSc Honors Programme

Semester IV (Open Elective)

Title of the course: Population and Settlement Geography **Code: OE.4.2 Credits: 3**

Number of Theory Credits	Number of lecture hours / semester
3	42

Course Outcomes:

After the completion of this course, students should be able to

1. Understand the concepts of both Population and Settlement geography.
2. Appreciate the man environment interplay which are expressed in different kinds and patterns in the distribution and density of population and Human settlements over space.
3. Understand the Demographic dynamics like birth, Death and Migration of Population and its relation with settlement dynamics like settlement size, types and rural urban settlements and its issues.

Course Objectives:

This course aims to

1. Introduce the basic concepts of Population Geography to the students.
2. Introduce the basic concepts of Settlement Geography to the students.
3. Bring the significance of Environment and society on Population dynamics and Mobility.
4. Critically examine the nature of man-environment relation and interaction with reference to human settlement types and patterns.

Module	Content	Hours
Module -1	**Population Geography -**	12
	Meaning, Definitions, Scope and nature of populationgeography Global Population size and growth, Malthus Theory,Demographic Transition Theory Over, Under and Optimum Population Population Policies in the world – Social Well being,Quality of Life	

Module -2	**Population Dynamics**	10
	Fertility – Measures and Distribution Mortality – Measures and Distribution Migration – Types, Causes and Consequences	
Module -3	**Settlement Geography**	10
	Meaning, Definitions, nature and importance of settlementgeography, Origin of settlement, influencing factors Site and situation of settlement – Stable and Unstable settlement	
Module -4	**Classification of Settlements- Rural and Urban Settlements**	10
	Rural Settlement – Types, Pattern, Functions Rural-Urban Continuum and Fringe Urban Settlement - Definition of urban place, Hierarchy, Functional classification of towns, Concept of Urban morphology. Primate City, Rank Size Rule	

References:

1. Alan Bowman and Andrew Wilson (2011), Settlement, Urbanization, and Population, Oxford UniversityPress, UK.
2. Chandna R.C (2011), Geography of Population, Kalyani publishers, Bangalore.
3. Izzi Howell (2019), Population and Settlement Geography (Geographics), Franklin Watts, UK.
4. John Pallister (2004), GCSE Geography: Human - Population and Settlement, Hodder Education Group,UK.
5. Majid Husain (2011) Human Geography, Rawat Publication, Jaipur.
6. Prithvish Nag, Debnath (2021), Population Geography, BharatiPrakashan, Bangalore.
7. Rama Yagya Singh (1994), Geography of Settlement, Rawat Publications, Jaipur
8. Sumita Ghosh (1998), Introduction to Settlement Geography, Orient Longman, Hyderabad.

DEPARTMENT OF GEOGRAPHY

MODEL QUESTION PAPER

B.A GEOGRAPHY

(For I, II, III, IV, V AND VI semesters)

Time: 2 Hours **Max. Marks: 60**

Part-A

I. Answer any FOUR of the following questions
4x3=12

1)… ……

2)……

3)……

4)……

5)……

6)……

Part-B

II. Answer any THREE of the following questions
3x6=18

7)……

8)……

9)……

10)……

11)……

Part –C

III. Answer any THREE of the following questions
3x10=30

12)……

13)……

14)……

15)……

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DEPARTMENT OF GEOGRAPHY

Revised Syllabus for Undergraduate (UG)
CBCS scheme - 2017-18

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY

ROAD, MYSURU-25 DEPARTMENT OF GEOGRAPHY

PROFORMA OF INSTRUCTIONS AND EXAMINATION FOR BA PROGRAMME IN

GEOGRAPHY (CBCS) DURATION OF THE COURSE: 3YEARS (6 SEMESTER)

PROGRAMME: BA EG PROGRAMME CODE: BA11 (2017-18)

Year	SEM	Course code & Core course	Title of the paper	L + P hours per week	L:T:P	Total Credit	Total hours		Percentage			Maximum Marks in exam/Assessment			Exam Duration	
							Th	Pr	Th	Pr	IA	Th	Pr	IA	Th	Pr
I BA	I	**DLA23011** DSC-I :Theory	Physical Geography	4	04:00:02	**6**	60	60	50	20	30	70	70	30	3h	3h
		DLA23311 DSC-I: Pract-I	Contour diagrams and meteorological instruments	4												
	II	**DLB23011** DSC-II: Theory	Human Geography	4	04:00:02	**6**	60	60	50	20	30	70	70	30	3h	3h
		DLB23311 DSC-II: Pract-II	Interpretation of Topographical Maps and Indian Daily Weather Maps	4												
II BA	III	**DLC23011** DSC-III:Theory	General Cartography	4	04:00:02	**6**	60	60	50	20	30	70	70	30	3h	3h
		DLC23311 DSC-III:PractIII	Map Projection	4												
	IV	**DLD23011** DSC-IV: Theory	Environmental Geography	4	04:00:02	**6**	60	60	50	20	30	70	70	30	3h	3h
		DLD23311 DSC-IV:PractIV	Statistical Methods in Geography	4												

III BA	V		**Choose any one**	4												
		DSE-V: Theory														
		DLE23011(A)/	DSE- A: Geography of India		04:00:02	**6**	60	60	50	20	30	70	70	30	3h	3h
		DLE23011(B)	DSE- B: Economic Geography													
		DLE23711 DSE- V:Pract-V	Fundamentals of GIS	4												
		SEC	**Choose any one**													
		DLE23211(A)/	SEC-A : Regional Planning and Development													
		DLE23211 (B)	SEC-B: Remote Sensing and GPS Based Project Report	4	04:00:00	**4**	60	-	70	-	30	70	-	30	3h	--
		GE 1	Regional Geography of India	4												
		DLE23411														
		DLE23711 GE-1 V:Pract-I	Computer Mapping	4	04:00:02	**6**	60	60	50	20	30	70	70	30	3h	3h
	VI	Theory	**Choose any one**	4												
		DSE-VI:														
		DLF23011(A)/	DSE- A: Disaster Management		04:00:02	**6**	60	60	50	20	30	70	70	30	3h	3h
		DLF23011(B)	DSE -B :Geography of Tourism													
		DLF23711	Computer Mapping and GPS Surveying	4												
		DSE-VI:PractVI														
		SEC	**Choose any one**	4												
		DLF23211(A)/	SEC-A : GIS Based Project Report													
		DLF23211(B)	SEC-B: Field Techniques and Survey Based Project Report		04:00:00	**4**	60	-	70	-	30	70	-	30	3h	--
		GE-2	Regional Geography of India	4												
		DLF23411														
		DLF23711 GE-2 VI:Pract-I	Computer Mapping	4	04:00:02	**6**	60	60	50	20	30	70	70	30	3h	3h
				56												

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY

ROAD, MYSURU-25 DEPARTMENT OF GEOGRAPHY

PROFORMA OF INSTRUCTIONS AND EXAMINATION FOR BA PROGRAMME IN

GEOGRAPHY (CBCS) DURATION OF THE COURSE: 3YEARS (6 SEMESTER)

PROGRAMME: BA KG PROGRAMME CODE:BA13 (2017-18)

Year	Sem	Course code & Core course	Title of the paper	L + P hours per week	L:T:P	Total Credit	Total hours		Percentage			Maximum Marks in exam/Assessment			Exam Duration	
							Th	Pr	Th	Pr	IA	Th	Pr	IA	Th	Pr
I BA	I	**DLA23013** DSC-I :Theory	Physical Geography	4	04:00:02	**6**	60	60	50	20	30	70	70	30	3h	3h
		DLA23313 DSC-I: Pract-I	Contour diagrams and meteorological instruments	4												
	II	**DLB23013** DSC-II: Theory	Human Geography	4	04:00:02	**6**	60	60	50	20	30	70	70	30	3h	3h
		DLB23313 DSC-II: Pract-II	Interpretation of Topographical Maps and Indian Daily Weather Maps	4												
II BA	III	**DLC23013** DSC-III:Theory	General Cartography	4	04:00:02	**6**	60	60	50	20	30	70	70	30	3h	3h
		DLC23313 DSC-III:PractIII	Map Projection	4												
	IV	**DLD23013** DSC-IV: Theory	Environmental Geography	4	04:00:02	**6**	60	60	50	20	30	70	70	30	3h	3h
		DLD23313 DSC-IV:PractIV	Statistical Methods in Geography	4												

III BA	V		**Choose any one**	4												
		DSE-V: Theory														
		DLE23013(A)/	DSE- A: Geography of India		04:00:02	**6**	60	60	50	20	30	70	70	30	3h	3h
		DLE23013(B)	DSE- B: Economic Geography													
		DLE23713 DSE- V:Pract-V	Fundamentals of GIS	4												
		SEC	**Choose any one**													
		DLE23213(A)/	SEC-A : Regional Planning and Development													
		DLE23213 (B)	SEC-B: Remote Sensing and GPS Based Project Report	4	04:00:00	**4**	60	-	70	-	30	70	-	30	3h	--
		GE 1 **DLE23413**	Regional Geography of India	4												
		DLE23713 GE-1 V:Pract-I	Computer Mapping	4	04:00:02	**6**	60	60	50	20	30	70	70	30	3h	3h
	VI	Theory	**Choose any one**	4												
		DSE-VI:														
		DLF23013(A)/	DSE- A: Disaster Management		04:00:02	**6**	60	60	50	20	30	70	70	30	3h	3h
		DLF23013(B)	DSE -B :Geography of Tourism													
		DLF23713 DSE-VI:PractVI	Computer Mapping and GPS Surveying	4												
		SEC	**Choose any one**	4												
		DLF23213(A)/	SEC-A : GIS Based Project Report													
		DLF23213(B)	SEC-B: Field Techniques and Survey Based Project Report		04:00:00	**4**	60	-	70	-	30	70	-	30	3h	--
		GE-2 **DLF23413**	Regional Geography of India	4												
		DLF23713 GE-2 VI:Pract-I	Computer Mapping	4	04:00:02	**6**	60	60	50	20	30	70	70	30	3h	3h
				56												

Programme Outcome

After completing the graduation in B A (EG) the students are able to:

PO1. Explain, graph, and analyze key economics models

PO2. Understand current events and evaluate specific policy proposals

PO3. To address problem that do not have clear economic solutions

PO4. Develop critical and quantitative thinking skills

PO5. Communicate effectively in written, oral and graphical form about specific issues

PO6. Apply economic analysis to everyday problems in real world situations

PO7. Understand and appreciate relationship between man and Environment

PO8. Read, interpret, and generate maps and other geographic representations

PO9. To extract, analyze, and present information from a spatial perspective

PO10. Understand physical-geographic processes, global distribution of Landforms and ecosystems

PO11. The role of physical environment on human population

PO12. Develop the ethical aptitudes and dispositions necessary to acquire and hold Leadership positions in industry, government, and professional organizations

Programme Outcome

After completing the graduation in B A (KG) the students will:

PO1. Develop human values and a sense of social service

PO2. Become a responsible and dutiful citizen.

PO3 Abel to enhance critical temper and creative ability

PO4. Understand and appreciate relationship between man and Environment.

PO5. Read, interpret, and generate maps and other geographic representations

PO6. Understand physical- geographic processes, the global distribution of landforms and Ecosystems

PO7.Role of the physical environment on human populations

Programme Specific Outcome

On Completion of BA (EG) students will:

PSO1. Understand theoretical and practical aspects of Economics and Geography

PSO2. Evaluate Economic behavior inconsonance with Geographical factors

PSO3. Suggest the policy makers about desirable changes to be made in Micro and Macro

Economic issues based on geographical factors

PSO4. Gain ability to understand the economic problems in Geographical indicators

PSO5. Able to offer palatable solutions for economic and geographical challenges

PSO6. Attain Proficiency to analyze the economic decision of Government and non-Govt.

Entities that correlate with Geographical factors

PSO7. Gain requisite knowledge to evaluate land use pattern and demographical profile

PSO8. Apply GIS for understanding Market situation, Transport problem change in

Weather Condition, Cropping Pattern, and Natural Calamities and so on

Programme Specific Outcome

On Completion of BA (KG) students will:

PSO 1: Know more specific terminologies along with its etymology

PSO2: Know the changes in the differences in formation of society and their culture

PSO3: Help to understand different races, Society, and culture.

PSO4 Understand the relationship between man and environment

PSO6. Understand in simple language environmental problems their cause, Effect and Remedies.

PSO7. Help the students to pursue higher studies and even in research

PSO8 Helpful for competitive examinations

PSO9. Students may help to guide agricultural activities, fertility of soils, their characteristics,

Climatic condition, in regional language

DLE23011 (A) / DLE23013 (A)

V – SEMSETER

Geography V: GEOGRAPHY OF INDIA

Course outcome

CO 1. Deliberate in depth physical stinting of India

CO 2.Write down in details with examples Irrigation system of India

CO 3. Identify in depth population study of India

CO 4. Learn in depth resources base study of India

CO 5. Identify the characteristics of economic study of India

UNIT	No. of Hours
1. Location, size and extent of India – Relief features- Drainage system – Climate	15
2. Irrigation – Types, multipurpose river valley projects – DVC, Bhakra- Nangal, Alamatti	10
3. Population – Size and Growth since 1901, Population Density and Distribution, Literacy, Sex Ratio.	10
4. Resource Base –Livestock (cattle & fisheries),Power (Coal,& hydroelectricity) Minerals (iron ore and bauxite).	10
5. Economy – Agriculture (Rice, Wheat, Sugarcane, Tea, Cotton); Industries (Cotton Textile, Iron-Steel, Automobile), Transportation Modes (Road and Rail).	15

References:

1. Hussain M., 1992: G*eography of India*, Tata McGraw Hill Education.
2. Mamoria C. B., 1980: *Economic and Commercial* G*eography of India*, Shiva Lal Agarwala.
3. Miller F. P., Vandome A. F. and McBrewster J., 2009: *Geography of India: Indo-Gangetic Plain, Thar Desert, Major Rivers of India, Climate of India and Geology of India* - Alphascript Publishing.
4. Nag P. and Sengupta S., 1992: G*eography of India*, Concept Publishing.
5 Pichamuthu C. S., 1967: *Physical Geography of India*, National Book Trust.
6 Sharma T. C. and Coutinho O., 1997: *Economic and Commercial* G*eography of India*, Vikas Publishing.
7. Singh Gopal, 1976: *A* G*eography of India*, Atma Ram.
8. Spate O. H. K. and Learmonth A. T. A., 1967: *India and Pakistan: A General and Regional Geography*,

DLE23011 (B) / DLE23013 (B)

V–SEMSTER

GEOGRAPHY V: ECONOMIC GEOGRAPHY

Course outcome

CO 1. Identify the classification and characteristics of concepts of economic geography

CO 2. Understand the characteristics of locational theories

CO 3 .Understand in depth study of primary activities

CO 4. Learn the details of study of secondary activities

CO 5. Write down in details with examples study of tertiary and quaternary activities

UNIT	No. of Hours
1. Definition, Approaches and Fundamental Concepts of Economic Geography; Patterns of Development.	12
2. Locational Theories – Agriculture (Von Thunen) and Industrial (Weber).	12
3. Primary Activities – Intensive Subsistence Farming, Commercial Grain Farming, Plantation, Commercial Dairy Farming, Commercial Fishing, and Mining (iron ore, coal and petroleum).	12
4. Secondary Activities – Cotton Textile Industry, Petro-Chemical Industry, Major Manufacturing Regions.	12
5. Tertiary and Quaternary Activities – Modes of Transportation, Patterns of International Trade, and Information and Communication Technology Industry.	12

Reading List

1. Alexander J. W., 1963: *Economic Geography*, Prentice-Hall Inc., Englewood Cliffs, New Jersey.
2. Bagchi-Sen S. and Smith H. L., 2006: *Economic Geography: Past, Present and Future*, Taylor and Francis.
3. Coe N. M., Kelly P. F. and Yeung H. W., 2007: *Economic Geography: A Contemporary Introduction*, Wiley-Blackwell.
4. Combes P., Mayer T. and Thisse J. F., 2008: *Economic Geography: The Integration of Regions and Nations*, Princeton University Press.
5. Durand L., 1961: *Economic Geography*, Crowell.
6. Hodder B. W. and Lee R., 1974: *Economic Geography*, Taylor and Francis.
7. Wheeler J. O., 1998: *Economic Geography*, Wiley.
8. Willington D. E., 2008: *Economic Geography*, Husband Pres

DLE23711 / DLE23713

V– SEMESTER

Practical V: FUNDAMENTALS OF G.I.S

UNIT			No. of Hours
1	a)	Meaning, definitions, components and importance of GIS	20
	b)	Spatial entities – Point, line and polygon Sources of spatial data- Census, Topographical Maps, Aerial Photographs and Satellite Imageries	
2	a)	Spatial Data Structure Raster and vector data Structures Linking spatial and non spatial data	20
	b)	Introduction to MapInfo software	
3	a)	Geo – referencing , Choice of map projection – Digitization, Attaching attribute data (Creating data base), Editing, Map layout, Thematic map	20

References:

1. Burrough P.A. : Geographical Information Systems for Land Resources
2. Maguire D. J. : Computers in Geography
3. Star J. C and J.E. : Geographic Information Systems
4. Internet : GIS. Development
5. Heywood : Introduction to GIS, 2002.
6. Mahesh : Introduction to GSI Shivalingappa Chandrashekar :

DLE23211 (A) / DLE23213 (A)

V – SEMSETER

Geography VI: REGIONAL PLANNING AND DEVELOPMENT

Course outcome

CO 1. Deliberate the details of concept of regional planning and development

CO 2. Write down in details with application, if applicable, characteristics and delineation of planning region

CO 3. Write down the characteristics of regionalization of India for planning

CO 4. Deliberate the details of models for regional planning

CO 5. Learn in depth backward regions and regional plans

UNIT	No. of Hours
1. Concept, Need and Types of Regional Planning.	8
2. Characteristics and Delineation of Planning Region.	10
3. Regionalization of India for Planning (Agro Ecological Zones).	12
4. Models for Regional Planning: Growth Pole Theory; Core Periphery Model and Growth Foci Concept in Indian Context	
5 Backward Regions and Regional Plans- Special Area Development Plans in India; DVC-The Success Story and the Failures; NITI Aayog.	15

References:

1. Blij H. J. De, 1971: Geography: Regions and Concepts, John Wiley and Sons.
2. Claval P.l, 1998: An Introduction to Regional Geography, Blackwell Publishers, Oxford and Massachusetts.
3. Friedmann J. and Alonso W. (1975): Regional Policy - Readings in Theory and Applications, MIT Press, Massachusetts.
4. Gore C. G., 1984: Regions in Question: Space, Development Theory and Regional Policy, Methuen, London.
5. Gore C. G., Köhler G., Reich U-P. and Ziesemer T., 1996: Questioning Development; Essays on the Theory, Policies and Practice of Development Intervention, Metropolis- Verlag, Marburg.
6. Haynes J., 2008: Development Studies, Polity Short Introduction Series.
7. Johnson E. A. J., 1970: The Organization of Space in Developing Countries, MIT Press,
8. Peet R., 1999: Theories of Development, The Guilford Press, New York
9. UNDP 2001-04: Human Development Report, Oxford University Press
10. World Bank 2001-05: World Development Report, Oxford University Press, New

DLE23211 (B) / DLE23213 (B)

V – SEMESTER

Geography VI: REMOTE SENSING AND GPS BASED PROJECT REPORT

Course Outcome

CO 1. Understand the characteristics of concept of remote sensing

CO 2. Identify in details with examples study of aerial photography

CO 3. Specify the details of principals of remote sensing satellites

CO 4. Write down the classification and characteristics of interpretation and application of remote sensing

CO 5. Deliberate in details with application, if applicable, study of global positing system

UNIT	No. of Hours
1. Remote Sensing: Definition, Development, Platforms and Types.	12
2. Aerial Photography: Principles, Types and Geometry.	12
3. Satellite Remote Sensing: Principles, EMR Interaction with Atmosphere and Earth Surface; Satellites (Land sat and IRS) and Sensors.	12
4. Interpretation and Application of Remote Sensing: Land use/ Land Cover.	12
5. Global Positioning System (GPS) – Principles and Uses	12

Practical Record: A project file consisting of five exercises will be done from aerial photos, satellite images (scale, orientation and interpretation) and GPS field survey.

Reading List

1. Campbell J. B., 2007: Introduction to Remote Sensing, Guildford Press.
2. Jensen J. R., 2004: Introductory Digital Image Processing: A Remote Sensing Perspective, Prentice Hall.
3. Joseph, G. 2005: Fundamentals of Remote Sensing, United Press India.
4. Lillesand T. M., Kiefer R. W. and Chipman J. W., 2004: Remote Sensing and Image Interpretation, Wiley. (Wiley Student Edition).
5. Nag P. and Kudra, M., 1998: Digital Remote Sensing, Concept, New Delhi.
6. Rees W. G., 2001: Physical Principles of Remote Sensing, Cambridge University Press.
7. Singh R. B. and Murai S., 1998: Space-informatics for Sustainable Development, Oxford and IBH Pub.
8. Wolf P. R. and Dewitt B. A., 2000: Elements of Photogrammetry: With Applications in GIS, McGraw-Hill.

DLE23411

GENERIC ELECTIVES - I
V – SEMESTER
GEOGRAPHY V: REGIONAL GEOGRAPHY OF INDIA

Course outcome

CO 1.Identify the characteristics of size and extent of India

CO 2. Understand the classification and characteristics of multipurpose river

CO 3.Identify the classification and characteristics of Population density and distribution

CO 4. Learn in details with examples power resources of India

CO 5. Specify the characteristics of Transportation modes

UNITS	No. of Hours
1. Location, size and extent of India – Relief features- Drainage system – Climate	15
2. Irrigation – Types, multipurpose river valley projects – DVC, Bhakra- Nangal, Alamatti	10
3. Population – Size and Growth since 1901, Population Density and Distribution, Literacy, Sex Ratio.	10
4. Resource Base –Livestock (cattle & fisheries),Power (Coal,& hydroelectricity) Minerals (iron ore and bauxite).	10
5. Economy – Agriculture (Rice, Wheat, Sugarcane, Tea, Cotton); Industries (Cotton Textile, Iron-Steel, Automobile), Transportation Modes (Road and Rail).	15

Reference:

1. Hussain M., 1992: Geography of India, Tata McGraw Hill Education.
2. Mamoria C. B., 1980: Economic and Commercial Geography of India, Shiva Lal Agarwala.
3. Miller F. P., Vandome A. F. and McBrewster J., 2009: Geography of India: Indo- Gangetic Plain,
Thar Desert, Major Rivers of India, Climate of India, Geology of India, Alphascript Publishing
4. Nag P. and Sengupta S., 1992: Geography of India, Concept Publishing
Pichamuthu C. S., 1967: Physical Geography of India, National Book Trust.
5 Sharma T. C. and Coutinho O., 1997: Economic and Commercial Geography of India, Vikas Publishing.
6 Singh Gopal, 1976: A Geography of India, Atma Ram.
7 Spate O. H. K. and Learmonth A. T. A., 1967: India and Pakistan: A General and Regional Geography,

DLE23711

GENERIC ELECTIVES - I

V – SEMESTER

PRACTICAL V: COMPUTER MAPPING

UNIT		No. of Hours
1.	Introduction to Computer : Generation of Computers, Hardware and Software Components	20
2.	Computer graphics : Creating Data base in computer, creation of Line, Bar and Pie diagrams. Thematic Maps - Choro chromatic and Schematic Maps	20
3.	GPS - Meaning, Function and its applications.	10
4.	Tour report / Factory visit	10

References:

1. Singh L.R. : Fundamentals of Practical Geography, Sharadha Pustaka Bhavan, Alahabad, 2006
2. Dr. M.A. Siddaqui : Introduction to Geographical Information System, Sharadha Pustaka Bhavan, Alahabad, 2006
3. Chang : Introduction to GIS, Tata McGraw Hill W, New Delhi.

DLF23011 (A) / DLF23013 (A)

VI – Semester
Geography VI: DISASTER MANAGEMENT

Course Outcome

CO 1. Identify in details with application, if applicable, hazards and disasters concepts

CO 2. Specify the characteristics of flood, landslide, drought are in India

CO 3. Write down in details with examples earthquake tsunami and cyclone are in India

CO 4. Identify the classification and characteristics of human induced disasters

CO 5. Learn in details with examples response and mitigation to disaster

UNIT	No. of Hours
1. Hazards, Risk, Vulnerability and Disasters: Definition and Concepts.	12
2. Disasters in India: (a) Causes, Impact, Distribution and Mapping: Flood, Landslide, Drought.	12
3. Disasters in India: (b) Causes, Impact, Distribution and Mapping: Earthquake, Tsunami and Cyclone.	12
4. Human induced disasters: Causes, Impact, Distribution and Mapping.	12
5. Response and Mitigation to Disasters: Mitigation and Preparedness, NDMA and NIDM; Indigenous Knowledge and Community-Based Disaster Management; Do's and Don'ts During Disasters	12

Reading List

1. Government of India. (1997) Vulnerability Atlas of India. New Delhi, Building Materials & Technology Promotion Council, Ministry of Urban Development, Government of India.
2. Kapur, A. (2010) Vulnerable India: A Geographical Study of Disasters, Sage Publication, New Delhi.
3. Modh, S. (2010) Managing Natural Disaster: Hydrological, Marine and Geological Disasters, Macmillan, Delhi.
4. Singh, R.B. (2005) Risk Assessment and Vulnerability Analysis, IGNOU, New Delhi. Chapter 1, 2 and 3
5. Singh, R. B. (ed.), (2006) Natural Hazards and Disaster Management: Vulnerability and Mitigation, Rawat Publications, New Delhi.
6. Sinha, A. (2001). Disaster Management: Lessons Drawn and Strategies for Future, New United Press, New Delhi.
7. Stoltman, J.P. et al. (2004) International Perspectives on Natural Disasters, Kluwer Academic Publications. Dordrecht.
8. Singh Jagbir (2007) "Disaster Management Future Challenges and Oppurtunities", 2007. Publisher- I.K. International Pvt. Ltd. S-25, Green Park Extension, Uphaar Cinema Market, New Delhi, India (www.ikbooks.com).

DLF23011 (B) / DLF23013 (B)

VI – SEMESTER
Geography VI: GEOGRAPHY OF TOURISM

Course outcome

CO 1. Learn in depth geography of tourism concepts

CO 2. Specify in details with examples types of tourism

CO 3. Learn in details with application, if applicable, recent trends of tourism

CO 4. Identify in details with application, if applicable, impact of tourism

CO 5. Understand the details of tourism in India

UNIT	No. of Hours
1. Origin, Development and significance of Tourism – factors influencing on tourism	10
1. Type of Tourism: Nature Tourism, Cultural Tourism, Medical Tourism, Pilgrimage	15
2. Recent Trends of Tourism: International and Regional; Domestic (India); Eco- Tourism, Sustainable Tourism, Meetings, Incentives, Conventions And Exhibitions (MICE), Carrying capacity of Tourism	15
3. Impact of Tourism: Economy; Environment; Society	10
4. Tourism in India: Tourism Infrastructure; Case Studies of Himalaya, Desert and Coastal and Heritage; National Tourism Policy	10

Reference:

1. Dhar, P.N. (2006) International Tourism: Emerging Challenges and Future Prospects. Kanishka, New Delhi.
2. Hall, M. and Stephen, P. (2006) Geography of Tourism and Recreation – Environment, Place and Space, Routledge, London.
3. Kamra, K. K. and Chand, M. (2007) Basics of Tourism: Theory, Operation and Practise, Kanishka Publishers, Pune.
4. Page, S. J. (2011) Tourism Management: An Introduction, Butterworth-Heinemann- USA.
5. Raj, R. and Nigel, D. (2007) Morpeth Religious Tourism and Pilgrimage Festivals Management: An International perspective by, CABI, Cambridge, USA, www.cabi.org.
6. Tourism Recreation and Research Journal, Center for Tourism Research and Development, Lucknow
7. Singh Jagbir (2014) "Eco-Tourism" Published by - I.K. International Pvt. Ltd. S-25, Green Park Extension, Uphaar Cinema Market, New Delhi, India(www.ikbooks.com).

DLF23711 / DLF23713

VI – SEMESTER
Practical VI: COMPUTER MAPPING AND GPS SURVEYING

UNIT		No. of Hours
1.	Introduction to Computer : Generation of Computers, Hardware and Software Components	20
2.	Computer graphics : Creating Data base in computer, creation of Line, Bar and Pie diagrams. Thematic Maps - Choro chromatic and Schematic Maps	20
3.	GPS Surveying: Concepts, Segments and applications, plotting way Points by using map source software.	20
4.	Tour report / Factory visit	

References:

1. Singh L.R. : Fundamentals of Practical Geography, Sharadha Pustaka Bhavan, Alahabad, 2006
2. Dr. M.A. Siddaqui : Introduction to Geographical Information System, Sharadha Pustaka Bhavan, Alahabad, 2006
3. Chang : Introduction to GIS, Tata McGraw Hill W, New Delhi.

DLF23211 (A) / DLF23213 (A)

VI – SEMESTER

Geography VI: GIS BASED PROJECT REPORT

Course Outcome

CO 1. Identify the characteristics of study of GIS
CO 2. Specify in depth GIS data structures
CO 3. Write down in depth GIS data analysis
CO 4. Deliberate in details with examples Application of GIS in Land use
CO 5. Identify the classification and characteristics of Application of GIS in Urban and Forest monitoring

UNIT	No. of Hours
1. Geographical Information System (GIS): Definition and Components.	12
2. GIS Data Structures: Types (spatial and Non-spatial), Raster And Vector Data Structure.	12
3. GIS Data Analysis: Input; Geo-Referencing; Editing and Output; Overlays.	12
4. Application of GIS in Land Use/Land Cover Mapping.	12
5. Application of GIS in Urban Sprawl and Forests Monitoring	12

Practical Record: A project file consisting of 5 exercises on using any GIS Software on above mentioned themes.

Reference:

1. Bhatta, B. (2010) Analysis of Urban Growth and Sprawl from Remote Sensing, Springer, Berlin Heidelberg.41
2. Burrough, P.A., and McDonnell, R.A. (2000) Principles of Geographical Information System-Spatial Information System and Geo-statistics. Oxford University Press
3. Chauniyal, D.D. (2010) Sudur Samvedan evam Bhogolik Suchana Pranali, Sharda Pustak Bhawan, Allahabad
4. Heywoods, I., Cornelius, S and Carver, S. (2006) An Introduction to Geographical Infromation system. Prentice Hall.
5. Jha, M.M. and Singh, R.B. (2008) Land Use: Reflection on Spatial Informatics Agriculture and Development, New Delhi: Concept.
6. Nag, P. (2008) Introduction to GIS, Concept India, New Delhi.
7. Sarkar, A. (2015) Practical geography: A systematic approach. Orient Black Swan Private Ltd., New Delhi
8. Singh, R.B. and Murai, S. (1998) Space Informatics for Sustainable Development, Oxford and IBH, New Delhi.

DLF23211 (B) / DLF23213 (B)

VI – SEMESTER

Geography VI: FIELD TECHNIQUES AND SURVEY BASED PROJECT REPORT

Course outcome

CO 1. Understand the characteristics of field techniques
CO 2. Deliberate in details with application, if applicable, case study rural and urban
CO 3. Specify in details with examples field work in Geographical studies
CO 4. Understand in details with examples preparation of questionnaires
CO 5. Learn the details of designing the field report

UNIT **No. of Hours**

1. Field Work in Geographical Studies – Role, Value and Ethics of Field-Work 10
2. Defining the Field and Identifying the Case Study – Rural /Urban /Physical /Human / Environmental.
10
3. Field Techniques – Merits, Demerits and Selection of the Appropriate Technique; Observation (Participant / Non Participant).
12
4. Questionnaires (Open/ Closed / Structured / Non-Structured); Interview with 16
Special Focus on Focused Group Discussions; Space Survey (Transects and Quadrants, Constructing a Sketch).

5. Designing the Field Report – Aims and Objectives, Methodology, Analysis, Interpretation and Writing the Report.
12

Practical Record

1. Each student will prepare an individual report based on primary and secondary data collected during field work.
2. The duration of the field work should not exceed 10 days.
3. The word count of the report should be about **8000 to 12,000** excluding figures, tables, photographs, maps, references and appendices.
4. One copy of the report on A 4 size paper should be submitted in soft binding.

References:

1. Creswell J., 1994: *Research Design:* Qualitative and Quantitative Approaches Sage Publications.
2. Dikshit, R. D. 2003. The Art and Science of Geography: Integrated Readings. Prentice-Hall of
India, New Delhi.
3. Evans M., 1988: "Participant Observation: The Researcher as Research Tool" in *Qualitative* Methods in Human Geography, eds. J. Eyles and D. Smith, Polity.
4. Mukherjee, Neela 1993. Participatory Rural Appraisal: Methodology and Application.

Concept
Publs. Co., New Delhi.
5 Mukherjee, Neela 2002. Participatory Learning and Action: with 100 Field Methods. Concept Publs. Co.,
New Delhi
6. Robinson A., 1998: "*Thinking Straight and Writing That Way*", in *Writing Empirical Research*
Reports: A Basic Guide for Students of the Social and Behavioral Sciences, eds. by F. Pryczak and R. Bruce Pryczak, Publishing: Los Angeles.
7. Special Issue on "Doing Fieldwork" *The Geographical Review* 91:1-2 (2001).
8. Stoddard R. H., 1982: *Field Techniques and Research Methods in Geography*, Kendall/Hunt.

DLF23411

GENERIC ELECTIVES II
VI – SEMESTER
Geography VI: REGIONAL GEOGRAPHY OF INDIA

Course outcome

CO 1. Identify the characteristics of size and extent of India

CO 2. Understand the classification and characteristics of multipurpose river

CO 3. Identify the classification and characteristics of Population density and distribution

CO 4. Learn in details with examples power resources of India

CO 5. Specify the characteristics of Transportation modes

UNITS	No. of Hours
1. Location, size and extent of India – Relief features- Drainage system – Climate	15
2. Irrigation – Types, multipurpose river valley projects – DVC, Bhakra- Nangal, Alamatti	10
3. Population – Size and Growth since 1901, Population Density and Distribution, Literacy, Sex Ratio.	10
4. Resource Base –Livestock (cattle & fisheries),Power (Coal,& hydroelectricity) Minerals (iron ore and bauxite).	10
5. Economy – Agriculture (Rice, Wheat, Sugarcane, Tea, Cotton); Industries (Cotton Textile, Iron-Steel, Automobile), Transportation Modes (Road and Rail).	15

Reference:

1. Hussain M., 1992: G*eography of India*, Tata McGraw Hill Education.
2. Mamoria C. B., 1980: *Economic and Commercial* G*eography of India*, Shiva Lal Agarwala.
3. Miller F. P., Vandome A. F. and McBrewster J., 2009: *Geography of India: Indo- Gangetic Plain,*
Thar Desert, Major Rivers of India, Climate of India, Geology of India, Alphascript Publishing
4. Nag P. and Sengupta S., 1992: G*eography of India*, Concept Publishing
Pichamuthu C. S., 1967: *Physical Geography of India*, National Book Trust.
7 Sharma T. C. and Coutinho O., 1997: *Economic and Commercial* G*eography of India*, Vikas Publishing.
8 Singh Gopal, 1976: *A* G*eography of India*, Atma Ram.
7 Spate O. H. K. and Learmonth A. T. A., 1967: *India and Pakistan: A General and Regional Geography*,

DLF23711

GENERIC ELECTIVES - II

VI – SEMESTER
Practical VI: COMPUTER MAPPING

UNIT		No. of Hours
5.	Introduction to Computer : Generation of Computers, Hardware and Software Components	20
6.	Computer graphics : Creating Data base in computer, creation of Line, Bar and Pie diagrams. Thematic Maps - Choro chromatic and Schematic Maps	20
7.	GPS - Meaning, Function and its applications.	10
8.	Tour report / Factory visit	10

References:

1. Singh L.R. : Fundamentals of Practical Geography, Sharadha Pustaka Bhavan, Alahabad, 2006
2. Dr. M.A. Siddaqui : Introduction to Geographical Information System, Sharadha Pustaka Bhavan, Alahabad, 2006
3. Chang : Introduction to GIS, Tata McGraw Hill W, New Delhi.

DEPARTMENT OF GEOGRAPHY
MODEL QUESTION PAPER FOR CBCS SCHEME
B.A GEOGRAPHY
(For I, II, III, IV, V AND VI semesters)

Time: 3 Hours **Max. Marks: 70**

Part-A

I. Answer any five of the following questions. Answer should not exceed 50 words 5x2=10

1)……
2)……
3)……
4)……
5)……
6)……
7)……

Part-B

II. Answer any Six of the following questions. Answer should not exceed 100 words 6x5=30

8)……
9)……
10)……
11)……
12)……
13)……
14)……
15)……

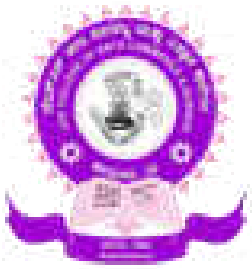
Part –C

III. Answer any Three of the following questions. 3x10=30

16)……
17)……

18)……
19)……
20)……

……..



JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE (AUTONOMOUS)
OOTY ROAD, MYSURU-25

DEPARTMENT OF HINDI

LANGUAGE - HINDI

SYLLABUS

NEP

2021-2022

CBCS

SCHEME OF STUDY & ASSESSMENT

INSTRUCTION

LANGUAGE HINDI

NEP AECC

PROGRAMME- BA

PR0GRAMME CODE: BA EG 31/HP 32/KG33/HE 34/JP 35

Semester	Course No	**Course code**	Title of the course	**Course type**	**Credits Pattern L:T: P**	**Total credits**	**Teaching Hrs/week**	**Assessment**				**Duration of Exam**
								C1	**C2**	**C3**	**TO**	
I	C1	FHA04034 FHA04035	Hindi Kahani sahetya Aur Vyakarna	AECC	2 : 1 : 0	03	4	20	20	60	100	2 ½
II	C2	FHB04034 FHB04035	Hindi Lagu upanyasa Our prayojan mulak Hindi	AECC	2 :1:0	03	4	20	20	60	100	2 ½

SCHEME OF STUDY & ASSESSMENT
INSTRUCTION

Language Hindi

NEP AECC

PROGRAMME: BSC

PR0GRAMME CODE: **BSC PC-31;PM -32; PE -33; CSM-34; PCS-35;BTZ -36;CBT -37;CZ -38;BZ -39;BTBC -40;MBBT -41;MBBC -42;**

Semester	Course No	**Course code**	Title of the course	**Course type**	**Credits Pattern L:T: P**	**Total credits**	**Teaching Hrs/week**	**Assessment**				**Duration of Exam**
								C1	**C2**	**C3**	**TO**	
I	C1	FSA04032 FSA04035 FSA04036 FSA04040 FSA04041	H FSA04032indi Kahani sahetya Aur Vyakarna	AECC	2 : 1 : 0	03	4	20	20	60	100	2 ½
II	C2	FSB04032 FSB04035 FSB04036 FSB04040 FSB04041	Hindi Lagu upanyasa Aur prayojan mulak Hindi	AECC	2 :1:0	03	4	20	20	60	100	2 ½

Programme: Bachelor of Arts
Economics and Geography
History and political science
Kannada and Geography
History and English
Journalism and English

Programme outcome:
After the completion of the graduation student are able to:
PO1-Understand culture and heritage
PO2- Manage business affairs
PO3-Create interest in literature
PO4 -Report and edit public events effectively
PO5-Develop reading writing communication and reasoning skills

Programme specific outcome:
After the completion of the Graduation Student are able to:
PSO1-Understand basic knowledge of Hindi grammar
PSO-2-Understand the History of short stories and how they are related with the society at large
PSO3-Avail job opportunity in translation

Programme: Bachelor of Science (Natural science & Physical science)
Physics and Chemistry
Physics and Mathematics
Physics and Electronics
Computer Science and Mathematics
Physics and Computer Science
Bio-Technology and Zoology
Chemistry and Bio-Technology
Chemistry and Zoology
Botany and Zoology
Bio-Technology and Bio-Chemistry
Micro-Biology and Bio-Technology
Micro-Biology and Bio-Chemistry

Programme outcome:
After the completion of the graduation student are able to:
PO1-Inculcate human values
PO2-Avail job opportunities in translation
PO3- Create interest in literature

Programme specific outcome:
After the completion of the Graduation Student are able to:

PSO1- Get information about the History ancient medieval and modern Hindi literature
PSO2-Develop research aptitude

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE (AUTONOMOUS)
OOTY ROAD, MYSURU-25

BA/BSC
I Semester
Language Hindi
Hindi Kahan sahetya aur Vyakarna

64hrs (4hrs/week**)** **3 credits, 4-hrs**

Course out come

After successful completion of this course students are able to

CO1 . Identify in details with examples kahani of 20th century
CO2. Write down in depth kahani of 20th century
CO3 . Deliberate in depth kahani of 20th century
CO4 . Specify the classification and characteristics of Hindi vykaran
CO5. Identify the characteristics of Hindi vykaran

UNIT-1: Kahani Ka saidanthik Adyayan
UNIT-1I: Kahani kirita-Dr.usha patak ,Dr,achala pande,(prescribed Lessons – 1-,4,)
UNIT-1II: Kahani kirita-Dr.usha patak ,Dr,achala pande,(prescribed Lessons – 5-,8,)

UNIT-IV : Hindi Vyakaran :Portions Prescribed :

1.Shabdabhed; a) Vyuthpatthi ki dristi se
b) Uthpatthi ki drishti se
c) Roopantar ki drishti se

2.Sangya : Paribhasha aur bhed
3. Sangya ke roopantar:
a) Ling - Paribhasha aur bhed
Ling parivarthan ke niyam
b) Vachan – Paribhasha aur bhed – Vachan parivarthan ke niyam
c) Karak – Paribhasha aur bhed
4. Sarvanaam : Paribhasha aur bhed
5. Visheshan – Paribhasha aur bhed

6. Kriya-Paribhasha aur bhed – Paribhasha aur bhed

7. Kal,prathya our upasrga

Reference

1. Saral Hindi Vyakaran –Pb. Prabhath Prakashan, # 4/19, Asaf Ali road,New Delhi-02
2. Parishkrith Hindi Vyakaran - Badarinath Kapur
3. Abhinav Hindi Vyakaran - Prof. N.Nagappa, Pb. Rajpal &sons, New Delhi
4. Shikshaarthi Hindi Vyakaran - Prof. N.Nagappa, Pb. Rajpal &sons, New Delhi
5. Sankshipta Hindi Vyakaran - Kamatha prasad Guru, Nagari Pracharini Sabha, kaashi.
6. Vyavaharik Hindi Vyakaran Tatha Rachana –Dr. Hardev Bahari, Lokabharathi prakashan,
   Allahabad -1

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JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE (AUTONOMOUS)
OOTY ROAD, MYSURU-25

BA/BSC
II Semester
Language Hindi
Hindi Lagu Upanyasa Aur Prayojan Mulak Hindi

64hrs (4hrs/week) **3 credits, 4-hrs**

Course out comes

After successful completion of this course students are able to
CO1. Learn in details with examples Novel- by kamaleshwra
CO2 Understand in details with examples Novel- by kamaleshwra
CO3. Understand the details of Novel- by kamaleshwra
CO4. Identify the classification and characteristics of Prayojan Mulak Hindi
CO5. Write down the characteristics of Prayojan Mulak Hindi

UNIT I : Hindi upanyasa ka vikasa krma
UNIT II : Kamaleshwra ka sahityaika yogadan
UNIT III : Kamaleshwra ki kali Andhi upanyas ka kathyagata visleshan

UNIT - IV : Hindi Vyakaran
Portions prescribed :
Alekan,Tippani,Sankshepana,prativedana,presa vigyapana

Reference

1. Saral Hindi Vyakaran –Pb. Prabhath Prakashan, # 4/19, Asaf Ali road,New Delhi-02
2 .Parishkrith Hindi Vyakaran - Badarinath Kapur
3. Abhinav Hindi Vyakaran - Prof. N.Nagappa, Pb. Rajpal &sons, New Delhi
4. Shikshaarthi Hindi Vyakaran - Prof. N.Nagappa, Pb. Rajpal &sons, New Delhi
5. Sankshipta Hindi Vyakaran - Kamatha prasad Guru, Nagari Pracharini Sabha, kaashi.
6 .Vyavaharik Hindi Vyakaran Tatha Rachana –Dr. Hardev Bahari, Lokabharathi prakashan, Allaha

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NEP SYLLBUS FOR UG PROGRAMMES

DEPARTMENT OF HINDI

Division of marks and Model Question Paper

LANGUAGE HINDI I , & II SEMESTERS of BA / BSC

Time : 2 ½ Hrs Max. Marks :60

QUESTION PAPER PATTERN

On.NO	Particulars			Marks	Total
	SECTION-A				
I	**O**bjective Type Questions (Compulsory)		**10 out of 10**	1	**10**
II	**Reference to** Context		**2out of 4**	**5**	**10**
	SECTION-B				
III	**S**hort Answer Questions		**4 out of 7**	**05**	**20**
	SECTION-C				
IV	**Essay** type Answer Questions		**2out of 4**	**10**	**20**
		Total			**60**
Internal	**IA Test**			**20**	**40**
Assessment	**Assignment**			**20**	
		Total			**100**

INTERNAL ASSESSMENT - 40 MARKS

NEP SYLLBUS FOR UG PROGRAMMES

DEPARTMENT OF HINDI

Division of marks and Model Question Paper

LANGUAGE HINDI I , & II SEMESTERS of BA / BSC

Time : 2 ½ Hrs Max. Marks : 60

I) 10 objective type questions on Vyakaran /prayojan moolak Hindi / Anuvad as the case may be, 01 mark each 01x10

II) Two short answer questions with internal choice on Vyakaran /prayojan moolak Hindi / Anuvad as the case may be, 5 marks each 05 x 2 = 10

III) One Annotation question – four out of seven on the prescribed text book 05 marks each 05 x 4 = 20

IV)Total Main questions with internal choice on the prescribed text book 10 marks each 10 x 2 = 20

QUESTION PAPERPATTERN

SECTION-A

Main -I Objective type questions 01 x 10 =10

Main -II

Qn. 1. ..... 02 x 05 = 10

2

3

4

SECTION-B

Main - III 02 x05 = 20

Qn. 1,2,3,4,5,6,7

SECTION-C

Main- IV

Qn.1,2,3,4 02 x 10 = 20

INTERNAL ASSESSMENT - 40 MARKS

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JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE (AUTONOMOUS)
OOTY ROAD, MYSURU-25

DEPARTMENT OF HINDI

LANGUAGE - HINDI

SYLLABUS

CBCS

2019-2022

SCHEME OF STUDY & ASSESSMENT
INSTRUCTION

BA CBCS AECC
BA HEG 21/HEP 22/KEG23/HEE 24/JPE 25

Semester	Course Title	Course code	No of credits L: T: P: TO	Assessment C1	C2	C3	TO	Duration of Exam
III	Hindi Nataka aur Vanjya Hindi	ELC 05021 ELC 05022 ELC 05023 ELC 05024 ELC 05025	2 : 1 : 0: 03	15	15	70	100	03
IV	Hindi Kavya aur Anuvada Paribhashik Shabdavali	ELD 05021 ELD 05022 ELD 05023 ELD 05024 ELD 05025	2 : 1 : 0: 03	15	15	70	100	03

Semester	Course Title	Course code	No of credits L: T: P: TO	Assessment C1	C2	C3	TO	Duration of Exam
III	**Communicative Hindi**	ELC 30021 ELC 30022 ELC 30023 ELC 30024 ELC 30025	2 : 0 : 0: 02	7 ½	7 ½	35	50	02

BA CBCS SEC

SCHEME OF STUDY & ASSESSMENT INSTRUCTION
BSC
CBCS AECC

BSC-PCM 01/ PMCS 02/ PMCM 03/ PME 04 / CZBT 05/ BMBT 06 /BBM 07/ CBZ 08

Semester	**Course Title**	**Course code**	**No of credits L: T: P: TO**	**Assessment**				**Duration of Exam**
				C1	**C2**	**C3**	**TO**	
III	Hindi Nataka aur Vanjya Hindi	DMC 05001	2 : 1 : 0: 03	15	15	70	100	03
		DMC 05002						
		DMC 05003						
		DMC 05004						
		DMC 05005						
		DMC 05006						
		DMC 05007						
		DMC 05008						
IV	Hindi Kavya aur Anuvada Paribhashik Shabdavali	DMD 05001	2 : 1 : 0: 03	15	15	70	100	03
		DMD 05002						
		DMD 05003						
		DMD 05004						
		DMD 05005						
		DMD 05006						
		DMD 05007						
		DMD 05008						

Programme: Bachelor of Arts
History Economics and political science
Kannada Economics and Geography
Economics Economics and Geography
History Economics and English
Journalism political science and English

Programme outcome:

After the completion of the graduation student are able to:
PO1-Understand culture and heritage
PO2- Manage business affairs
PO3-Create interest in literature
PO4 -Report and edit public events effectively
PO5-Develop reading writing communication and reasoning skills

Programme specific outcome:

After the completion of the Graduation Student are able to:
PSO1-Understand basic knowledge of Hindi grammar
PSO-2-Understand the History of short stories and how they are related with the society at large
PSO3-Avail job opportunity in translation

Programme: Bachelor of Science (Natural science & Physical science)
Physics Chemistry and Mathematics
Physics Mathematics and Computer Science
Physics Mathematics Computer Maintenance
Physics mathematics and Electronics
Chemistry Zoology Biotechnology
Biochemistry Microbiology Biotechnology
Botany Biochemistry Microbiology
Chemistry Botany Zoology

Programme outcome:
After the completion of the graduation student are able to:
PO1-Inculcate human values
PO2-Avail job opportunities in translation
PO3- Create interest in literature

Programme specific outcome:
After the completion of the Graduation Student are able to:
PSO1- Get information about the History ancient medieval and modern Hindi literature
PSO2-Develop research aptitude

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE (AUTONOMOUS)
OOTY ROAD, MYSURU-25

ELC 050 21/22/23/24/25
DMC 05001/02/03/04/05/06/07/08

BA/BSC
III Semester
Language Hindi-AECC
Hindi Nataka aur Vanjya Hindi

60hrs (4hrs/week) 3 Credits

Course out comes

After successful completion of this course students are able to

CO1. Understand the characteristics of Hindi Natak
CO2 . Deliberate in details with application, if applicable, Hindi Natak -deep daan by Ramkumar varma
CO3 . Deliberate the characteristics of Hindi Natak -Red ke haddi by Jagadeshachandra mathur
CO4 . Understand the details of Hindi Natak -sukhe dale by Upendranath ashka
CO5. Write down in details with examples Hindi Natak -mai bee manav hu by Vishnu prabakar
CO6. Identify the details of Hindi Vanijya Hindi
CO7. Specify in depth Vanijya Hindi

UNIT A &B -EKanki Sapthak (1 to 6)

1.Deep daan
2.Reed ke hadde
3.Sukhi daal
4. mai bhe Manav hu
5. Ande ke chillke
6.Bahu ke Bida

UNIT C Vanijya Hindi

Portions Prescribed :

1. a. Patra Vyavahar ka Samanya Parichay tatha Mahatva
   b. Patron ke prakar
2. Vyavasaik patra Vyavahar :
   a. Bank Sambandhi Patra
   b. Beema Sambandhi Patra
   c. Pooch-Taach Sambandhi Patra
   d. Shikayati Sambandhi Patra
   e. Naukari Sambandhi Patra
   f. Pari patra
   g. Agency Sambandhi Patra
3. Alekhan - Uttam Alekhan ke gun
4. Sampreshan - uske Prakar
5. Sankshiptikaran - Sankshipt Lekhan ke Pradhan gun aur udaaharan

UNIT-3 Ekaanki ke Activities

1 Ekaanki aur Naatak ka antar samjhana
2 Ekaanki ke tatvon ke Aadhar par charcha karna
3 Ekaanki ka rangmanchan karana
4 Ekaanki mein prayukt vividh mukhya aur gaun rason ka parichay karana
5 Ekaankiyon ke kathya aur tathya par charcha karna

UNIT-4

Vaanijya Hindi ke Activities

1. vaanijya patron ke vibhinn prakaaron ko samjhana
2. vaanijya patron ke daanche par vishesh dhyan dena
3. Aalekh ki kala aur swarup ka parichay karaana.
4. sampreshan kala ka mahatva samjhana
5. Aadhunik samaaj mein sankshiptikaran ki Avashyakata par joor dena

Reference Books

1. Vyavasaik Sampreshan –Dr. Anup Chandra Bhayani Pb. Rajpal &sons, New Delhi-6
2 . Karyalay Alekhan aur Tippan – Karnatak Mahila Hindi Seva Samithi, Chamarajpet,Bangalore.
3. Prashasanik Hindi – Ed. Ramdarash Mishra and amswaroop Shastry
4 . Vanijya Patra Vyavahar,Anuvad,Nibandh tatha Sankshiptikaran – A V Narti, Gnanoday Prakashan , Dharwad.

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JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE (AUTONOMOUS)
OOTY ROAD, MYSURU-25

ELD 05021 /22/23/24/25
DMD 05001/02/03/04/05/06/07/08

BA/BSC
IV Semester
Language Hindi-AECC
Hindi Kavya aur Anuvada Paribhashik Shabdavali

60hrs (4hrs/week) 3 Credits

Course out comes

After successful completion of this course students are able to

CO 1. Write down the classification and characteristics of medieval and madran Hindi Kavya
CO2 . Deliberate in details with application, if applicable, medieval - saakhi by Kaber
CO3 . Specify in details with examples Hemala by Ramadhare Simha Dinakar
Co4 . Specify in details with application, if applicable, Gurukul by Ramkumar Varma
Co5 . Specify the characteristics of Hindi Anuvada Paribhasik Shabdavali
Co6 . Learn in details with examples Hindi Anuvada Paribhasik Shabdavali

UNIT A & B KAVYAGANGA (Prescribed Lessons-1, 2,5, 8, 11, 12, 13, 14, 16,19)

Kaber
Thulse Das
Bhihare Lal
Maithilisharan Gupta
Surya Kanth Tripathi Nirala
sumitranandan pant
Subhadra Kumari Chauhan
Ramkumar Verma
Ramdhari Simha Dinkar
Kuvempu

UNIT C Anuvad tatha Paribhashik Shabdavali

Portions Prescribed :

1. Anuvad ki Paribhashayen , Adhunik jagat mein Anuvad ka mahatva
   Anuvadak kee Yogyathayen , Anuvad kala hai yaa vignan ?
2. Anuvad ke prakar:
   a) Shabdanuvad
   b) Bhavanuvad
   c) Kavyanuvad
   d) Saranuvad
3. Angreji / Kannad se Hindi me Anuvad – vice versa (passages)
4. Paribhashik Shabdavali

UNIT-3 Kaavya ke Activities

1. Bhakti kaal ke alag alag shaakhaon ke pravartak kaviyon ka parichay karana
2. Nirgun aur sugun bhakti ka antar spasht karna aur dohon ka patan karaana.
3. Braj, avadhi, aur khadi boli shabdon ka parichay, prayog aur Ucchaaran karaana.
4. Hindi ke gyaanpeeth puraskrut kaviyon ki rachnaaon ki charcha karna.
5. Hindi mein Anoodith kannad kavitaaon ka parichay karaana.

UNIT-4 Anuvaad ke Activities

1. Shabdhanuvaad, bhaavanuvaad, aadi swaroop aur antar ka parichay karaana.
2. Aaj ke Bhoomandalikrut sandarbh mein anuvaad ki Avashyakta par charcha karna.
3. Hindi ke vaakyon ko kannad aur angrezi mein anuvaad karne ki kala sikhaana.
4. Paaribhaashik shabdavali ka prayog karna.
5. Anuvaad karte samay honewaali trutiyon par vishesh dhyaan dilaana

Reference Books:

1) Anuvad Vignan – Bholanath Thiwari Pb. Shabdaker, Delhi -110092
2) Anuvad Kala Kuch Vichar –Anuvad Prakash Khemani , S.Chand & co. Delhi.
3) Anuvad Siddhant aur Samasyayen- R.N. Srivastava and K.K.Goswami
4) Alok Prakashan , Delhi Anuvad Patrika Ank, Pb. Anuvad Sahitya Parishad , New Delhi

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JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE (AUTONOMOUS)
OOTY ROAD, MYSURU-25

ELC 30021/22/23/24/25

II BA
III Semester
Language Hindi -SEC

Communicative Hindi

30hrs (2hrs/week) 2 Credits

Course out comes

After successful completion of this course students are able to

CO1. Learn the details of Communicative Hindi

CO2. Identify in depth Communicative Hindi

CO3. Deliberate in depth Communicative Hindi

UNIT I : HINDI GRAMMAR

1) Parts of speech – A general outlook
2) Gender - a) Ling pehchanne ke niyam
   b) Ling parivarthan ke niyam
3) Synonymns and Antonymns
   a)Definition
   b)Difference

UNIT II : GENERAL COMMUNICATION AND PRACTICE

1) Conversation - in market, hotel , journey etc.
2) Conversation on health , education etc.
3) Practice.

Reference

1 Saral Hindi Vyakaran –Pb. Prabhath Prakashan, # 4/19, Asaf Ali road,New Delhi-
2 Parishkrith Hindi Vyakaran - Badarinath Kapur
3 Abhinav Hindi Vyakaran - Prof. N.Nagappa, Pb. Rajpal &sons, New Delhi
4 Shikshaarthi Hindi Vyakaran - Prof. N.Nagappa, Pb. Rajpal &sons, New Delhi
5 Sankshipta Hindi Vyakaran - Kamatha prasad Guru, Nagari Pracharini Sabha, kaashi.

6 Anuvad Vignan - Bholanath Thiwari , Shabdakar , Delhi -92
7 Anuvad Kala – Kuch Vichar - Anandprakash Khemani , S.Chand & Co., Delhi
Anuvad siddhant aur Samasyayen

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CBCS SYLLBUS FOR UG PROGRAMMES

DEPARTMENT OF HINDI

Division of marks and Model Question Paper

Language HINDI I ,II , & III SEMESTERS of BA / BSC

Time : 3 Hrs Max. Marks : 70

I) Total Main questions with internal choice on the prescribed text book 10 marks each 10 x 2 = 20

II) One Annotation question – three out of five on the prescribed text book 05 marks each 05 x 3 = 15

III) Two short answer questions with internal choice on Vyakaran /prayojan moolak Hindi / Anuvad as the case may be, 10 marks each 10 x 2 = 20

IV) 15 objective type questions on Vyakaran /prayojan moolak Hindi / Anuvad as the case may be, 01 mark each 01 x 15 = 15

MODEL QUESTION PAPER

Qn.1. ..... OR ..... 01 x 10 = 10

Qn.2. .....OR ..... 01 x 10 = 10

Qn. 3. Annotate three out of six 05 x03 =15

Qn.4. .....OR..... 01 x 10 = 10

Qn.5. .....OR..... 01 x 10 = 10

Qn.6. Objective type questions 01 x 15 =15

INTERNAL ASSESSMENT - 30 MARKS

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DEPARTMENT OF HINDI

BA CBCS SEC

lll SEMESTER -PAPER lll

Communicative Hindi

MODEL QUESTION PAPER

TIME : 2HOURS **MAX. MARKS :35**

Instructions: All sections are compulsory

UNIT-I:Hindi Grammar

I. . Answer The Following Questions in a sentence or a ward. 1X7=7

1).....2)..... 3).....4).....5).....

6).....7).....……

II Answer The Following Questions (Any fou 3 X 4 = 12

1).....2).....

3).....4).....

5)……6)……..

UNIT II : GENERAL COMMUNICATION AND PRACTICE 2X8=16

I . Answer The Following Questions (any two)

1..... 2.....

3..... 4.....

INTERNAL ASSESSMENT - 15 MARKS ,F-1 -7 ½ ,F-2-7 ½

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www.uni-mysore.ac.in

mqN0 : 1916

ವಿಶ್ವವಿದ್ಯಾನಿಲಯ ಆಡಳಿತಸೌಧ
ಕ್ರಾಫರ್ಡ್ ಭವನ, ಮೈಸೂರು-570005

*0aS¿:a .6/152/NEP/2020—21

Bmofi: 26—10-2021

ವಿಷಯ:- ಬಿ.ಎ-ಇತಿಹಾಸ ಅಧ್ಯಯನ ಪಠ್ಯಕ್ರಮ ಮತ್ತು ಪರೀಕ್ಷಾ ವಿಧಾನವನ್ನು NEP-2020 ಅನುಸಾರ 2021-22ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಜಾರಿಗೆ ತರುವ ಬಗ್ಗೆ.

ಉಲ್ಲೇಖ:- 1. ದಿನಾಂಕ: 23-09-2021 ರಂದು ಜರುಗಿದ ಇತಿಹಾಸ ಅಧ್ಯಯನ ಮಂಡಳಿ ಸಭೆಯ ತೀರ್ಮಾನದ್ದು.
2. ದಿನಾಂಕ: 13-10-2021 ರಂದು ಜರುಗಿದ ಕಲಾ ನಿಕಾಯ ಸಭೆಯ ತೀರ್ಮಾನದ್ದು.
3. ದಿನಾಂಕ: 22-10-2021 ರಂದು ಜರುಗಿದ ಶೈಕ್ಷಣಿಕ ಮಂಡಳಿಯ ನಡಾವಳಿ.

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ದಿನಾಂಕ:23-09-2021 ರಂದು ಜರುಗಿದ ಉಲ್ಲೇಖ (1) ರ ಇತಿಹಾಸ ಅಧ್ಯಯನ ಮಂಡಳಿ (ಸ್ನಾತಕ) ಬಿ.ಎ. ಇತಿಹಾಸ ಅಧ್ಯಯನ ವಿಷಯಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ ಪಠ್ಯಕ್ರಮ ಮತ್ತು ಪರೀಕ್ಷಾ ವಿಧಾನವನ್ನು NEP-2020 ರ ಅನುಸಾರ ರೂಪಿಸಿ **2021-22** ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಜಾರಿಗೆ ತರಲು ತೀರ್ಮಾನಿಸಿರುತ್ತದೆ.

ಉಲ್ಲೇಖಿತ (2 & 3) ರ ದಿನಾಂಕ 13-10-2021 ಮತ್ತು 22-10-2021 ರಂದು ಕ್ರಮವಾಗಿ ನಡೆದ ಕಲಾ ನಿಕಾಯ ಹಾಗೂ ವಿದ್ಯಾ ವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಗಳು ಮೇಲಿನ ಪ್ರಸ್ತಾವನೆಗಳನ್ನು ಅನುಮೋದಿಸಿರುವುದರಿಂದ ಈ

ಇತಿಹಾಸ ಅಧ್ಯಯನ ಮಂಡಳಿ (ಸ್ನಾತಕ) ಪಠ್ಯಕ್ರಮಗಳು ಮತ್ತು ಪರೀಕ್ಷಾ ವಿಧಾನಗಳನ್ನು **www.uni-mysore.ac.in** ನಿಂದ ಪಡೆಯಬಹುದಾಗಿದೆ.

ಕುಲಸಚಿವರು
(ಪರೀಕ್ಷಾಂಗ)

1. ಸಂಯೋಜನೆಗೊಳಪಟ್ಟ ಎಲ್ಲಾ ಕಾಲೇಜುಗಳ ಪ್ರಾಂಶುಪಾಲರುಗಳಿಗೆ- ಆಗತ್ಯ ಕ್ರಮಕ್ಕಾಗಿ
2. ಕುಲಸಚಿವರು (ಪರೀಕ್ಷಾಂಗ), ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ, ಮೈಸೂರು.
3. ಡೀನರು, ಕಲಾ ನಿಕಾಯ, ರಾಜ್ಯಶಾಸ್ತ್ರ ಅಧ್ಯಯನ ವಿಭಾಗ, ಮಾನಸಗಂಗೋತ್ರಿ, ಮೈಸೂರು.
4. ಅಧ್ಯಕ್ಷರು, ಇತಿಹಾಸ ಅಧ್ಯಯನ ಸಂಸ್ಥೆ/ ಮಂಡಳಿ, ಮಾನಸಗಂಗೋತ್ರಿ, ಮೈಸೂರು.
5. ನಿರ್ದೇಶಕರು, ಕಾಲೇಜು ಅಭಿವೃದ್ಧಿ ಮಂಡಳಿ, ಕಟ್ಟಡ, ಮಾನಸಗಂಗೋತ್ರಿ, ಮೈಸೂರು.
6. Ddr86d, roo.ac„ tNdoV K¿id.

7. ನಿರ್ದೇಶಕರು, ಐ.ಸಿ.ಡಿ., ಮಾನಸಗಂಗೋತ್ರಿ, ಮೈಸೂರು- ಇವರಿಗೆ ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯದ ವೆಬ್‌ಸೈಟ್‌ನಲ್ಲಿ ಪ್ರಕಟಿಸಲು ಕೋರಲಾಗಿದೆ.
8. ಕುಲಪತಿಗಳು/ ವಿಶೇಷ ಅಧಿಕಾರಿಗಳು/ ಆಪ್ತ ಸಹಾಯಕರು/ ಕುಲಸಚಿವರು/ ಉಪಕುಲಸಚಿವರು/ ಸಹಾಯಕ ಕುಲಸಚಿವರು/ಅಧೀಕ್ಷಕರು, ಆಡಳಿತ ವಿಭಾಗ/ಸಾಮಾನ್ಯ/ಒಡಿಐ/ಪ್ರಾಧಿಕಾರ ಮತ್ತು ಪರೀಕ್ಷಾ ವಿಭಾಗ, ಪ್ರಾಧಿಕಾರ/ಒಡಿಐ, ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ, ಮೈಸೂರು.
9. ಕಾರ್ಯನಿರ್ವಾಹಕರು, ಆಡಳಿತಾಂಗ, AC2(S)/ AC-3/ AC-7(a)/ AC-9, ಶೈಕ್ಷಣಿಕ ವಿಭಾಗ, ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ, ಮೈಸೂರು.- ಈ ಸಂಬಂಧ ಮುಂದಿನ ಕ್ರಮವಹಿಸುವಂತೆ ತಿಳಿಸಲಾಗಿದೆ.
10. ರಕ್ಷಾ ಕಡತಕ್ಕೆ

SYN

BA Semester 1

Paper No.1.1 DSC-1

Course Title: **Introduction to Ancient World Civilizations**	
Total Contact Hours: 39 to 42	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 60
Syllabus Authors: BOS (UG)	Summative Assessment Marks: 100

Course Pre-requisite(s): Introduction to Ancient World Civilization

Course Outcomes (COs):

At the end of the course the student should be able to:

- Understand the birth of Ancient Civilizations across the world.
- Obtain an idea of the geographical influences which aided the establishment of these Civilizations.
- Trace the evolution of political history and socio-economic characteristics of the different Civilizations.
- Analyse the ideas of theocracy and statehood during this time.
- Gather information on the various contributions in the fields on religion, law, education, language, literature, science mathematics, art and architecture.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)

Course Outcomes (COs) /Program Outcomes (POs)	**DSC 1**	**DSC 2**	**DSC 3**	**DSC 4**	**DSC 5**	**DSC 6**	**OE 1**	**OE 2**	**SEC 1**	**SEC 2**
Disciplinary Knowledge	X									
Communication Skills										
Critical Thinking	X									
Problem Solving	X									
Analytical Reasoning	X									
Cooperation and Team Work	X									
Reflective Thinking	X									
Self-motivated Learning	X									
Diversity Management and Inclusive Approach	X									
Moral and Ethical Awareness Reasoning	X									
Lifelong Learning	X									

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark „X in the intersection cell if a course outcome addresses a particular program outcome.

BA Semester 1

Paper No.1.1 DSC-1

Title of the Course**: Introduction to Ancient World Civilizations**

Course 1		Course 2	
Number of Theory Credits	**Number of lecture hours/semester**	**Number of Theory Credits**	**Number of lecture hours/semester**
3	**39 or 42**	**3**	**39 or 42**

Content of Course 1	**39/42 Hrs**
Unit–I - Mesopotamian, Egyptian and Chinese Civilizations	**13/14**
Introduction: Geographical Formation and Early Man Origin and Stages of the Earth – Geological Formation of World – Evolution of Human Species – From Archaic Man to Homo Sapiens – Homo Sapiens: Out of Africa and Spread all over the World	**02**
Chapter No : 1 Mesopotamian civilisation Geographical Background - From Neolithic to Bronze Age - Bronze Age in Mesopotamia **Sumerians** – Race - Political History of the Sumerians - Kings and Governments of Sumer **The Akkadians** - Old Babylonian Empire - Hammurabi and his Code - The Kassite domination - Attacks from the Hittites - The New Babylonian Empire - King Nebuchadnezzar and the Days of Babylonian Glory - The Decline of Babylon **The Assyrian Empire** - The reforms of Tiglathpileser III - Decline of Assyrians - The decline of Mesopotamian civilization Social condition - Economic Condition -–Theocratic State - Cultural contributions of Mesopotamians - Religion - Law – Education - Language and Writing– Literature - Art and Architecture - Hanging Garden - Science and Mathematics – Astronomy - Development of Calendar – Medicine	**04**
Chapter No: 2 Egyptian Civilization Egypt – The Gift of Nile - Cultural Transition from Neolithic to Bronze Age Political History of Egyptian Civilization - Intermediate Periods - The Archaic Period (3100-2700 BCE) - The Old Kingdom (2770 -2180 BCE) - Middle Kingdom (2200-1630BCE) - New Kingdom (1630-1075 BCE) – The invasion of the Hyksos -The New Kingdom or the Period of Empire (1560-1087 BCE) - The downfall of	**04**

Egypt Social Condition - Economic Condition – Agriculture – Industry – Trade - Cultural contributions of Egyptians - Writing and Literature – Games – Education - Religion - Akhenaton and his Monotheism - Art and Architecture	
Chapter No: 3 Chinese Civilization Early dynasties – The State – Decline of Ancient China – Economy and Society – Occupations – Art and Crafts – Ancestor Worship and Oracles – Script – Solar-Lunar Calendar - Literature	**04**
Unit II - Greek, Roman Civilizations	**13/14**
Chapter No : 4 **Greek Civilization** Geographical influences on the Greek - Aegean culture - The Early Greek Civilizations **-** The Minoan Civilization - The Mycenaean Civilization - The Dark Age - The Archaic and Classical Period City-States - Polity – Socio-Economic Background - Class Conflict between Aristocracy and Peasantry: Process of Reforms - Transition to Democracy - Conflict with Persia: Delian League (478 BCE) - The Peloponnesian War (431-404 BCE) - The End of the Classical Period Social Conditions - Slavery in Ancient Greece: Economy and Society - Position of Women Economic Conditions – Agriculture – Crafts - Maritime Commerce – Taxation Cultural contributions of Ancient Greece – Philosophy - Literature and Drama - Scientific Approach – Mathematics – Medicine - Astronomy – Religion - Olympic Games - Art and Architecture	**05**
Chapter No : 5 Roman Civilization (Early Part) The Impact of Geography - The Earliest Inhabitants of Italy - Etruscans - Decline of Etruscans - The Greeks in Italy The founding of Rome City - Rome under Monarchy - The Assembly and the Senate - The Roman Republic - The Roman Expansion Political Structure and Society during the Roman Republic - Effects of the Roman Expansion on commoners - Struggle between Patricians and Plebeians - The Assemblies - The Conflict of Orders – Patricians and Plebeians - Last Hundred Years of the Republic - Anti-Rome upheavals - Professional Army and War Lords - Rise of Dictatorship in Rome – Julius Caesar	**04**

Chapter No: 6 Roman Principate and Empire Augustus Caesar and His Successors - The Third Century Crisis (235-284 CE) - Division of Roman Empire – Diocletian and Constantine - The decline of the Western Roman Empire Social Condition of the early Roman Empire - Social Structure of the Later Roman Empire - Status of Roman Women – Slavery -Economic Condition - Judicial System Cultural Contributions – Language – Philosophy and Literature - Religion in Ancient Rome - Judaism - Christianity - Art and Architecture - Sculpture - Painting - Coins and medals	**05**
Unit III – Iranian, Early American and African Civilizations	**13/14**
Chapter No:7 Iranian Civilization Early History - Achaemenid Empire – Sassanid Empire – Economic and social Life – Religion – Art and Culture	**05**
Chapter No: 8 Early American Civilizations Mayan Civilization – Astronomy – Calendar Making -The Aztecs -The Incas – The Olmec – Culture – Religion – Art - Decline	**04**
Chapter No : 9 Early African Civilizations The Kingdom of Kush – Kingdoms of Nubia and Aksum – Sudanic Kingdoms – Civilizations of the Bantu Peoples – Kingdom of Kongo- Lunda Empire – Kingdom of Mwenemutepa – Coastal Regions of East Africa	**04**

Suggested Readings

1. Austin, M. M., The Hellenistic World from Alexander to the Roman conquest, Cambridge, 1981.
2. Algaze, Guillermo., Ancient Mesopotamia at the dawn of Civilisation: The Evolution of an Urban Landscape, University of Chicago Press, Chicago, 2009.
3. Badian, E., Studies in Greek and Roman History, Oxford University Press, 1964.
4. Badian, Ernst., Roman Imperialism in the Late Republic, Oxford, 1967.
5. Edward MacNall Burns and others, World Civilisations, Vol. A, GOYL SaaB Publishers & Distributors, Delhi, 2011.
6. Ferrero, Guglielmo., Characters and Events of Roman History, Barnes & Noble Books, New York, 1909.
7. Keith Bradley and Paul Cartledge, ed., The Cambridge World History of Slavery, vol. 1, Cambridge University Press, New York, 2011.
8. Nissen, Hans J., The Early History of the Ancient Near East, 9000-2000 BC, University of Chicago Press, Chicago, 1988.
9. Pollock, Susan., Ancient Mesopotamia: the Eden that never was, Cambridge University Press, Cambridge, 1999.

10. Potter, David S, ed., A Companion to the Roman Empire, Blackwell, Oxford and London, 2006.
11. Sharma. S.R., A Brief Survey of Human History, Hind Kitabs Ltd, Bombay, 1963.
12. Rakesh Kumar, Ancient and Medieval World, From Evolution of Humans to the Crisis of Feudalism, Sage Publications India Pvt Ltd, New Delhi, 2018.
13. Roux, George., Ancient Iraq, Penguin, London, 1992
14. Scarre, C., and Brian M. Fagan., Ancient Civilisations, Routledge, New York, 2016.
15. Sharma. S.R., A Brief Survey of Human History, Hind Kitabs Ltd, Bombay, 1963.
16. Shaw, Ian, ed., The Oxford History of Ancient Egypt, Oxford University Press, 2000.
17. Trigger, Bruce G., Understanding Early Civilisations, Cambridge University Press, 2003.
18. Wenke, Robert, The Ancient Egyptian State: The Origins of Egyptian Culture, c8000- 2000 BCE, Cambridge University Press, Cambridge, 2009

Pedagogy

- Lecture Method – Class Room Teaching
- Learning Through Project work
- Collaborative learning strategies
- Use of Resources like Audio- Visual aids, Films, Documentaries
- Visit to Historical Sites, Museums etc.
- ICT Supplemented Teaching
- Seminars / Guest / Special Lectures
- Group Discussions

Modes of Assignment

- Individual Assignments
- Project Work
- Written Test
- Documentaries

Assessment:

Weightage for assessments (in percentage)

Formative Assessment		
	Internal Assessment	**Theory Part Semester End Examination**
Internal Test	10	60
Assignment / Book Review	10	
Seminar with Group Discussion	10	
Viva Voice	10	
Total	**40**	
Grand Total		**100**

Dr. K. SADASHIVA

Date: 18.10.2021

BOS Chairperson

BA Semester 1

Paper No. 1.2 DSC-2

Course Title: **History of Ancient India (From Earliest Times to 1206 CE)**	
Total Contact Hours: 39 to 42	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 60
Syllabus Authors: BOS (UG)	Summative Assessment Marks: 100

Course Pre-requisite(s): History of Ancient India (From Earliest Times to 1206 CE)

Course Outcomes (COs):

At the end of the course the student should be able to:

- Gain an extensive insight of the political developments in Ancient India.
- Become familiar with development of Human evolution and material culture in the Indian subcontinent.
- Analyse sources in different forms to study the history of Ancient India.
- Capture a glimpse of the evolving socio- cultural and religious diversities and dissents of Ancient India.
- Understand the progress of early State formations and political structures in Ancient India.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)

Course Outcomes (COs) /Program Outcomes (POs)	**DSC 1**	**DSC 2**	**DSC 3**	**DSC 4**	**DSC 5**	**DSC 6**	**OE 1**	**OE 2**	**SEC 1**	**SEC 2**
Disciplinary Knowledge		X								
Communication Skills										
Critical Thinking		X								
Problem Solving		X								
Analytical Reasoning		X								
Cooperation and Team Work		X								
Reflective Thinking		X								
Self-motivated Learning		X								
Diversity Management and Inclusive Approach		X								
Moral and Ethical Awareness Reasoning		X								
Lifelong Learning		X								

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark „X in the intersection cell if a course outcome addresses a particular program outcome.

BA Semester 1

Paper No. 1.2 DSC-2

Title of the Course: **History of Ancient India (From Earliest Times to 1206 CE)**

Course 1		Course 2	
Number of Theory Credits	**Number of lecture hours/semester**	**Number of Theory Credits**	**Number of lecture hours/semester**
3	**39 or 42**	**3**	**39 or 42**

Content of Course 1	**39/42 Hrs**
Unit–I Pre Historic Culture to Nandas	**13/14**
Introduction Survey of Sources - Archaeological and literary sources Geographical Features and Natural Environment -The Geological Formation of India – Physical India since the Coming of Man – Climate – Natural Vegetation and Wildlife	**02**
Chapter No:1 Pre Historic Cultures in India Early Man in India – Hominid Fossils – Paleolithic Ages – Earliest Stone Tools - The Homo Sapiens (Modern Man) in India – Mesolithic Cultures - New Developments in Technology and Economy –Rock Art – Neolithic Revolution and Neolithic Cultural Regional Patterns - Animal Domestication – Beginning of Food Production in India and the Evidence from Mehrgarh – Growth of Villages from Baluchistan to Western Uttar Pradesh and Gujarat - Important sites- Bhimbetka, Daimabad, Nevasa, Isampur, Adichanallur , Chandravalli	**03**
Chapter No: 2 The Indus Civilisation Towards „Urban Revolution" – Origin and Chronology of the Indus Civilisation - Early Indus Cultures – Distribution and Morphological Features of Mature Harappan Settlements – Extent and Population – Agriculture and Subsistence – Craft Production – The Cities and Towns – Trade – Culture: Writing, Art, Religion – Social and Political Framework – Later Harappan Phase – End of the Indus Civilisation	**03**
Chapter No: 3 The Vedic and Later Vedic Age Archaeological sources - Vedas as a Historical Source – Tribes and Wars – Lineage, Clan, tribe – Varna in the Rig Vedic Period – Religion: Sacrifices to the Gods – Coronation Rituals – Rajasuya and Ashwamedha - Later Vedic Age – The Emergence of Monarchy – Varna Hierarchy - Polity in Vedic Period -Gana-Samudaya- Sabha, Samiti and Vidata.	**03**

Chapter No : 4 The Age of Mahajanapadas to the Nandas Economic Background – Urbanisation – Political History - Mahajanapadas - Republican States and their functioning- Kosala – Political Conflicts and the Growth of the Magadhan Empire -The Nandas – Foregin Invasions on India – Persians and Macedonians - Alexander‟s Invasion The Religious Revolution **-** The Intellectual Ferment – Ajivikas – Jainism – Buddhism – Brahminism	**03**
Unit–II The Age of Empire	**13/14**
Chapter No : 5 The Mauryan Empire Sources - Chandragupta Maurya - Ashoka – Ashoka‟s Dhamma – Political Philosophy of Mauryans – Arthashastra of Kautilya – The Nature and Structure of the Mauryan Empire - Central and Provincial Administration - Revenue and Finance – Internal and Foreign Trade – Industries – Social Conditions – Ashoka‟s Inscriptions – Language – Literature – Art and Architecture	**07**
Chapter No: 6 Post - Mauryan India: 200 BCE – 300 CE The Political History of North India – The Shungas – Kanvas - Indo-Greeks – The Shaka-Pahlavas or Scytho-Parthians –The Kushanas – Kanishka –Gandhara Art - The ShakaKshatrapas of Western India – The Shatavahana Empire in the Deccan	**04**
Chapter No: 7 The Sangam Age The three Kingdoms - The Cheras, Cholas, and Pandyas – Sangam Polity – The Sangam Government – Central and Local Self Government	**03**
Unit –III Guptas and their Successors	**13/14**
Chapter No: 8 The Guptas and Their Successors (CE 300–CE 750) Rise of the Central Ganga Valley – Rise of the Gupta Dynasty - Chandragupta I - Samudragupta, - Chandragupta II – Administrative Structure - Central and Provincial Administration Political Development in Deccan and North India: The Vakatakas and the Vardhanas – Harshavardhana- Polity and Administration - Central and Provincial Administration Political Development in South India: Pallavas – Mahendra Varma, Narasimha Varma – Cholas - Raja Rajachola, Rajendra chola, local self-government - Art and Architecture of Pallavas and Cholas Greater India- India and the World - Indian cultural influences on different parts of the World	**9**
Chapter No : 9 The Rajputs Gurjara – Prathiharas - Chauhans–Solankis – Paramaras –Chandellas - Polity and Administration	**03**

Maps for Study : i. Mauryan Empire under Ashoka ii. Kushana Empire under Kanishka iii. Gupta Empire under Samudragupta iv. Vardhana Empire under Harshavardhana	**01**
Important Historical Places: 1.Sanganakallu 2. Lothal 3.Kalibangan 4.Bimbetka 5. Harappa 6. Mahenjodharo 7. Purushapura 8.Gandhara 9. Allahabad 10.Kanauj 11. Shravanabelagola 12. Kausambi 12.Rajagriha 13.Ujjaini 14.Pataliputra 15.Bodhagaya 16. Delhi 17.Nalanda 18. Tarain 19.Kalibangan 20.Prayaga.	**01**

Suggested Readings

1. Irfan Habib - People‟s History of India Series (Vols 1- 7)
2. Upinder Singh - A History of Ancient and Early Medieval India
3. Chakrabarthi Dilip K - A History of Indian Archaeology from beginning to 1947
4. S. Piggott - Prehistoric India
5. R.S. Sharma - Ancient India
6. RomilaThapar - Ancient India
7. D.D. Kosambi - The Culture and Civilisation of Ancient India in Historical Outline.
8. K.A. NilakantaSastri - A History of South India
9. V. N. HariRao - History of India Vol. I
10. S. R. Sharma - Comprehensive History of India
11. V. A. Smith - The Oxford History of India
12. R.S. Tripathi - History of Ancient India

Pedagogy

- Lecture Method – Class Room Teaching
- Learning Through Project work
- Collaborative learning strategies
- Use of Resources like Audio- Visual aids, Films, Documentaries
- Visit to Historical Sites, Museums etc.
- ICT Supplemented Teaching
- Seminars / Guest / Special Lectures
- Group Discussions

Modes of Assignment

- Individual Assignments
- Project Work
- Written Test
- Documentaries

Assessment:

Weightage for assessments (in percentage)

Formative Assessment		
	Internal Assessment	**Theory Part Semester End Examination**
Internal Test	10	60
Assignment / Book Review	10	
Seminar with Group Discussion	10	
Viva Voice	10	
Total	**40**	
Grand Total		**100**

Dr. K. SADASHIVA

Date:18.10.2021

BOS Chairperson

BA Semester 1

Open Elective

Paper No.1.3 OE -1

Course Title: **Cultural Heritage of India**	
Total Contact Hours: 39 to 42	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 60
Syllabus Authors: BOS (UG)	Summative Assessment Marks: 100

Course Pre-requisite(s): Cultural Heritage of India

Course Outcomes (COs):

At the end of the course the student should be able to:

- Provide an insight about an extensive survey of heritage of India
- Familiarize oneself with Indian history and culture
- Expertize to analyse further development of culture of India
- Analyse the factor responsible for origin and decline of culture
- Provide the opportunity to understand the process of cultural development

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)

Course Outcomes (COs) /Program Outcomes (POs)	**DSC 1**	**DSC 2**	**DSC 3**	**DSC 4**	**DSC 5**	**DSC 6**	**OE 1**	**OE 2**	**SEC 1**	**SEC 2**
Disciplinary Knowledge							X			
Communication Skills										
Critical Thinking							X			
Problem Solving							X			
Analytical Reasoning							X			
Cooperation and Team Work							X			
Reflective Thinking							X			
Self-motivated Learning							X			
Diversity Management and Inclusive Approach							X			
Moral and Ethical Awareness Reasoning							X			
Lifelong Learning							X			

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark “X” in the intersection cell if a course outcome addresses a particular program outcome.

BA Semester 1

Open Elective

Paper No.1.3 OE -1

Title of the Course**: Cultural Heritage of India**

Course 1		Course 2	
Number of Theory Credits	**Number of lecture hours/semester**	**Number of Theory Credits**	**Number of lecture hours/semester**
3	**39 or 42**	**3**	**39 or 42**

Content of Course 1	**39/42 Hrs**
Unit -I Introduction	**13/14**
Chapter No: 1 Cultural Heritage Meaning – Definitions – Concepts – Characteristics – Types of Indian Cultural Heritage – Tangible and Intangible - Oral and Living Traditions – Significance of Cultural Heritage in Human Life – Cultural Zones of India.	**05**
Chapter No: 2 Fairs, Festivals, Rituals: Ethnic Indian Cultural Construct – Significance and Historical background of Fairs, Festivals and Religious Rituals – Regional – Folk – Tribal – National – Monsoon Fairs - Animal Fairs – Jatres: Mylarlinga, Mudukutore, Suttur – Dasara, Baisaki, Deepavali, Onam, Nagarapanchami, Bangalore Karaga	**05**
Chapter No: 3 Pilgrimage Centres of India – Kashi – Mathura– Rameshwara – Bodh Gaya– Shravanabelagola — BandeNavazDarga – Amrithsara – Velangani	**03**
Unit – II Legends, Narratives and Cultural Ethos	**13/14**
Chapter No: 4 Meaning – Significance – Forms and Traditions of Legends – Puranic Legends – Tradition of Cultural Heritage: Ramayana and Mahabharata – Ancient Fables of Ethical and Moral Values: Panchatantra and Jataka Stories- MatnagaJataka	**04**
Chapter No: 5 Traditional Performing Arts - Indian Aesthetics – Important Sources: Bharata‟s Natyashastra, Nandikeshwara‟s Abhinaya Darpana - Srikumara‟s Shilparatnaand - Kitab –i- Navaras by Ibrahim Adil Shah II – Indian Classical Dances: Bharatanatyam – Kathakali – Mohiniyattam – Kuchipudi – Odissi – Sattriya – Manipuri Dance **Folk Dances and Theatre** –Important Folk Dances: Lavani, Garba, Ghoomar, Changlo, Giddha, Kalbelia **Theatre:** Sanskrit Plays – Kutiyattam as a specimen of Oral and Intangible Cultural Heritage **Oral Tradition and Performing Arts** – Bhajan, ,Harikatha, Vedic Chants, Gurbani-	**06**

Yakshagan, Bootaaradane – **Puppetry**	
Chapter No: 6 Indian Classical Music –Sources - Matanga Muni‟s Brihaddeshi– Two Major Traditions: Hindustani and Carnatic Music -Tradition in Indian Music: Gharana System – Historically Important Personalities of Indian Classical Music: Amir Khusrow, Sarangdev, Tansen, Mohammad Shah "Rangeela", Purandaradasa and Kanakadasa– , M.S. Subbulakshmi – Music Fusions: East and West	**04**
Unit – III Architecture and Built Heritage	**13/14**
Chapter No. 7 Indian Architecture – The Beginnings – Indus Valley: Town Planning - Vedic Architecture - Mauryan Architecture: Characteristics, Palaces and Pillars – Stupa Architecture – Important Stupas – Rock Cut -Architecture: Caves and Temples – Temple Architecture: Nagara, Dravida and Vesara Styles– Mughal Architecture – Colonial Architecture	**6**
Chapter No.8 Important Monuments of North India (Study of Historical and Cultural Sites through maps) Nalanda, Ajanta, Ellora, Prayaga, Dwaraka, Sun Temple -Konark, Khajuraho, Agra –TajMahal, Delhi – Red Fort,	**04**
Chapter No.9 Important Monuments of South India - Shore Temple (Mahabalipuram), Sannati, Aihole, Badami, Pattadakal, Hampi, Kanchi, Nagarjunakonda, Amaravati, Thiruvanantapuram	**04**
Historical Places **1**. Pushkar **2.** Prayaga **3.**Shravanabelagola **4.** Ajmer **5.**Amritsara **6.**Delhi **7.**Kashi **8.**Nalanda **9.**Ajanta **10.**Dwarka **11.**Puri **12.**Konark **13.**Khajurahoo **14.**Tiruvanathapuram **15**.Ellor **16.**Mah**a**balipuram **17.**Pattadakal**l**u **18.**Hampi **19.**Kanchi **20.**Nagarjunakonda	**01**

Note: Historical Tour and Preparation of Project Report based on field work is Mandatory

Suggested Readings

1. K.T Acharya - Indian food: A Historical Companion, oxford University Press, 1998.
2. Banga, I. (ed). - The City in Indian History : Urban Demography, Society and Politics, Delhi, Manohar, 1991
3. A.L Basham - The wonder that was India. Picador Publisher, Indian ed. 2014
4. N.K Bose - Culture Zones of India" in culture and Society in India, Asia publishing House 49
5. S.Narayan - Indian Classical Dances, Shubhi Publications, 2005.s
6. Prakash, H.S - Shiva - Traditional Theatres, Incredible India Series, New Delhi, 2007
7. S. Radhakrishnan - Culture of India" in the Annals of the American Academy of Political and Social Science, Vol 233, India Speaking (May 1944).pp 18-21.
8. K. Thapiyal , S. Shukla - Sindhu Sabhyataien, Luckhnow,2003 The Director General Survey of India (ed.), Guide Books: World Heritage Series, New Delhi

9. Shashi Tiwari - Origin of Environmental Science from Vedas. A Research paper presented at the National Seminar on" Science and Technology" in Ancient Indian Text, Special Centre for Sanskrit Studies. JNU, 9-10th, January, 2010
10. Raman Varadara - Glimpses of Indian Heritage, Popular Prakashan Private Ltd., Bombay, 1989
11. Varapande, M.L - History of Indian Folk Theatre (Lok Ranga Panorama of Indian Folk Theatre) Abhinav Publications,1992
12. V. Vasudev - Fairs and Festivals, Incredible India series, 2007
13. A. Sundara (Ed.) - Kannada Vishaya Vishvakosha Ithihasa mattu Puratatva
14. H. Tipperudraswamy - Karnataka Samskruti Sameekshe
15. Janapada Vishya Viswakosha Vol- I and II Prasaranga University of Mysore
16. Rangacharya - The Natya shastra, English translation with critical Notes, New Delhi, Munshiram Manoharlal Publishers Pvt ltd.

Pedagogy

- Lecture Method – Class Room Teaching
- Learning Through Project work
- Collaborative learning strategies
- Use of Resources like Audio- Visual aids, Films, Documentaries
- Visit to Historical Sites, Museums etc.
- ICT Supplemented Teaching
- Seminars / Guest / Special Lectures
- Group Discussions

Modes of Assignment

- Individual Assignments
- Project Work
- Written Test
- Documentaries

Assessment:

Weightage for assessments (in percentage)

Formative Assessment		
	Internal Assessment	**Theory Part Semester End Examination**
Internal Test	10	60
Assignment / Book Review	10	
Seminar with Group Discussion	10	
Viva Voice	10	
Total	**40**	
Grand Total		**100**

Dr. K. SADASHIVA

Date:18.10.2021

BOS Chairperson

BA Semester 1

Open Elective

Paper No.1.3 OE -1

Course Title: **Introduction to Archaeology**	
Total Contact Hours: 39 to 42	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 60
Syllabus Authors: BOS (UG)	Summative Assessment Marks: 100

Course Pre-requisite(s): Introduction to Archaeology

Course Outcomes (COs):

At the end of the course the student should be able to:

- Understand the concept of Archaeology as an ancillary for study of history
- Study the various features of Archaeology in understanding history
- Familiarize with the scope of Archaeology.
- Understand the various tools and techniques imbibed in Archaeology
- Study various schools of disciplines of Archaeology.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)

Course Outcomes (COs) /Program Outcomes (POs)	**DSC 1**	**DSC 2**	**DSC 3**	**DSC 4**	**DSC 5**	**DSC 6**	**OE 1**	**OE 2**	**SEC 1**	**SEC 2**
Disciplinary Knowledge							X			
Communication Skills										
Critical Thinking							X			
Problem Solving							X			
Analytical Reasoning							X			
Cooperation and Team Work							X			
Reflective Thinking							X			
Self-motivated Learning							X			
Diversity Management and Inclusive Approach							X			
Moral and Ethical Awareness Reasoning							X			
Lifelong Learning							X			

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark „X in the intersection cell if a course outcome addresses a particular program outcome.

BA Semester 1

Open Elective

Paper No.1.3 OE -1

Title of the Course**: Introduction to Archaeology**

Course 1		Course 2	
Number of Theory Credits	**Number of lecture hours/semester**	**Number of Theory Credits**	**Number of lecture hours/semester**
3	**39 or 42**	**3**	**39 or 42**

Content of Course 1	39/42 Hrs
Unit – 1 Introduction	**13/14**
Chapter No: 1 Definition of Archeology - its Aims and Scope : difference between History and Archeology	**04**
Chapter No: 2 Kinds of Archaeology – Ethno -Marine and Salvage	**04**
Unit – II Archaeology by Period	**13/14**
Chapter No: 3 Lower Paleolithic – Middle Paleolithic – Upper Paleolithic – Mesolithic – Neolithic - Chalcolithic – Bronze age – Iron Age.	**06**
Chapter No: 4. Archaeology in India – William Jones, James Princep, Alexander Cunningham, John Marshall, Sir Mortimer Wheeler, Allchin, H. D. Sankalia, S.R.Rao. M. H. Krishna**.**	**06**
Chapter No: 5 Archaeological Survey of India – Department of Archaeology Government of Karnataka	**02**
Unit – III Exploration, Excavation and Analysis	**13/14**
Chapter No: 6 Identification of a site – field survey – sampling techniques –Application of Scientific methods.	**06**
Chapter No: 7. Methods of Excavation – vertical and horizontal – Trenching - Gridding	**04**
Chapter No: 8 Excavation of burial mounds – Open Stripping – Quadrant method – Excavation of pits – Excavation of a typical site	**04**
Chapter No: 9 Visit to Local Archaeological Sites and Preparation of Field Study Report for Assignment is Mandatory.	**06**

Suggested Readings

1. Agrawal D.P - Archaeology in India
2. Aiken M.J - Science based dating in archaeology
3. Allchin Bridget
4. & Raymond Allchin - Rise of Civilisation in India and Pakistan
5. Atkinson RJC - Field Archaeology
6. Basker .P - Techniques of Archaeological Excavation
7. Chakrabarthi D.K - A History of Indian Archaeology from the Beginning to 1947
8. Chakrabarthi D.K - Theoretical Perspectives in Indian Archaeology
9. Gosha .A - Encyclopedia of Indian Archaeology
10. Rajan .K - Archaeology, Principles and Methods
11. Raman K.V - Principles and Methods in Archaeology
12. Dr.Srinivas V Padigar - Principles of Archaeology.
13. Dr Srinivas V Padigar - Puratattva Parichaya-(Kan)
14. Sundara (Ed.) - Kannada Vishaya Vishvakosha Ithihasa mattu Puratattva
15. Srikanta Shastri - Puratattva Shodane

Pedagogy

- Lecture Method – Class Room Teaching
- Learning Through Project work
- Collaborative learning strategies
- Use of Resources like Audio- Visual aids, Films, Documentaries
- Visit to Historical Sites, Museums etc.
- ICT Supplemented Teaching
- Seminars / Guest / Special Lectures
- Group Discussions

Modes of Assignment

- Individual Assignments
- Project Work
- Written Test
- Documentaries

Assessment:

Weightage for assessments (in percentage)

Formative Assessment		
	Internal Assessment	**Theory Part Semester End Examination**
Internal Test	10	60
Assignment / Book Review	10	
Seminar with Group Discussion	10	
Viva Voice	10	
Total	**40**	
Grand Total		**100**

Dr. K. SADASHIVA

Date:18.10.2021

BOS Chairperson

BA Semester 2

Paper No.2.1 DSC-3

Course Title: **Introduction to Medieval World Civilization**	
Total Contact Hours: 39 to 42	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 60
Syllabus Authors: BOS (UG)	Summative Assessment Marks: 100

Course Pre-requisite(s): Introduction to Medieval World Civilization

Course Outcomes (COs):

At the end of the course the student should be able to:

- Understand the geographic limitations and advantages that contributed to the rise of different civilizations in the Medieval world.
- Get information on the development of religious traditions and organizations in the Medieval world.
- Understand the growth of Feudalism and European towns in the middleages.
- Indicate the causes and impact of the Crusades in the Medieval Europe.
- Derive the influences of Oriental Civilizations on Medieval Europe.
- Illuminate the aspects of Economy and its development in MedievalWestern Europe.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)

Course Outcomes (COs) /Program Outcomes (POs)	**DSC 1**	**DSC 2**	**DSC 3**	**DSC 4**	**DSC 5**	**DSC 6**	**OE 1**	**OE 2**	**SEC 1**	**SEC 2**
Disciplinary Knowledge			X							
Communication Skills										
Critical Thinking			X							
Problem Solving			X							
Analytical Reasoning			X							
Cooperation and Team Work			X							
Reflective Thinking			X							
Self-motivated Learning			X							

Diversity Management and Inclusive Approach			X							
Moral and Ethical Awareness Reasoning			X							
Lifelong Learning			X							

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark „X in the intersection cell if a course outcome addresses a particular program outcome.

BA Semester 2

Paper No.2.1 DSC-3

Title of the Course: **Introduction to Medieval World Civilization**

Course 1		Course 2	
Number of Theory Credits	**Number of lecture hours/semester**	**Number of Theory Credits**	**Number of lecture hours/semester**
3	**39 or 42**	**3**	**39 or 42**

Content of Course 1	**39/42 Hrs**
Unit I – Arab and Persian Civilizations	**13/14**
Introduction to Medieval World Civilizations Introduction – „Medieval" – Terminology and Periodization – Transitions and Historical Debates	**02**
Chapter No : 1 Arab Civilization Introduction - Geographical Background - Arab on the Eve of the rise of Islam - Birth of Islam – Origin and Spread of Islam - The Doctrines of Islam The Caliphate State / The Arab Empire - Rashidun Caliphs - The Umayyad Caliphate -The Abbasid Caliphate -The Fatimid Caliphate -The end of Arab Empire Arab contributions to Medieval World - Islamic Religious Traditions - Scholarship and Learning –Mathematics –Chemistry-Medicine-Paper and Bookmaking -Adab Literature –Philosophy -Art and Architecture	04
Chapter No: 2 Persian Civilization (Iranian Civilization) Introduction – Early History - Muslim Conquest of Persia - During Muhammad"s life -First invasion of Mesopotamia (633) -Second invasion of Mesopotamia (634–636) - Conquest of Mesopotamia (636–638) - Persian Raids in Mesopotamia (638–641) - Conquest of Persia (642–651) - Second and last Muslim invasion - Persian rebellion and reconquest Persia under Muslim rule – Administration – Religion - Language of Persia – Urbanisation	04

Chapter No: 3 Persian Civilization - Safavid Dynasty - Shah Abbas the Great - Shah and his Achievements – Political - Shah and his Achievements - Cultural Persia‟s Contribution to Medieval World - Political Ideas and Institutions - State and Polity –The Third Force (Ghulam) - Emergence of a Clerical Aristocracy - Islamic Jurisprudence Persia„s Cultural Contributions - Fine Arts - Carpet Weaving – The Art of the Book Making – Ceramics – Literature – Architecture	04
Unit II European Civilisations	13/14
Chapter No : 4 The Middle Ages in Europe (Political and Social Development) – Introduction - Successors Kingdoms to the Western Roman Empire -Germanic Foundations of Early Medieval Europe - Germanic Kingdoms in Western Europe Europe in the Early Middle Ages (Political and Economic Institutions of Medieval Europe) - The Rise of Frankish Empire - Merovingian Period – Carolingian Period - Charlemagne (768-814) - New States in Response to Invasions - Otto the Great (936-973) - The Holy Roman Empire	05
Chapter No : 5 The Age of Feudalism in Europe - Origin or Development of Feudalism - Feudal Polity and Economy - Decline of Feudalism	04
Chapter No: 6 Religious Developments in Medieval Europe - Saintly and Virgin Mary Cults - Monasticism in Europe - Organization of the Church and Growth of Papacy - Struggle between Secular and Spiritual Authority	04
Unit –III The Middle Ages in Europe	**13/14**
Chapter No: 7 Byzantine Empire - Constantine (306-337 CE) - Justinian (482-565 CE) - Decline of Byzantine Empire - Achievements of the Byzantium Empire - Effective Diplomacy - Trade and Commerce – Agriculture – Religious Reforms - Revival of Greek Classical Literature - Architecture and Art	**04**
Chapter No: 8 Crusades Introduction - The Crusades - Causes for the Crusades - Pope„s call for Crusade – Crusades 1st to 9th - Crusades and Their Impact - Influences of Oriental Civilisation on Medieval Europe - Byzantine Influences of Medieval European Civilization - Islamic Influences on Medieval European Civilization	04
Chapter No : 9 Growth of Economy and Culture in Medieval Western Europe Growth of European Towns - Growth of Middle Class - Early Medieval European Economy - The Economy of Western Europe in the High Middle Ages - The first Agricultural Revolution - Expansion of Trade and Commerce in	06

Medieval Europe - Guild System Contributions of Medieval Europe - Intellectual and Cultural Life in Medieval Europe - Medieval European universities - Acquisition of classical and Islamic knowledge - Growth of Western Scientific and Speculative Thought – Scholasticism - Literature – Drama – Music - Art and Architecture	

Suggested Readings

1. Arthur Hassall, (ed), General History of Europe, Oxford, 1901.
2. Edward MacNall Burns and others, World Civilisations, Vol. A, GOYL SaaB Publishers & Distributors, Delhi, 2011.
3. Holt. P.M., Ann K.S.Lambton and Bernard Lewis, The Cambridge History of Islam, Vol.1, Cambridge University Press, 1970.
4. Israel Smith Clare, Medieval History of the World, vol. I and II, Arihant Publishing House, Jaipur, 2008.
5. Lars Brown worth, Lost to the West – The Forgotten Byzantine Empire, Random House Inc., New York, 2009.
6. Rahman A, Islam on Science and Technology.
7. Rakesh Kumar, Ancient and Medieval World, From Evolution of Humans to the Crisis of Feudalism, Sage Publications India Pvt Ltd, New Delhi, 2018.
8. Ferrero, Guglielmo., Characters and Events of Roman History, Barnes & Noble Books, New York, 1909

Pedagogy

- Lecture Method – Class Room Teaching
- Learning Through Project work
- Collaborative learning strategies
- Use of Resources like Audio- Visual aids, Films, Documentaries
- Visit to Historical Sites, Museums etc.
- ICT Supplemented Teaching
- Seminars / Guest / Special Lectures
- Group Discussions

Modes of Assignment

- Individual Assignments
- Project Work
- Written Test
- Documentaries

Assessment:

Weightage for assessments (in percentage)

Formative Assessment		
	Internal Assessment	**Theory Part Semester End Examination**
Internal Test	10	60
Assignment / Book Review	10	
Seminar with Group Discussion	10	
Viva Voice	10	
Total	**40**	
Grand Total		**100**

Dr. K. SADASHIVA

Date:18.10.2021

BOS Chairperson

BA Semester 2

Paper No. 2.2 DSC-4

Course Title: **History of Medieval India (1206 to 1761)**	
Total Contact Hours: 39 to 42	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 60
Syllabus Authors: BOS (UG)	Summative Assessment Marks: 100

Course Pre-requisite(s): History of Medieval India (1206 to 1761)

Course Outcomes (COs):

At the end of the course the student should be able to:

- The students will get the knowledge of the political history of Delhi Sultanate, Mughals and Marathas.
- To analyze the changes in state and society under the Delhi Sultanates with respect to their administrative structure and theory of state/kingship of the Delhi Sultanate.
- Understand the critical historiographical approaches on the State and also the Decline of the Delhi Sultans and Mughal Empire.
- To understand the significance of the Bhakti and Sufi Movements and their impact on the socio-cultural sphere.
- To understand the fusion of art, architecture, literature, language and fine arts in medievalIndia under Islamic and Hindu styles.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)

Course Outcomes (COs) /Program Outcomes (POs)	**DSC 1**	**DSC 2**	**DSC 3**	**DSC 4**	**DSC 5**	**DSC 6**	**OE 1**	**OE 2**	**SEC 1**	**SEC 2**
Disciplinary Knowledge				X						
Communication Skills										
Critical Thinking				X						
Problem Solving				X						
Analytical Reasoning				X						
Cooperation and Team Work				X						
Reflective Thinking				X						
Self-motivated Learning				X						
Diversity Management and Inclusive Approach				X						
Moral and Ethical Awareness Reasoning				X						
Lifelong Learning				X						

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark „X in the intersection cell if a course outcome addresses a particular program outcome.

BA Semester 2

Paper No. 2.2 DSC-4
Title of the Course: **History of Medieval India (1206 to 1761)**

Course 1		Course 2	
Number of Theory Credits	**Number of lecture hours/semester**	**Number of Theory Credits**	**Number of lecture hours/semester**
3	**39 or 42**	**3**	**39 or 42**

Content of Course 1	**39/42 Hrs**
Unit -I Arabs, Turks and Delhi Sultanate	**15/14**
Chapter No: 1 Sources of Medieval Indian History Sources– Literary, Foreign Accounts and Archaeological sources	**02**
Chapter No: 2 Advent of Arabs and Turks in Medieval India Political condition of India in the Beginning of 8th Century- Arab Invasion – Muhammud Bin Qasim - Rise of Turks – Condition of India during the invasions of Muhammud of Ghazni and Ghori and their Impact – Tarain Wars	**04**
Chapter No: 3 Foundation of the Delhi Sultanate Qutub ud din Aibak - Era of Balban - Early Life and accession, The Mongols and the problems of the north west- Theory of kingship, achievements Khalji Dynasty - Alauddin Khalji – Conquests - Administrative measures - Price control and Market regulations Mohammad-bin-Tughlaq - Experiments and Reforms - Firoz Shah Tughlaq - Firoz„s concept of benevolence and People„s Welfare - Administrative reforms The Later Tughlaqs - Decline of the Delhi Sultanates - Timur‟s invasion (1398 A.D) - The Saiyyids and the Lodis – Babur‟s Invasion- First Battle of Panipat	**08**
Chapter no: 4 - State-Polity, Society and Economy under the Delhi Sultanates Central and Provincial Administration - Economy - Tax policy Trade and industries - Society – Social manners and Customs - Slavery under the Delhi Sultans	**02**
Unit II – The Mughal Empire	**13/14**

Chapter No: 5 The foundation of the Mughal Empire -Babar and Humayun - Revival of Afghan Power - Sher Shah Suri and his Successors-The Second Battle of Panipat and triumph of the Mughals- Hemu and Bairam Khan–Akbar's rise and consolidation of power - Conquests, Rajput Policy, Religious Policy- (Din-Ilahi)- Revenue Administration, Evolution of Mansabdari system- Jagirdari Crisis - Jahangir, Shah Jahan and Aurangzeb - Military exploits, Religious Policy, Deccan policy- Revolts and reaction	**06**
Chapter No: 6 Administration and Economy under the Mughals Mughal Administration – Central, Provincial, Local – Theory of Kingship – Mansabdari System – Jagirdari System – Sources of Revenue – Military – Judicial System – Mughal Nobility and Bureaucracy – Deccan Policy of the Mughals - Development in Trade	**04**
Chapter No: 7 Society and Culture under the Mughals Social structure under Mughals – Muslim Nobles – Indian Muslims – Hindus – Condition of Women – Feudalistic Society – Religion and Celebration - Mughal Interaction with Europeans - Development of Science, literature, art, architecture and painting	**04**
Unit – III Bhakti and Sufi Movements	**10/08**
Chapter No. 8 Bhakti and Sufi Movements in India The Bhakti Movement in South India and North India – Alvars – Nayanars Basavanna – Kabir – Ravi Das – Guru Nanak – Causes for the popularity of the Movement – Impact of the Bhakti Movement - The **S**ufi Movement **-** Shaik Nizamudin Auliya – Salim Chisti	**06**
Chapter No.9 The Marathas Rise of the Maratha Power under Shivaji - Swarajya and Peshwas - Third Battle of panipat 1761	**04**
Maps for Study: i) Khilji empire Under Allauddin Khilji ii) Tuglaq Empire Under Mummmad Bin Tuglaq iii) Mughal empire Under Akbar iv) Martha empire Under Peshwas/ Shivaji	**01**

Important Historical Places Delhi, Agra, Panipat, Fatehpur-Sikri, Chittor, Gwalior, Udaipur, Kalinjar, Surat, Kanauj, Amarkot, Ayodhya, Ranthamboor, Devagiri, Dwarasamudra, Madurai, Srinagar, Sasaram, Raigar, Warangal, Poona, Lahore	**01**

Suggested Readings

1. A.L Srivastava: Delhi Sultanate , Shiv Lal Agarwal & Co., Agra, Reprint, 2017
2. A.L. Srivastva : The Mughal Empire (Shiv Lal Agarwal & Co., Agra, Reprint, 2017
3. Sharma S.R, The Crescent in India (Agra 1933)
4. Srivastava A.L, Medieval Indian Culture (Agra 1975)
5. Sharma L.P, The Sultanate of Delhi (Delhi, 1996)
6. Edwards S.M & Garratt, Mughal Rule in India (New Delhi 1974)
7. Banerjee A.C, A New History of Mediecal India (New Delhi 1983)
8. Lane Poole S, Medieval India under Muhammadan Rule (London)
9. Majumdar R.C (ed), History and Culture of the Indian people, Vol.V & VI (Bhavan‟s Series)
10. Majumdar R.C (ed), Bharatiya Janateya Ithihasa Mattu Samskriti (Bhavan‟s Series)
11. Sathish Chandra, History of Medieval India, Vol 1 and Vol 2.
12. Irfan Habib, Medieval India.
13. B.N.S Yadav : Society and Culture in North India in the 12th century. .Raka Prakashan, Prayagraj, 2012
14. B.P. Majumdar: Socio-Economic History of Northern India, Firma K. L. Mukhopadhyay(1960)
15. Herman Kulke (ed.) The State in India (1000-1700), OUP, 199516. Ishwari Prasad : Medieval India 4th ed., Digitized 2006
16. J.N Sarkar: Life and Times of Shivaji, Orient Blackswan Pvt. Ltd., New Delhi, 2010
17. K.N Chitnis: Socio- Economic History of Medieval India, Atlantic Publishers, 2018
18. Majumdar, Raychaudhary & Dutta : An Advanced History of India, Laxmi Publications, 2016
19. Mohammad Habib and K.A. Nizami,(Ed). : Comprehensive History of India, Vol. V, The Delhi Sultanate, PPH, 1992
20. R.C.Majumdar & others (ed.): The History and Culture of the Indian People Vol. 6, the Delhi Sultanate, Bhartiya Vidya Bhawan, 2006
21. R.P Tripathi : Rise and fall of the Mughal Empire Surjeet Publications, 2012
22. S.R. Sharma : The Crescent in India: A Study in Medieval History, Bhartiya Kala Prakashan, 2005
23. Ishwari Prasad : A Short History of Muslim Rule in India, Surjeet Publications, 2018
24. Mehata J.L : Advanced Study in the History of Medieval India Volumes
25. Satish Chandra - Medieval India From Sultanate to the Mughals

Pedagogy

- Lecture Method – Class Room Teaching
- Learning Through Project work
- Collaborative learning strategies
- Use of Resources like Audio- Visual aids, Films, Documentaries
- Visit to Historical Sites, Museums etc.
- ICT Supplemented Teaching
- Seminars / Guest / Special Lectures
- Group Discussions

Modes of Assignment

- Individual Assignments
- Project Work
- Written Test
- Documentaries

Assessment:

Weightage for assessments (in percentage)

Formative Assessment		
	Internal Assessment	**Theory Part Semester End Examination**
Internal Test	10	60
Assignment / Book Review	10	
Seminar with Group Discussion	10	
Viva Voice	10	
Total	**40**	
Grand Total		**100**

Dr. K. SADASHIVA

Date:18.10.2021

BOS Chairperson

BA Semester 2

Open Elective

Paper No.2.3 OE -2

Course Title: **Cultural Heritage of Karnataka**	
Total Contact Hours: 39 to 42	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 60
Syllabus Authors: BOS (UG)	Summative Assessment Marks: 100

Course Pre-requisite(s): Cultural Heritage of Karnataka

Course Outcomes (COs):

At the end of the course the student should be able to:

- Understand the concept of cultural heritage of Karnataka
- Study various cultural factors which influence the flow of culture
- Familiarize the factors which influenced in influencing culture and society
- Analyze the factors responsible for formation of pluralistic society
- Understand the concept "Unity in diversity"

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)

Course Outcomes (COs) /Program Outcomes (POs)	**DSC 1**	**DSC 2**	**DSC 3**	**DSC 4**	**DSC 5**	**DSC 6**	**OE 1**	**OE 2**	**SEC 1**	**SEC 2**
Disciplinary Knowledge								X		
Communication Skills										
Critical Thinking								X		
Problem Solving								X		
Analytical Reasoning								X		
Cooperation and Team Work								X		
Reflective Thinking								X		
Self-motivated Learning								X		
Diversity Management and Inclusive Approach								X		
Moral and Ethical Awareness Reasoning								X		
Lifelong Learning								X		

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark „X in the intersection cell if a course outcome addresses a particular program outcome.

BA Semester 2

Open Elective

Paper No.2.3 OE -2

Title of the Course: Cultural Heritage of Karnataka

Course1		Course2	
Number of Theory Credits	**Number of lecture hours/semester**	**Number of Theory Credits**	**Number of lecture hours/semester**
3	**39 or 42**	**3**	**39 or 42**

Content of Course 1	**39/42 Hrs**
Unit–I Introduction	**13/14**
Chapter No: 1 Cultural Heritage – Meaning – Definitions – Concepts – Characteristics – Types of Indian Cultural Heritage – Tangible and Intangible - Oral and Living Traditions – Significance of Cultural Heritage in Human Life – Cultural Zones of Karnataka.	03
Chapter No: 2 Fairs, Festivals, Rituals: Ethnic Indian Cultural Construct – Significance and Historical background of Fairs, Festivals and Religious Rituals – Regional – Folk – Tribal– Monsoon Fairs - Animal Fairs – Jatres: Mylarlinga, Mudukutore, Suttur - Dasara, Deepavali, Nagarapanchami, Bangalore Karaga	04
Chapter No: 3 Pilgrimage Centres of Karnataka–Nanjanagudu, Malemadeshwara Betta, Dharmasthala, Shravanabelagola, Karkala, Moodabidare, Kukke Subramanya, Horanadu	04
Unit – II Legends, Narratives and Cultural Ethos	**13/14**
Chapter No: 4 Meaning – Significance – Forms and Traditions of Legends – Puranic Legends – Tradition of Cultural Heritage: Ramayana and Mahabharata – Ancient Fables of Ethical and Moral Values: Panchatantra and Vaddakatha, MylaraKavya, JunjappaKavya, Malemadeshwara Mahatme etc.	04
Chapter No:5 Traditional Performing Arts-Dravidian Aesthetics – Important Sources: Matanga Muni‟s Brihaddeshi and others. **Folk Dances and Theatre –Important Folk Dances:**Lavani, Kolata, Doddataetc **Oral Tradition and Performing Arts –**Bhajane, ,Harikatha,Yakshagana, Bootaaradane – **Puppetry**	05
Chapter No: 6 Karnataka Classical Music –Sources - Matanga Muni‟s Brihaddeshi– Two Major Traditions: Hindustani and Carnatic Music- Purandaradasa and Kanakadasa	04
Unit – III Architecture and Built Heritage	**13/14**
Chapter No: 7 Karnataka Architecture – The Beginnings – Influence of Mauryan Art and Architecture– Inscriptions - Introduction of Stupa Architecture – Important Stupas – Rock Cut Architecture: Caves and Temples – Temple Architecture: Nagara,	05

Dravida and Vesara Styles– Islamic Architecture – Colonial Architecture	
Chapter No.8 Important Monuments of North Karnataka (Study of Historical and Cultural Sites through maps)Sannati, Badami, Ihole, Pattadakallu, Hampi, Keladi etc.	04
Chapter No: 9 Important Monuments of South Karnataka - Rajaghatta , Halebidu, Beluru, Somanathapura, Talakadu, Shravanabelagola, Nandi etc	04

Note: Historical Tour and Preparation of Project Report based on field work is Mandatory

Suggested Readings

1. S.Settar - Prakrita Jagadvalaya
2. A. Sundara (Ed.) - Kannada VishayaVishvakosha Ithihasa mattu Puratatva
3. K.R Basavaraja - History and Culture of Karnataka
4. P.B.Desai - A History of Karnataka
5. A.Sundara(Ed) - Karnataka Charitre, Vol- I
6. B.SurendraRao(Ed.) - Karnataka CharitreVol - II
7. S.Settar - Halagannada;Bhashe, BhashaVikasa,Bhasha Bandhavya
8. M.Chidananda Murthy - Karnataka Shasanagala Samskrutika Adhyayana
9. S. Rajashekara - Karnataka Architecture
10. K.A.NilakantaSastri - A History of South India
11. .H. Tipperudraswamy - Karnataka Samskruti Sameekshe

Pedagogy

- Lecture Method – Class Room Teaching
- Learning Through Project work
- Collaborative learning strategies
- Use of Resources like Audio- Visual aids, Films, Documentaries
- Visit to Historical Sites, Museums etc.
- ICT Supplemented Teaching
- Seminars / Guest / Special Lectures
- Group Discussions

Modes of Assignment

- Individual Assignments
- Project Work
- Written Test
- Documentaries

Assessment:

Weightage for assessments (in percentage)

Formative Assessment		
	Internal Assessment	**Theory Part Semester End Examination**
Internal Test	10	60
Assignment / Book Review	10	
Seminar with Group Discussion	10	
Viva Voice	10	
Total	**40**	
Grand Total		**100**

Dr. K. SADASHIVA

Date:18.10.2021

BOS Chairperson

BA Semester 2

Open Elective

Paper No.2.3 OE -2

Course Title: **Manuscriptology**	
Total Contact Hours: 39 to 42	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 60
Syllabus Authors: BOS (UG)	Summative Assessment Marks: 100

Course Pre-requisite(s): Manuscriptology

Course Outcomes (COs):

At the end of the course the student should be able to:

- Understand the importance of manuscripts
- Study manuscripts as an ancillary for study of history
- Understand the concept of cataloguing of manuscripts
- Practice the science of conservation and preservation of manuscripts
- Visit libraries and Archives to study conservation and preservation

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)

Course Outcomes (COs) /Program Outcomes (POs)	**DSC 1**	**DSC 2**	**DSC 3**	**DSC 4**	**DSC 5**	**DSC 6**	**OE 1**	**OE 2**	**SEC 1**	**SEC 2**
Disciplinary Knowledge								X		
Communication Skills										
Critical Thinking								X		
Problem Solving								X		
Analytical Reasoning								X		
Cooperation and Team Work								X		
Reflective Thinking								X		
Self-motivated Learning								X		
Diversity Management and Inclusive Approach								X		
Moral and Ethical Awareness Reasoning								X		
Lifelong Learning								X		

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark „X in the intersection cell if a course outcome addresses a particular program outcome.

BA Semester 2

Open Elective

Paper No.2.3 OE -2

Title of the Course:
Manuscriptology

Course 1		Course 2	
Number of Theory Credits	**Number of lecture hours/semester**	**Number of Theory Credits**	**Number of lecture hours/semester**
3	**39 or 42**	**3**	**39 or 42**

Content of Course 1	**39/42 Hrs**
Unit – 1 Introduction	13/14
Chapter No: 1 Meaning – Definition – Characteristics - Scope and Importance	04
Chapter No: 2 Types of Manuscripts - Methods of Study- Writing Materials- Palm Leaf, Kadtatas (Black Book)	05
Unit – II Collection	13/14
Chapter No: 3 History of Manuscriptlogy	05
Chapter No: 4 Introduction of Indian Manuscriptology	04
Chapter No:5 Manuscripts in Kannada, Tigalari, Samskrita, Pali,Tamil/ Grantha, Tulu, Nandinagari and Modi	05
Unit – 3 Editing	13/14
Chapter No: 6 Collection of Manuscripts- Oriental Research Institute, Mysore, Melkote	03
Chapter No: 7. Process of Editing	05
Chapter No: 8. Preservation of Manuscripts – Regional Conservation Laboratory	06
Chapter No: 9 Visit to Oriental Research Institute and Regional Conservation Laboratory, Mysore, Academy of Sanskrit Research Center, Melukote. **Visit to Oriental Research Centers – Preparation Filed Study Report for Assignment is Mandatory.**	05

Suggested Readings

1. Chinthahar Chakravathi - Study of Manuscriptology
2. M.V Seetharamiah & M. Chidanada murthy - Hastiprati Sastra
3. N. Geethacharya - Hastiprati Sastra Adhyayana
4. Sitharam Jahagirdar - Kannada Grantha Sampadhana Sastra Parichaya
5. S. Jagannath - Grantha Sampadana Shastra
6. Devarakondareddy - Lipiya Huttu mattu Belavanige
7. Madhavana Katti - Lipishastra Pravesha
8. B.S Sanaya - Kannada Hasta Prathigala Micro film Soochi
9. T.V Venkatalachala Sastri - Halaya Honnu
10. A.K Sasthri - Sringeri Kadathagalu
11. S. Shankarappa Toranagallu - Lipi Niguda

Pedagogy

- Lecture Method – Class Room Teaching
- Learning Through Project work
- Collaborative learning strategies
- Use of Resources like Audio- Visual aids, Films, Documentaries
- Visit to Historical Sites, Museums etc.
- ICT Supplemented Teaching
- Seminars / Guest / Special Lectures
- Group Discussions

Modes of Assignment

- Individual Assignments
- Project Work
- Written Test
- Documentaries

Assessment:

Weightage for assessments (in percentage)

Formative Assessment		
	Internal Assessment	**Theory Part Semester End Examination**
Internal Test	10	60
Assignment / Book Review	10	
Seminar with Group Discussion	10	
Viva Voice	10	
Total	**40**	
Grand Total		**100**

Dr. K. SADASHIVA

Date:18.10.2021

BOS Chairperson

Course Matrix for B.A. (History-Honors): 5 Years (10 Semesters)for Academic Year 2021-22

[As per NEP-2020 Guidelines]

FIRST SEMESTER

Paper No.	Course	Title of theCourse	Course Code	Instruction Hours per week	Exam Duration	Marks			Credits
						IA	ETE	Total	
1.1	DSC-1	Introduction to Ancient World Civilization		4	3	40	60	100	3
1.2	DSC-2	History of Ancient India (From Earliest Times to 1206 CE)		4	3	40	60	100	3
1.3	OE-1	Cultural Heritage of India OR Introduction to Archaeology		4	3	40	60	100	3
	Total Credits								**9**

SECOND SEMESTER

Paper No.	Course	Title of the Course	Course Code	Instruction Hours per week	Exam Duration	Marks			Credits
						IA	ETE	Total	
2.1	DSC-3	Introduction to Medieval World Civilization		4	3	40	60	100	3
2.2	DSC -4	History of Medieval India (1206 to 1761)		4	3	40	60	100	3
2.3	OE-2	Cultural Heritage of Karnataka OR Manuscriptology		4	3	40	60	100	3
	Total Credits								**9**

THIRD SEMESTER

Paper No.	Course	Title of the Course	Course Code	Instruction Hours per week	Exam Duration	Marks			Credits
						IA	ETE	Total	
3.1	DSC-5	Rise of Modern West (1600 – 1871)		4	3	40	60	100	3
3.2	DSC-6	History of Modern India (1761 to 1947)		4	3	40	60	100	3
3.3	OE-3	Freedom Struggle in India (1885 to 1947) OR Introduction to Epigraphy		4	3	40	60	100	3
	Total Credits								**9**

FOURTH SEMESTER

Paper No.	Course	Title of the Course	Course Code	Instruction Hours per week	Exam Duration	Marks			Credits
						IA	ETE	Total	
4.1	DSC-7	History of Karnataka (From Earliest Times to 10th Century CE)		4	3	40	60	100	3
4.2	DSC-8	History of Modern Europe (1871- 1945)		4	3	40	60	100	3
4.3	OE-4	Freedom Movements in Karnataka (1800 to 1947) Or Principles and Practice of Museology		4	3	40	60	100	3
	Total Credits								**9**

FIFTH SEMESTER

Paper No.	Course	Title of theCourse	Course Code	Instruction Hours per week	Exam Duration	Marks			Credits
						IA	ETE	Total	
5.1	DSC-9	History of Karnataka (From 11th Century to 1761 CE)		4	3	40	60	100	4
5.2	DSC-10	India and its Neighbours (1947 to 2020)		4	3	40	60	100	4
5.3	DSE-1	Colonialism and Nationalism in Asia Or History of Africa (c1500 -1960s) Or History of Latin America (c1500 - 1960s)		4	3	40	60	100	3
5.6	VOC	History of Tourism in India Or Heritage Tourism in Karnataka Or Guiding Skills in Tourism		4	3	40	60	100	3
	Total Credits								**14**

SIXTH SEMESTER

Paper No.	Course	Title of the Course	Course Code	Instruction Hours per week	Exam Duration	Marks			Credits
						IA	ETE	Total	
6.1	DSC-11	History of Karnataka (From 1761 - 1956)		4	3	40	60	100	4
6.2	DSC-12	Regional History – Modern Mysore (1881-1947)		4	3	40	60	100	4
6.3	DSE-2	History of China and Japan OR History of South East Asia OR History of West Asia		4	3	40	60	100	3
6.6	VOC	Historical Sites in Your own District Or History of Indian Paintings Or History of Indian Numismatics		4	3	40	60	100	3
	Total credits								**14**

SEVENTH SEMESTER

Paper No.	Course	Title of theCourse	Course Code	Instruction Hours per week	Exam Duration	Marks			Credits
						IA	ETE	Total	
7.1	DSC-13	Social Formations and Cultural Patterns of Ancient India		4	3	40	60	100	4
7.2	DSC-14	Social Formations and Cultural Patterns of Ancient Karnataka		4	3	40	60	100	4
7.3	DSC-15	Economic History of Ancient India		4	3	40	60	100	3
7.4	DSE-3	Art and Architecture of Ancient India OR Art and Architecture of Ancient South India OR Art and Architecture of Ancient Karnataka		4	3	40	60	100	3
7.5	Research method	Historical Research - Theory and Method		4	3	40	60	100	3
7.6	DSE-4	History of USA (1773-1991) OR History of Russia (1917- 1991)		4	3	40	60	100	3
	Total credits								**20**

EIGHTH SEMESTER

Paper No.	Course	Title of theCourse	Course Code	Instruction Hours per week	Exam Duration	Marks			Credits
						IA	ETE	Total	
8.1	DSC- 16	Historiography		4	3	40	60	100	4
8.2	DSC-17	Social Formations and Cultural Patterns of the Medieval India		4	3	40	60	100	4
8.3	DSC-18	Social Formations and Cultural Patterns of Medieval Karnataka		4	3	40	60	100	3
8.4	DSE-5	Art and Architecture of Medieval India OR Art and Architecture of Medieval South India OR Art and Architecture of Medieval Karnataka		4	3	40	60	100	3
8.5	Research Project	Field Visits – Theory .		4	3	40	60	100	6
	Total credits								**20**

NINTH SEMESTER

Paper No.	Course	Title of the Course	Course Code	Instruction Hours per week	Exam Duration	Marks			Credits
						IA	ETE	Total	
9.1	DSC-19	Colonialism and Nationalism in Modern India		4	3	40	60	100	4
9.2	DSC-20	Social Movements in Modern India		4	3	40	60	100	4
9.3	DSC-21	Economic History of Medieval India		4	3	40	60	100	3
9.4	DSE-6	Science and Technology in Ancient India OR History of War Techniques and Strategies in Ancient India		4	3	40	60	100	3
9.5	DSE-7	Dr. B.R. Ambedkar's Social and Political Philosophy OR Social Dissents in India (6th BCE to 1800 CE) OR Women Studies		4	3	40	60	100	3
9.6	DSE- 8	Contemporary India (1947-2020) OR Contemporary Karnataka (1947-2020) OR Contemporary World (1945 – 2020)		4	3	40	60	100	3
	Total credits								**20**

TENTH SEMESTER

Paper No.	Course	Title of the Course	Course Code	Instruction Hours per week	Exam Duration	Marks			Credits
						IA	ETE	Total	
10.1	DSC-22	Multi-Disciplinary Approach to Historical Research		4	3	40	60	100	4
10.2	DSC-23	Debates in Indian History		4	3	40	60	100	4
10.3	DSC-24	Major Trends in Historical Thoughts and Writings		4	3	40	60	100	3
10.4	DSE-9	Science and Technology in Medieval India OR History of War Techniques and Strategies in Medieval India OR History of Communication OR History of Environment		4	3	40	60	100	3
10.5	DSE- 10	Field Visit – Theory OR Project Work - Compilation of Data		4	3	40	60	100	3
	Total Credits								**20**

UNIVERSITY OF MYSORE

DEPARTMENT OF JOURNALISM & MASS COMMUNICATION

MANASAGANGOTRI, UNIVERSITY OF MYSORE – 570006

Submitted to the Registrar (Academic)

CHOICE BASED CREDIT SYSTEM

Approved Syllabus

BOS Approved Syllabus for UG Program

(NEP 2021)

Syllabus for I & II Semester

(EFFECTIVE FROM ACADEMIC YEAR 2021-22)

SEPTEMBER 2021
BA HONOURS & MASTER'S PROGRAMME IN JOURNALISM AND MASS COMMUNICATION

Programme: Five-year Integrated Master's Programme in Journalism and Mass Communication to be introduced under NEP

Programme Objectives:

- Five-year Integrated Course in Journalism and Mass Communication would aim to familiarize students with all aspects of the field of Journalism. They become more proficient in both theory and practical skills of the media in general.

- The programme would prepare the students 'ready-to-be recruited by media, advertising & corporate houses'. The content of the programme is designed to be dynamic and incorporate changes to meet requirements of the industry.

Learning Outcome:

- The programme aims to churn out responsible media professionals who would contribute positively to the society.

- The programme aims to facilitate better career opportunities for all those students of this course and get them ready to tackle challenges in the professional setup.

- The programme aims to strike a balance between the dynamic working environment and professional ethics in the field of Journalism and Mass Communication.

Need for Curriculum Development:

NEP 2020 initiative is intended to formulate a curriculum to bring about uniformity among the students studying in different Universities/Institutes. The need for the curriculum development in Journalism and Mass Communication emerges due to the following reasons:

Changing Media Scenario: The curriculum has been designed keeping with the industry requirements and includes subjects such as Multimedia, Photojournalism, Short Film Making, Creating Blogs and Vlogs, Mobile Journalism, Writing for Media, Producing News Bulletins

for Radio and TV, Advertising and Corporate Communications, among several others. The rapid growth in media industry demands highly skilled human resource.

Credit transfer: Credit transfer is approved by the UGC and the Government that allows the students to transfer course from their existing university to a new UGC approved university. The same number of credits in all the Universities in Karnataka is the first step towards the credit transfer from University to University.

Skill Enhancement: The new curriculum focuses more on hands on training, internship and thereby enhancing the skills of the students. It not only aims at producing responsible communication professionals but also citizens with a humane approach in day to day life. The papers like Writing for Media, Photojournalism, Computer Applications for Media etc., further helps in skill development of students.

Pedagogy:

The goal of Journalism and Mass Communication pedagogy is offered with an objective to train and prepare professionally skilled media persons and communication experts. It lends exposure to a wide range of meticulously framed syllabi.

Importance to Theory and Practicals and its application: The Journalism and Mass Communication curriculum focuses on innovative components in theory and practice, which in turn equips students to be full-fledged media men.

Utilisation of ICT: The global media industry is in anticipation of ICT trained communication experts. To enhance critical and creative thinking amongst students, ICT tools are incorporated into the teaching methods which include research-led teaching, via presentations through smart classrooms, and practical productions.

Research-based and research-led teaching: The Research Projects are introduced in the curriculum to strengthen the research concepts among the budding researchers. The students are introduced to various facets of Journalism and Mass Communication research such as print, electronic and new media research, global, health and political communication research, folk media, intercultural communication and research on development issues and so on in accordance to the relevance of the profession. The students will be required to do research project on a topic of their choice under the supervision of a research guide.

Brain Storming Approach: Students will be involved in groups and individual discussions. This will help the students to develop and involve in the process of critical thinking and analysing. It further helps them in decision making and crisis management and also boosts self confidence.

Exit Options and Credit Requirements:

A Certificate / Diploma/ Bachelor Degree or Bachelor Degree with Honours in Journalism and Mass Communication is awarded at the completion of every progressive year.

Exit Option with	Certificate/Diploma/Degree/ Honours
Successful completion of First year (two semesters) of the Four years multidisciplinary undergraduate Degree programme.	Certificate in Journalism and Mass Communication
Successful completion of Second year(four semesters)of the four years multidisciplinary undergraduate Degree programme	Diploma in Journalism and Mass Communication
Successful completion of Three year (six semesters) of the four years multidisciplinary undergraduate degree Programme	Bachelor of Arts Degree in Journalism and Mass Communication
Successful completion of Four year (eight semesters) of the four years multidisciplinary undergraduate degree Programme	Bachelor of Arts Degree with Honours in Journalism and Mass Communication
Successful completion of Five year (Ten semesters)of the Five years multidisciplinary degree programme	Master of Arts Degree With Honours in Journalism and Mass Communication

A student will be allowed to enter/re-enter only after the odd semester and they can only exit after even semester. Re-entry at various as lateral academic programmes based on the above mentioned earned proficiency test records. The validity of the earned credit will be for a maximum period year or as specified by the academic bank of credits (ABC).

Acronyms Expanded	
AECC	Ability Enhancement Compulsory Course
DSCC	Discipline Specific Core Course
SEC/SB/VB	Skill Enhancement Course- Skill Based/Value Based
OEC	Open Elective Course
DSE	Discipline Specific Elective

Continuous Internal Evaluation and Semester End Examination:

Total marks for each course shall be based on continuous assessments and term end examinations. As per the decision of the Karnataka State Higher Education Council, it is necessary to have uniform pattern of Class Internal Assessment and Semester End examinations respectively, among all the Universities, their affiliated and autonomous colleges. The state level committee deliberated on the same and suggested the following pattern for the CIE Marks. The BOS has also approved to follow the same pattern.

COURSE PATTERN AND SCHEME OF EXAMINATION FOR BA AS PER NEP (2021-22 AND ONWARDS)

Semester	Course Code	Paper Title	Teaching Hours	Hours/ Week			Total Marks /Paper				Total Marks	Duration of Examination (Hours)		Credits		
							Theory & Practical									
				Theory	Practical	Total Hrs	Max	Min	IA	Total		Theory	Practical	Theory	Practical	Total
I	DSC 1	Introduction to Journalism (With Practical)	60	04	04	08	60 30	24 12	40 20	100 50	100 + 50	2Hr 30Min	02	04	02	04 + 02
	OE 1	Writing for Media	45	03	-	03	60	24	40	100	100	2Hr 30Min	-	03	-	03
II	DSC 2	Computer Applications for Media (With Practical)	60	04	04	08	60 30	24 12	40 20	100 50	100 + 50	2Hr 30Min	02	04	02	04 + 02
	OE 2	Photo Journalism	45	03	-	03	60	24	40	100	100	2Hr 30Min	-	03	-	03

BA Programme Structure Having Practical Core Courses

Sem	Discipline Specific Core Courses (DSCC)			Open Elective Courses (OEC/DSE)			Skill Enhancement Course						Ability Enhancement Compulsory Course (AECC)			Total Credits
							Skill Based			Value Based						
	Core Courses	L+T+P	Credit	Core Courses	L+T+P	Credit	Core Courses	L+T+P	Credit	Core Courses	L+T+P	Credit	Course	Hours	Credit	
I	DSCC 1	4+0+4	4+2=6	OEC 1	3+0+0	3	SEC 1	1+0+2	1+1=2	Health & Wellness/ Social & Emotional Learning	1+0+2	1+1=2	Kannada 1	04	3+0+1	24
													MIL/MEL1	04	3+0+1	
II	DSCC 2	4+0+4	4+2=6	OEC 2	3+0+0	3				Activity Based Course	1+0+2	1+1=2	Kannada 2	04	3+0+1	24
													MIL/MEL2	04	3+0+1	
													EVS	02	2+0+2	

EXIT OPTION WITH CERTIFICATE (48 CREDITS)

NOTE:

1. Two Hours of Practical = Two Hour,
2. Students per batch = Nineteen (in case of students above 20 -35 make two batches).
3. Geography, Psychology, Criminology and other subjects to follow the GOK norms.
4. IA means Assignment, Seminar, Test, Group Discussion, Quiz, Workshop etc.
5. OE paper – Minimum intake of the students for DSE (OE) is at the discretion of the principal or as per the government norms.

(Structure for the remaining semesters will be formulated in the upcoming BOS meetings.)

DSCC 1: INTRODUCTION TO JOURNALISM

Course Title and Code	DSC 1-Introduction to Journalism (With Practical)		
Programme Title	Bachelor of Arts in Journalism and Mass Communication		
Credits	Theory -04 Practical - 02	Semester	I
Course Type	Core	Academic Year	2021-22

Pedagogy: Theory: 4hrs/week
Practical: 4hrs/week
Total: 6 credits
Theory Marks– 100 = 60 T + 40 IA
Practical Marks 50 = 30 T + 20 PR
Total Marks = 150

Course Objectives:

- To introduce the concept of journalism and mass communication
- To familiarize the students with different facets of journalism
- To educate the students about the role of journalism in the development of society

Learning Outcome:

At the end of the course, the students should be able

- To identify the distinct nature of journalism and its professional aspects, including career opportunities
- To familiarize and use terms specific to media
- To acquaint the students about the historical perspective of Indian journalism
- To upgrade the students with the current practices in journalism

Unit – I:
Definition, Meaning, Nature, Scope, Functions and Principles of Journalism, Types of Journalism – Magazine, Business, Environment, Sports, Entertainment, Moffussil, Citizen Journalism, MoJo, Glossary of Journalism, Introduction to Mass Media, Types of Mass Media – Traditional, Folk Media, Print Media, Electronic Media and New Media.

Unit –II:
Brief History of Indian Journalism – Evolution & Growth with special references to James Augustus Hickey, James Silk Buckingham, Raja Ram Mohan Roy, Mahatma Gandhi, Dr. B.R. Ambedkar, Bal Gangadhar Tilak and Annie Besant, History of Centenarian Newspapers – The Hindu, Times of India, The Tribune, Amrit Bazar Patrika and The Statesman.

Unit – III:
Brief History of Kannada Journalism with special reference to Hermann Moegling, M. Venkatakrishnaiah, DV Gundappa, Mohare Hanumantha Rao, and P R Ramaiah, H.K.Veeranna Gowda. Contribution of Women Journalists – Nanjanagudu Thirumalamba, Kalyanamma.

Unit – IV:
Career Opportunities, Qualification, Duties, Responsibilities of Journalists, Professional Code of Ethics, Role of Press in Democracy, Theories of Press - Authoritarian, Libertarian, Social Responsibility, Soviet Media Theory, Development Media Theory and Democratic Participation

Theory.

Practical Component:

1. Letters to the Editor – Publish 2 letters in any of the Local or National Dailies.
2. Make a comparative analysis of any two regional/national newspapers.
3. Compare any two magazines.
4. Analyze the contribution of any journalistic personality from Unit III
5. Analyze a news channel of your choice (regional/national).

Books for Reference:

1. Theory and Practice of Journalism - B N Ahuja
2. Professional Journalism - M V Kamath
3. Mass Communication & Journalism in India - Keval J Kumar
4. Adhunika Bharathiya Parthrikodhyma - Shree L Bhandarkar
5. Professional Journalist John Hohenberg
6. Mass Communication & amp; Journalism in India - Mehta
7. Eradu Dadagala Nadhuve – Niranjana Vanalli
8. Pathrikodyama - Ranganath Rao
9. History of Indian Journalism - S Natarajan
10. Indian Journalism - Nadig Krishnamurthy
11. Journalism in India- R.Parthasarathy
12. New History of Indian Journalism - G N S Raghavan
13. History of Press, Press Laws & Communication- B N Ahuja
14. Karnataka Pathrika Ithihasa Vol. 1,2,3 - Karnataka Pathrika Academy
15. Indian Journalism - K M Srivastava

DSE (OE) 1: WRITING FOR MEDIA

Course Title and Code	OE 1-Writing for Media		
Programme Title	Bachelor of Arts in Journalism and Mass Communication		
Credits	3	Semester	I
Course Type	Core	Academic Year	2021-22

Pedagogy: Theory: 3hrs/week
Total: 3 credits
Theory Marks- 100 = 60 T + 40 IA
Total Marks = 100

Course Objectives:

- Familiarizing students with writing skills for various media..
- To instill interest among students for media writing
- To equip the students with recent trends in media writing.

Learning Outcome:

- Learning various writing techniques for different media.
- Creating content for various social media platforms.
- Students become industry-ready.

Unit I:

Print Media: Introduction to Writing for Print Media, Principles & Techniques of Writing for Print Media. – Clarity, Brevity, Simplicity, Readability and Accuracy.

Forms of Journalistic Writing - News Writing – Inverted Pyramid, Writing Columns, Articles, Features, Editorials, Letters to the Editor, Preparing Press Releases.

Unit-II:

Electronic Media:
Radio: Writing for Radio, Language and Grammar, Writing News Scripts, Preparing Ad Scripts, Radio Jockey Skills.

Television: Basic Principles and Techniques of TV Writing, Elements of TV Scripting, Language and Grammar, Writing News Scripts.

Unit-III:

New Media: Writing Techniques for New Media, Writing for Social Media (Facebook, Twitter, LinkedIn, Instagram), Introduction to Blogging and Vlogging, Current Trends in Web Journalism.

Books for Reference:

1. History of Indian Journalism: Nadig Krishnamurthy- University of Mysore press
2. Dilwali, Ashok. (2002). All about photography. New Delhi: National Book Trust.
3. Kobre, Kenneth. (2000). Photojournalism. The professional approach (4th Ed). London: Focal Press
4. Horton, Brian. (2000). Guide to photojournalism. New York: McGraw-Hill
5. Chapnick, Howard. (1994). Truth needs no ally: Inside photojournalism. New York: University of Missouri Press
6. British Press Photographers Association. (2007). 5000 Days: Press photography in a changing world. London: David & Charles.
7. Nair, Archana. (2004). All about photography. New Delhi: Goodwill Publishing House.

DSCC 2: COMPUTER APPLICATIONS FOR MEDIA

Course Title and Code	DSE 2- Computer Applications for Media (With Practical)		
Programme Title	Bachelor of Arts in Journalism and Mass Communication		
Credits	Theory -04 Practical - 02	Semester	II
Course Type	Core	Academic Year	2021-22

Pedagogy: Theory: 4hrs/week
Practical: 4hrs/week
Total: 6 credits
Theory Marks– 100 = 60 T + 40 IA
Practical Marks 50 = 30 T + 20 PR
Total Marks = 150
Total Marks = 150

Course Objectives:

- To introduce students to the basics of computer.
- To familiarize the students to the applications of computers in print and electronic journalism
- To facilitate the students to learn the practical applications of computers at different levels in media.

Learning Outcome:

- Students will be equipped with computer related media skills.
- Students will get hands on experience on various computer applications.
- Students will independently be able to create new media content.

Unit I:

Introduction to Computers, Basic Hardware, Computer and Newspaper Production, Softwares for Newspaper Production, Internet, DTP, PageMaker, Adobe Indesign, Baraha and Nudi.

Unit II:

MS Office: Word, Power Point, Excel – Creating Charts, Graphs, Tables, Use of Computers in Reporting, Editing, Pagination and Printing.

Unit III:

Web Journalism, Techniques of Web Writing, Illustrations and Web Designing, Language,

Presentation, Multimedia, Online Newspapers, Web Portals

Unit IV:

New Media – Definition and Characteristics, Types of New Media – Websites, Blogs, Vlogs, Email, Social Media Networks & OTT Platforms, Types, Techniques & Softwares for Blogging & Vlogging, Cyber Crime, Web Glossary.

Practical Component:

1. Create a blog/vlog on a topic of your choice.
2. Compare any two news/ sports portal of your choice.
3. A review on any recent OTT content of your choice.
4. Present two recent case studies on Cyber Crime.
5. Prepare a lab journal of 2 pages (A3 size).

Books for Reference:

1. Sunder, R., 2000. Computers Today Ed.2, JohnWiley,
2. Benedict, M., Cyberspace: First steps, ed. Cambridge, MA. MITPress.
3. Chapman and Chapman, Digital Multimedia, WileyPublication.
4. James C. Foust, Online Journalism: Principles and Practices ofNews for the Web.3 Scottsdale, AZ: Holcomb Hathaway.
5. Janet H. Murray, Hamlet on the Holodeck: The Future of Narrative in Cyberspace, New York: Free Press,1997
6. Macintosh, Advanced Adobe Photoshop, Adobe publishers.
7. Satyanarayana, R., Information Technology and its facets, Delhi, Manak2005.
8. Smith, Gene. Tagging: People-powered Metadata for the Social Web, Indianapolis, Indiana: New Riders Press, 2008.

DSE (OE) 2: PHOTO JOURNALISM

Course Title and Code	OE-2 Photo Journalism		
Programme Title	Bachelor of Arts in Journalism and Mass Communication		
Credits	03	Semester	II
Course Type	Core	Academic Year	2021-22

Pedagogy:
Theory: 3 hrs/week
Total: 3 credits
Theory Marks– 100 = 60 T + 40 IA
Total Marks = 100

Course Objectives:

- To attract students towards photojournalism
- To familiarize the students to techniques of photography and photojournalism
- To give a practical knowledge in the field of photography

Learning Outcome:

- Students will get hands on experience on visual communication.
- Students will learn the significance of pictures in various media.
- Students will upgrade their knowledge on various photo- editing software.

Unit-I

Concept of Photography, Evolution of Photography, Different Types of Cameras--Manual, Digital and Phone Cameras, Types of Photography – Portrait, Landscape, Street Photography, Wildlife, News Photography, Celebrity Photography.

Unit-II

Meaning of Photo Journalism, Qualifications, Role and Responsibilities of Photo Journalists, Photo Features, Techniques of Photo Editing, Caption Writing, Leading Press Photographers and Photo Journalists in India.

Unit-III

Mobile Journalism - Using Smartphones for News Reporting, Photo Editing on Smart Phones, Publishing News Content using Smartphones on Digital Platforms, Techniques of Short Film Making.

Books for Reference:

1. Milten Feinberg- Techniques of Photo Journalism
2. Michel Long ford- Basic Photography
3. Tom Ang- Digital Photography- Master classes
4. N Manjunath- Chayachitra Patrikodyama
5. Cyernshem G R- History of Photography

QUESTION PAPER PATTERN

DSCC THEORY:

Time: 2 hours 30 mins **Marks: 60**

Instructions:
All parts are mandatory.

PART A

Answer any FIVE of the following: 5 x2=10

1.
2.
3.
4.
5.
6.
7.

PART B

Answer any FOUR of the following: 4x5=20

8.
9.
10.
11.
12.
13.

PART C

Answer any THREE of the following: 3x10=30

14.
15.
16.
17.
18.

NOTE: Questions must be prepared such that all units are covered.

DSC PRACTICAL.

Time: 2 hours **Marks: 30**

NOTE:
1. Questions for practical examination should be in the form of applied knowledge of the theory part. (The question paper should be prepared by BoE for **30 marks.)**
2. A practical record should be evaluated by both internal and external examiner for the remaining **20 marks.**

QUESTION PAPER PATTERN

DSE (OE) THEORY:

Time: 2 hours 30 mins **Marks: 60**

Instructions:
All parts are mandatory.

PART A

Answer any FIVE of the following: 5 x2=10

1.
2.
3.
4.
5.
6.
7.

PART B

Answer any FOUR of the following: 4x5=20

8.
9.
10.
11.
12.
13.

PART C

Answer any THREE of the following: 3x10=30

14.
15.
16.
17.
18.

NOTE: Questions must be prepared such that all units are covered.

CURRICULUM STRUCTURE FOR UNDERGRADUATE DEGREE PROGRAM

(Inputs to this document: List of Core and GE Courses of the Program)

Course Objectives (not exceeding three per course)

Name of the Degree: BA **Specialization: Journalism and Mass Communication**

Program Articulation Matrix:

This matrix lists all course papers **(DSC + GEC).** It include all types of courses (Theory, Lab, Tutorial, Project, Internships that every student of the course). Electives are also a part of this list.

Sem	Name of the course	Course Objectives (not exceeding three per course)	Pre-requisite course(s)	Pedagogy	Assessment Marks
1	Introduction to Journalism (DSC)	To introduce the concept of journalism and mass communication. To familiarize the students with different facets of journalism To educate the students about the role of journalism in the development of society	PUC	Practical assignments	Theory – 60 IA - 40 Practical Exam : Practical Exam– 30 Practical Record -20 **Total – 100 (T) + 50(P)=150**
1	Writing for Media (OE)	Familiarizing students with writing skills for various media. To instill interest among students for media writing To equip the students with recent trends in media writing.			Theory – 60 IA - 40 **Total – 60(T) + 40 (IA) = 100**
2	Computer applications for media (DSC)	To introduce students to the basics of computer. To familiarize the students to the applications of computers in print and electronic journalism To facilitate the students to learn the practical applications of computers at different levels in media.		Practical assignments	Theory – 60 IA - 40 Practical Exam : Practical Exam– 30 Practical Record -20 **Total – 100 (T) + 50(P)=150**
2	Photo Journalism (OE)	To attract students towards photojournalism To familiarize the students to techniques of photography and photojournalism To give a practical knowledge in the field of photography			Theory – 60 IA - 40 **Total – 60(T) + 40 (IA) = 100**

NOTE: The Course Objectives (DSCC + OEC) for the remaining semesters will be formulated during the syllabus framing process in the upcoming BOS Meeting.

CURRICULUM STRUCTURE FOR UNDERGRADUATE DEGREE PROGRAM

(Inputs to this document: List of Core Courses of the Program)

Learning Outcome

Name of the Degree: BA **Specialization: Journalism and Mass Communication**

Program Articulation Matrix:

This matrix lists all course papers **(DSCC + OEC)**. It include all types of courses (Theory, Lab, Tutorial, Project, Internships that every student of the course). Electives are also a part of this list.

Sem	Name of the course	Leaning Outcome	Pre-requisite course(s)	Pedagogy	Assessment Marks
1	Introduction to Journalism **(DSC)**	To identify the distinct nature of journalism and its professional aspects, including career opportunities To familiarize and use terms specific to media To acquaint the students about the historical perspective of Indian journalism & upgrade the students with the current practices in journalism	PUC	Practical assignments	Theory – 60 IA - 40 Practical Exam : Practical Exam- 30 Practical Record -20 **Total – 100 (T) + 50(P)=150**
1	Writing for Media **(OE)**	Learning various writing techniques for different media. Creating content for various social media platforms. Students become industry-ready.			Theory – 60 IA – 40 **Total – 60(T) + 40 (IA) = 100**
2	Computer applications for media **(DSC)**	Students will be equipped with computer related media skills. Students will get hands on experience on various computer applications. Students will independently be able to create new media content.		Practical assignments	Theory – 60 IA - 40 Practical Exam : Practical Exam- 30 Practical Record -20 **Total – 100 (T) + 50(P)=150**
2	Photo Journalism **(OE)**	Students will get hands on experience on visual communication. Students will learn the significance of pictures in various media. Students will upgrade their knowledge on various photo- editing software.			Theory – 60 IA – 40 **Total – 60(T) + 40 (IA) = 100**

NOTE: The Learning Outcome (DSCC + OEC) for the remaining semesters will be formulated during the syllabus framing process in the upcoming BOS Meeting.

Proposed CBCS Scheme for the Four Years Multidisciplinary Undergraduate Honours Programme/ Five years Integrated Masters Programme

Option: Major with Minor

Discipline and Other Courses (Four credits per course)

Subject: Journalism & Mass Communication

Sem	DSC	MDC	DSE	GEC	Language	Voc	AEC	SEC	ECA	Total Credits
1	Introduction to Journalism		Writing for Media		L1 L2				ECA1	23
	Practical in Journalistic writing									02
	Total Credits					**25**				
2	Computer applications for media		Photo Journalism		L1 L2				ECA2	21
	Practical: Computer Applications for media									02
	Total Credits					**23**				
3	News Reporting and Analysis		Feature writing and Freelancing		L1 L2	Videography		Multi Media		21
	Practical: News reporting and analysis									02
	Total Credits					**23**				
4	News Processing and Editing		Translations for Media		L1 L2	Radio Jockey		Technical Writing		22
	Practical: News Processing and Editing									02
	Total Credits					**25**				
	DSC5: Introduction to Communication									

5	DSC6: Media Laws and Ethics DSC7: Introduction to Digital Media								Web Journalism		18
	Practical: Digital Media Production										02
	Total Credits					**20**					
6	DSC 8: Development Journalism DSC9: Fundamentals of Digital Film Making								Film Appreciation		18
	Practical: Digital Film Making										02
	Total Credits					**20**					
7	DSC10: Theories of Communication DSC11: Advertising & Corporate Communication DSC12: Media Research		DSE1: Radio Programme & Production (P)DSE1: Radio Production DSE2: Basics of Camera, Lights &Sound (P) DSE 2: Camera Lights and Sound DSE3: Television Programme & Production (P)DSE 3: Television Production DSE4: Introduction to Story and Script Writing (P) DSE 4: Story and Script Writing DSE5: Writing Techniques for New Media (P) DSE 5: Writing for Digital Media DSE6: Web Design and						Graphic Design		20

			Development (P) DSE 6: Web Design and Development							
	Total Credits					**20**				
8	DSC13:Event Management DSC14: Media Entrepreneurship		DSE7: Virtual Content Development (P)DSE7: Virtual Content Development DSE 8: Web & Digital Publishing (P)DSE8: Web and Digital Publishing DSE9: Production Techniques for Digital Platforms (P)DSE9: Production Techniques for Digital Platforms DSE 10: Audio and Video Editing (P)DSE10: Audio and Video Editing DSE11:Social Media Strategies for Corporate Communication (P)DSE11: Social Media Strategies for Corporate Communication DSE12: Media Planning, Buying and Selling (P)DSE12: Media Planning, Buying and Selling DSE13: Documentary Production/Dissertation					Anchoring		20
		Total Credits		**20**						

9	**DSC15: NEW MEDIA** I. New Age Technologies II. Writing Techniques for new Media III. Data Journalism		Theory 50 Marks Practical 50 Marks DSE10 Fundamentals of Multimedia Or DSE11Web Design and Development DSE12 Writing Techniques for Social Media Or DSE13 Web and Digital Publishing DSE14Data Journalism Or DSE15 Creative Solution Design (or choose any 3)					24
	DSC16: RADIO AND TELEVISION JOURNALISM I. Writing and Reporting for Radio II. Writing and Reporting for Television III. Data Journalism		Theory 50 Marks Practical 50 Marks DSE10 Script Writing for Audio Or DSE11 Presentation Skills for Radio DSE12 Script Writing for Video Production Or DSE13 Presentation Skills for Television DSE14Data Journalism OR DSe15 Basics Sound and Sound Recording (or choose any 3)					
	DSC17: ADVERTISING AND CORPORATE COMMUNICATION I. Introduction to Marketing Communication II. Writing Techniques III. for Corporate Communication IV. Data Journalism		Theory 50 Marks Practical 50 Marks DSE10 Digital Advertising DSE11 Social Media for Public Relations					

			DSE12Visual Communication for Advertising Or DSE13 Visual Communication for Corporate Communication DSE14 Data Journalism DSe15 Content Creation for Ad & Corporate Communication (or choose any 3)							
10	**DSC18: NEW MEDIA** I. Digital Media Marketing Tools and Strategies II. Social Media Concepts and Strategies III. Applied Digital Media Production		Theory 50 Marks Practical 50 Marks DSE16 Graphic Design for Digital Media DSE17 Basic Animation DSE18 Social Media Strategies for Marketing DSE19 Content Creation Techniques for Social Media DSE20 Production Techniques for Digital Media DSE9 Management of Social Media Blogs Project work (or choose any 3)							24

DSC19: RADIO AND TELEVISION JOURNALISM I. Radio Programme Production II. Television Programme Production III. Fundamentals of Audio, Video and Lights	Theory 50 Marks Practical 50 Marks DSE16 Audio Production DSE17 Audio Editing DSE18 Video Programme Production DSE19 Video Editing DSE20 Virtual Content Production DSE9 Audio and Video Production Management Project work (or choose any THREE)
DSC20: ADVERTISING AND CORPORATE COMMUNICATION I. Digital Media Strategies for Advertising II. Media Strategies for Corporate Communication III. Creative Strategies for Advertising	Theory 50 Marks Practical 50 Marks DSE16 Creative Strategies for Advertising DSE17 Advertising Copy Writing DSE18 Media Planning, Buying and Selling DSE19 Writing and Story Telling Across the Platforms DSE20 Ad. Production DSE9 PR Campaign Production Techniques Project work (or choose any THREE)

Model Curriculum

Name of the Degree Program: **BA**

Discipline Core: Journalism and Mass Communication/ Electronic Media

Total Credits for the Program: **176** **Starting year of implementation: 2021-22**

Program Outcome:

By the end of the program's the students will be able to:

(Refer to literature on outcome-based education (OBE) for details on Program Outcomes)

1. The programme ensures responsible citizens to the society as a product.
2. The programme will facilitate job opportunities for all those who invest five years in attending this programme.
3. The programme ensures that the products of the programme are not only good in technology but also respect the ethics of the field.

Assessment:

Weightage for assessments (in percentage)

Type of Course	Formative Assessment / IA	Summative Assessment
Theory (DSCC)	40 (C1+C2)	60
Practical (DSCC)	20 (Practical Record)	30
Projects (DSCC)	40 (20 – Assessment + 20 - Viva)	60 (Dissertation)
Experiential Learning (Internships etc.)		100
Theory (OEC)	40 (C1+C2)	60

Dr. C K Puttaswamy
Professor & Chairman
Board of Studies

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(©.J./©PÁA/©.©.J./©.J¹ì./©¹J/©.ªÉÇÃPï)

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I	C1 L 1-1	FSA010/ FPA010B S DB010B ANB010B QP 11101/	©.J¹ì/©.ªÉÇÃP ï ¥ÀwæPÉ-1 «eÁÕ£À ¹j-1	AECC	3:0:0	3	4	20	20	60	100
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COMBINATIONWISE COURSE CODE

BA—EG- FHA01031,HP- FHA01032,KG- FHA01033,HE- FHA01034,
JP- FHA01035

BSc—PC- FSA01031,PM- FSA01032,PE- FSA01033,CsM- FSA01034,
ECs- FSA01035,BtZ- FSA01036,CBt- FSA01037,CZ- FSA01038,BZ- FSA01039
BtBC- FSA01040,MbBt- FSA01041,MBBC- FSA01042

B.VOC- FP- FPA010B,SD- SDA010B,ANI- ANA010B

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I	C1 OE-1	1. FHA880 2.FHA890	1.PÀ£ÀßqÀ ªÁåPÀgÀt. 2.DzsÀÄ¤PÀ ¥ÀÆªÀð PÀ£ÀßqÀ ¸Á»vÀå ¥ÀjZÀAiÀÄ ªÀÄvÀÄÛ ¥ÀoÀå	OE	3:0:0	3	4	20	20	60	100

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								C1	C2	C3	MIÄÖ CAPÀU À¼ÀÄ
II	C2 L 1-2	FHB010 QP 10201	©.J. ¥ÀwæPÉ-2 PÀ¯Á ¹j-2	AECC	3:0:0	3	4	20	20	60	100
II	C2 L 1-2	FSB010/ FPB010 S DB010 ANB010 QP 11201/	©.J¹ì/©.ªÉÇ ÃPï ¥ÀwæPÉ-2 «eÁÕ£À ¹j-2	AECC	3:0:0	3	4	20	20	60	100
II	C2 L 1-2	FCB010 QP 12201	©.PÁA. ¥ÀwæPÉ-2 ªÁtÂdå ¹j-2	AECC	3:0:0	3	4	20	20	60	100
II	C2 L 1-2	FBB010 QP 13201	©©J. ¥ÀwæPÉ-2 ¤ªÀðºÀuÁ ¹j—2	AECC	3:0:0	3	4	20	20	60	100
II	C2 L 1-2	FAB010 QP 14201	©¹J ¥ÀwæPÉ-2 UÀtPÀ ¹j -2	AECC	3:0:0	3	4	20	20	60	100

COMBINATIONWISE COURSE CODE

BA—EG- FHB01031,HP- FHB01032,KG-FHB01033,HE- FHB01034, JP-FHB01035

BSc—PC-FSB01031,PM-FSB01032,PE-FSB01033,CsM-FSB01034, ECs-FSB01035,BtZ- FSB01036,CBt- FSB01037,CZ-FSB01038,BZ- FSB01039

BtBC-FSB01040,MbBt-FSB01041,MBBc-FSB01042

B.VOC- FP- FPB010,SD- SDB010,ANI- ANB010.

ªÀÄÄPÀÛ DAiÉÄ ÌPÀ£ÀßqÀ ¥ÀwæPÉ ¢éwÃAiÀÄZÀvÀÄªÀiÁð¸À

(©PÁA/©.©.J./©.J¹ì./©¹J)

ZÀvÀÄªÀiÁð¸À	PÉÆÃ¸ïð ¸ÀASÉå	PÉÆÃ¸ïð PÉÆÃqï	¥ÀwæPÉU À¼À ²Ã¶ðPÉ	PÉÆÃ¸ïðjÃw	PÉærmïUÀ ¼À «£Áå¸ À L:T:P	PÉærmïUÀ¼À ¸ÀASÉå	¨ÉÆÃzsÀ£Á UÀAmÉUÀ¼ÀÄ /	ªÀiË®åªÀiÁ¥À£À «£Áå¸À			
								C1	C2	C3	MIÄÖ CA PÀ UÀ ¼À Ä
II	C2 OE-2	1.FHB880 2.FHB890	1.DqÀ½vÁv ÀäPÀ PÀ£ÀßqÀ PÀ°PÉ 2.DzsÀĤP À PÀ£ÀßqÀ ¸Á»vÀå¥Àj ZÀAiÀÄ ªÀÄvÀÄÛ ¥ÀoÀå	OE-2	3:0:0	3	4	20	20	60	100

PÀqÁØAiÀÄ PÀ£ÀßqÀ ¥ÀwæPÉ ¢éwÃAiÀÄ ZÀvÀÄªÀiÁð¸À

(PÀ£ÀßqÉÃvÀgÀjUÉ)

II	**C2** F-KAN	**FHB120**	**PÀ£ÀßqÉÃv ÀgÀjUÉ PÀ£ÀßqÀ PÀ£ÀßqÀ-PÀ°**	F-KAN	**3:0:0**	**3**	**4**	**20**	**20**	**60**	**100**

LaÑPÀ PÀ£ÀßqÀ ¥ÀwæPÉUÀ¼ÀÄ

¥ÀæxÀªÀÄ ªÀÄvÀÄÛ ¢éwÃAiÀÄ

ZÀvÀÄªÀiÁð¸À

ZÀvÀÄªÀiÁ	PÉÆÃ¸ï ¸ÀASÉå	PÉÆÃ¸ÀÏ ð PÉÆÃqÀ	¥ÀwæPÉUÀ¼À ²Ã¶ðPÉ	PÉÆÃ¸ïðjÃw	PÉærmïUÀ¼À «£Áå¸À L:T:P	PÉærmïUÀ¼À ¸ÀASÉå	¨ÉÆÃzsÀ£Á UÀAmÉUÀ¼ÀÄ /	ªÀiË®åªÀiÁ¥À£À «£Áå¸À			
								C1	C2	C3	MlÄÖ CAPÀ UÀ¼À Ä
I	**C1** OPT KAN	**FHA490** **QP 10114**	**¥ÀwæPÉ-1 ¥ÁæaÃ£ÀPÀ£ ÀßqÀ ¸Á»vÀåZÀjvÉæ (DgÀA¨sÀ¢AzÀ 10£ÉÃ ±ÀvÀªÀiÁ£ÀzÀ ªÀgÉUÉ)**	**DSC**	**3:0:0**	**3**	**3**	**20**	**20**	**60**	**100**
I	**C2** OPT KAN	**FHA490** **QP 10115**	**¥ÀwæPÉ-2 ªÀÄzsÀåPÁ°Ã£ ÀPÀ£ÀßqÀ ¸Á»vÀåZÀjvÉæ (11£ÉÃ ±ÀvÀªÀiÁ£À¢A**	**DSC**	**3:0:0**	**3**	**3**	**20**	**20**	**60**	**100**

			zÀ 16£ÉÃ ±ÀvÀªÀiÁ£ÀzÀ ªÀgÉUÉ)								
II	**C3** OPT KAN	**FHB500** **QP 10214**	**¥ÀwæPÉ-3 DzsÀÄ¤PÀ ¥ÀÆªÀðPÀ£ÀßqÀ ¸Á»vÀåZÀjvÉæ (17£ÉÃ ±ÀvÀªÀiÁ£À¢AzÀ 19£ÉÃ ±ÀvÀªÀiÁ£ÀzÀ ªÀgÉUÉ)**	**DSC**	**3:0:0**	**3**	**3**	**20**	**20**	**60**	**100**
II	**C4** OPT KAN	**FHB500** **QP 10215**	**¥ÀwæPÉ-4 DzsÀÄ¤PÀPÀ£ÀßqÀ ¸Á»vÀåZÀjvÉæ (20£ÉÃ ±ÀvÀªÀiÁ£À¢AzÀ)**	**DSC**	**3:0:0**	**3**	**3**	**20**	**20**	**60**	**100**

¥ÀæxÀªÀÄ ZÀvÀÄªÀiÁð¸À ©.J – 2021-22 £ÉÃ ¸Á°£À PÀ£ÀßqÀ ¨sÁµÁ ¥ÀoÀåPÀæªÀÄ PÀ¯Á ¹j – 1 (J£ï.E.¦. ¥ÀoÀåPÀæªÀÄ: 2021-22)

WÀIPÀ -1 PÀ£ÀßqÀ £ÁqÀÄ - £ÀÄr aAvÀ£É

1. C) PÀ£ÀßqÀªÉÄ¤¥Áà £ÁqÀÄ ZÉ¯ÁèAiÀÄÄÛ - («zsÀ PÁªÀåUÀ½AzÀ DAiÀÄÝ ¥ÀzÀåUÀ¼ÀÄ)

D) ¤vÉÆåÃvÀìªÀ - PÉ J¸ï ¤¸Ágï CºÀªÀÄzï

2. PÀ£ÀßqÀªÉÃ £À£Àß zsÀªÀÄð - dAiÀÄzÉÃ« vÁ¬Ä °UÁqÉ *

3. vÀ£ÀßÀÄß w½zÀÄPÉÆ¼Àî¨ÉÃPÁzÀ PÀ£ÁðlPÀ - ¥ÁnÃ® ¥ÀÄlÖ¥Àà

WÀlPÀ – 2 ¨Á®å

1. lÄvÀÄ ¸ÀAºÁgÀ - qÁ. §AdUÉgÉ dAiÀÄ¥ÀæPÁ±ï
2. gÁªÀÄgÁªÀtgÀ AiÀÄÄzÀÞ - PÀÄªÉA¥ÀÄ
3. PÉÃ¼ÀzÀ PÁtzÀ ¸ÀAUÀwUÀ¼ÀÄ - ¹zÀÞ°AUÀAiÀÄå

WÀlPÀ – 3 ¥ÀæPÀÈw

1. C. ªÀÄAPÀÄwªÀÄä£À PÀUÀÎ (DAiÀÄÝ JAlÄ ¥ÀzÀåUÀ¼À - r.«.f *
   D. ºÀÆªÀÅ ºÉÆgÀ¼ÀÄªÀªÀÅ ¸ÀÆAiÀÄð£À PÀqÉUÉ - ZÀ£Àß«ÃgÀ PÀt« *
2. MAn¸À®UÀ - PÀÈ¥ÁPÀgÀ ¸ÉÃ£Á¤
3. ºÉÆ¼ÉUÀ¼À ªÀÄÆ®PÀ PÀ£ÁðlPÀ - gÀºÀªÀÄvï vÀjÃPÉgÉ

WÀlPÀ – 4 ¸ÀAQÃtð

1. C. UÁªÉÄðAmï ºÀÄqÀÄV ºÉÆ°zÀ ZÉAzÀzÀ ¥ÉÆÃµÁPÀÄ – qÁ. ¸À©vÁ §£Áßr
   D. ªÉÄÊ®ÄUÀ®ÄèUÀ¼ÀÄ - ¸ÀÄPÀ£Áå ªÀiÁgÀÄw
2. ¦Vä KeÉAmï ªÀÄvÀÄÛ UÁA¢ü eÉÆÃUÀw - ªÀÄAdªÀÄä eÉÆÃUÀw

(¤gÀÆ¥ÀuÉ: CgÀÄuï eÉÆÃ¼ÀzÀ PÀÆrèV)

3. vÉÃ®¸ÀAUÀzÀ ºÉAUÀ¸ÀjUÉ ¸À¯ÁA! - qÁ. «£ÀAiÀiÁ

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¥ÀæxÀªÀÄ ZÀvÀÄªÀiÁð¸À ©.J – 2021-22 £ÉÃ ¸Á°£À PÀ£ÀßqÀ ¨sÁµÁ ¥ÀoÀåPÀæªÀÄ

ªÁtÂdå ¹j – 1

(J£ï.E.¦. ¥ÀoÀåPÀæªÀÄ: 2021-22)

WÀlPÀ -1 PÀ£ÀßqÀ £ÁqÀÄ - £ÀÄr aAvÀ£É

2. C) PÀ£ÀßqÁA¨ÉAiÀÄ »jªÉÄ (PÀªÀ£À) - ¨É£ÀUÀ¯ï gÁªÀÄgÁªï

D) PÀ£ÁðlPÀ gÁeÉÆåÃvÀìªÀ (PÀªÀ£À) - PÉ J¸ï £ÀgÀ¹AºÀ¸Áé«Ä

2. «ÃgÀªÀiÁ£Àå(PÀxÉ) - ¨ÉlUÉÃj PÀÈµÀÚ±ÀªÀÄð

3. PÀ£ÁðlPÀ ElÖ ºÉ¸ÀgÀÄ PÉÆlÖ ªÀÄAvÀæ (¯ÉÃR£À) - PÀÄªÉA¥ÀÄ

WÀlPÀ – 2 ¸ÀA¸Àløw

1. C)CªÀÄä DZÁgÀ £Á£ÀÄ(PÀªÀ£À) - PÉ.J¸ï. ¤¸Ágï CºÀªÀÄzï
D)J®Ä©£À ºÀAzÀgÀzÉÆ¼ÀUÉ(PÀªÀ£À) - ªÀÄÆqÁßPÀÆqÀÄ a£Àß¸Áé«Ä *

2. º À§âUÀ¼ÀÄ (¥Àæ§AzsÀ) - ¥ÉÆæ. r.PÉ. gÁeÉÃAzÀæ

3. £ÀªÀÄä ¸ÀA¸ÀløwAiÀÄ ºÉªÉÄä ¸Á®zÀÄ(¯ÉÃR£À) - PÉ. ²ªÀgÁªÀÄPÁgÀAvÀ

WÀlPÀ – 3 eÁUÀwÃPÀgÀt

2. C. VgÀtÂ «¸ÁÛgÀ £ÉÆÃqÀªÀÄä (vÀvÀé¥ÀzÀ) - ²±ÀÄ£Á¼À ±ÀjÃ¥sÀ
D. £À£Àß ±Á¯É (PÀªÀ£À) - d.£Á. vÉÃd²æÃ

2. ºÀÄ° ¸ÀªÁj (PÀxÉ) - «ªÉÃPÀ±Á£À¨ÁUï

3. eÁUÀwÃPÀgÀt ªÀÄvÀÄÛ ¸ÀA¸ÀlØw(¯ÉÃR£À) - gÀAUÁgÉrØ PÉÆÃrgÁA¥ÀÄgÀ

WÀlPÀ – 4 ¸ÀAQÃtð

1. C. ¢QÌ®èzÀ ºÁqÀÄ(PÀªÀ£À) – qÁ. ZÉ£ÀßtÚªÁ°ÃPÁgÀ

D. ¥ÀÆtðvÉAiÀÄ ¥ÀgÀªÀÄ PÀ¯É(ZË¥À¢UÀ¼ÀÄ) - PÉ.¹. ²À¥Àà

2. PÀÄtÂAiÀÄÄªÀ PÀÄgÀÄqÀ PÁAZÁt (PÀxÀ£À) - ¥ÉÆæ .f. ZÀAzÀæ±ÉÃRgÀ

3. ªÀiË®åUÀ¼À ¥Á®£É(¯ÉÃR£À) - qÁ. J¦eÉ C§ÄÝ¯ï PÀ¯ÁA

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¥ÀæxÀªÀÄ ZÀvÀÄªÀiÁð¸À ©.J¹ì / ©.ªÉÇÃPï
2021-22 £ÉÃ ¸Á°£À PÀ£ÀßqÀ ¨sÁµÁ
¥ÀoÀåPÀæªÀÄ
«eÁÕ£À ¹j –1 J£ï.E.¦. ¥ÀoÀåPÀæªÀÄ

WÀlPÀ -1 PÀ£ÀßqÀ £ÁqÀÄ £ÀÄr aAvÀ£É

1. C. PÀ£ÀßqÀ ¥ÀzÀUÉÆ¼ï - f.¦ gÁdgÀvÀßA

D) ¨ÉAQ ©¢ÝzÉ ªÀÄ£ÉUÉ - PÀAiÀiÁågÀ QkÕtÚ gÉÊ

2. ºÉÆ¬Ä¸À¼À£À zÀ¼À¥Àw - ªÀiÁ¹Û ªÉAPÀmÉÃ±À CAiÀÄåAUÁgï

3. PÀ£ÀßqÀ ¸ÀAªÀzsÀð£É - r.Dgï. £ÁUÀgÁdÄ *

WÀlPÀ – 2 ¨sÀÆ«Ä

1. C. ºÉÆ£ÀÃ ©vÉÛÃªÀÅ ºÉÆ®PÉ®è - d£À¥ÀzÀ
   D. ¨sÀÆ«ÄVÃvÀ - PÉ.J¸ï. £ÀgÀ¹AºÀ¸Áé«Ä *
2. PÉA¥ÀÄ VtÂ - ªÀ¸ÀÄzÉÃAzÀæ
3. §Ä¯ÉÆÙÃdgï ¸ÀA¸ÀÌøw - £ÁUÉÃ±ï ºÉUÀqÉ

WÀlPÀ – 3 ªÉÊeÁÕ¤PÀ ªÀÄ£ÉÆÃzsÀªÀÄð

1.C. MAzÉÃ MAzÀÄ ¨Áj ºÉÆgÀ§¤ß - ©.n. ®°vÀ£ÁAiÀÄPï
D. PÀvÉÛ ªÀÄvÀÄÛ zsÀªÀÄð - ¹zÀÝ°AUÀAiÀÄå
2. ªÉÊZÁjPÀ ¥ÀæeÉÕUÉ CqÉvÀqÉUÀ¼ÀÄ - JZï. £ÀgÀ¹AºÀAiÀÄå *
3. £ÀªÀÄä C¼ÀvÉAiÀÄ£ÀÄß «ÄÃgÀ¯ÁgÀzÀ zÉÃªÀgÀÄ - PÉ. ²ªÀgÁªÀÄ PÁgÀAvÀ

WÀlPÀ – 4 ¸ÀAQÃtð

2. C. ZÀjvÉæAiÉÄAzÀgÉ - JZï.J¸ï.
C£ÀÄ¥ÀªÀÄ
D. JgÀqÀÄ ¯ÉÆÃlUÀ¼ÀÄ -
aÃªÀÄ£ÀºÀ½î gÀªÉÄÃ±ï ¨Á§Ä

2. E°è AiÀiÁgÀÆ ªÀÄÄRågÀ®è,AiÀiÁgÀÆ CªÀÄÄRågÀ®è
- PÀÈ¥ÁPÀgÀ ¸ÉÃ£Á¤

3. ¸ËAzÀAiÀÄð ªÀÄvÀÄÛ ªÉÄÊ§tÚ - gÁªÀÄ ªÀÄ£ÉÆÃºÀgÀ ¯ÉÆÃ»AiÀiÁ

(C£ÀÄ; PÉ« ¸ÀÄ§âtÚ)

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¥ÀæxÀªÀÄ ZÀvÀÄªÀiÁð¸À ©¹J – 2021-22 £ÉÃ ¸Á°£À PÀ£ÀßqÀ ¨sÁµÁ ¥ÀoÀåPÀæªÀÄ

UÀtPÀ ¹j – 1 J£ï.E.¦. ¥ÀoÀåPÀæªÀÄ

WÀlPÀ -1 . PÀ£ÀßqÀ £ÁqÀÄ £ÀÄr aAvÀ£É

C) PÀ£ÀßrUÀgÀ vÁ¬Ä - JA. UÉÆÃ«AzÀ ¥ÉÊ

D) PÀ£ÀßqÀ £ÀÄr - D£ÀAzÀ PÀAzÀ

2. PÀ£ÁðlPÀ: ElÖ ºÉ¸ÀgÀÄ PÉÆlÖ ªÀÄAvÀæ -
PÀÄªÉA¥ÀÄ

3. PÀ£ÀßqÀ ªÀÄ£À¸ÀÄì -ºÁ. ªÀiÁ.
£ÁAiÀÄPÀ

WÀlPÀ – 2 DPÁ±À

1. C. DPÁ±À - ¸ÀgÀdÆ PÁlÌgÀ
D. ªÉÆÃqÀUÀ¼À ¸ÁªÀÅ - CUÀæºÁgÀ
PÀÈµÀÚªÀÄÆwð

2. DPÁ±ÀPÉÌ ¤Ã° ¥ÀgÀzÉ -¨ÉÆÃ¼ÀÄªÁgÀÄ
ªÀÄºÀªÀÄzï PÀÄAkÕ

3. G¯ÁÌªÀÈ¶ÖAiÀÄ gÉÆÃZÀPÀ ¯ÉÆÃPÀ - n. J¸ï.
±ÉÊ®d

WÀlPÀ – 3 vÁgÀÄtå

1. C. §qÀªÀ£ÁzÀgÉ K£ÀÄ ¦æAiÉÄ - ¸ÀvÁå£ÀAzÀ ¥ÁvÉÆæÃl
D. J®èªÀ¼É®èªÀ¼É®èªÀ¼ÀÄ - ¥ÀÄ.w.£À

2. MAzÀÄ SÁ¸ÀV ¥ÀvÀæ - «£ÀAiÀiÁ MPÀÄÌAzÀ

3. ºÀ¢ºÀgÉAiÀÄzÀªÀgÀ CªÀ±ÀåPÀvÉUÀ¼ÀÄ - ¹. Dgï. ZÀAzÀæ±ÉÃRgï

WÀlPÀ – 4 ¸ÀAQÃtð

1. C. E°è K£ÁzÀgÀÆ §gÉ¬Äj - JA.Dgï. PÀªÀÄ®
D. ¨ÉÆUÀ¸ÉAiÀÄ°èzÉ ¨sÀÆ«Ä - «¨sÁ
2. PÀ£ÀßqÀ ªÀÄvÀÄÛ PÀA¥ÀÆålgï - n.f. ²æÃ¤¢ü
3. PÀ£ÀßqÀzÀ°è UÀtPÀzÀ §¼ÀPÉAiÀÄ EwºÁ¸À, ¨É¼ÀªÀtÂUÉ ªÀÄvÀÄÛ ºÉÆ¸À ¸ÁzsÀåvÉUÀ¼ÀÄ,
PÀ£ÀßqÀ ¨sÁµÉ ªÀÄvÀÄÛ vÀAvÁæA±ÀUÀ¼ÀÄ
PÀ£ÀßqÀzÀ°è UÀtPÀzÀ §¼ÀPÉUÉ ±Àæ«Ä¹zÀ vÀAvÀædÕgÀÄUÀ¼À ªÀÄvÀÄÛ ¸ÀA¸ÉÜUÀ¼À ¸ÀAQë¥ÀÛ ¥ÀjZÀAiÀÄ

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¥ÀæxÀªÀÄ ZÀvÀÄªÀiÁð¸À ©.©.J – 2021-22 £ÉÃ ¸Á°£À PÀ£ÀßqÀ ¨sÁµÁ ¥ÀoÀåPÀæªÀÄ

¤ªÀðºÀuÁ ¹j –1 J£ï.E.¦. ¥ÀoÀåPÀæªÀÄ

WÀlPÀ -1. PÀ£ÀßqÀ £ÁqÀÄ £ÀÄr aAvÀ£É

C) ¸ÁAiÀÄÄwzÉ ¤ªÀÄä £ÀÄr - PÀÄªÉA¥ÀÄ
D) PÀ£ÀßqÀ vÁ¬ÄAiÀÄ ¸ÀÄ¥Àæ¨sÁvÀ - qÁ. ZÀAzÀæ±ÉÃRgÀ PÀA¨ÁgÀ *

2. ¤dUÀ°è£À gÁtÂ - ªÀiÁ¹Û ªÉAPÀmÉÃ±À CAiÀÄåAUÁgï

3. £À£Àß PÀ£ÀßqÀ dUÀvÀÄÛ - PÉ .«. ¸ÀÄ§âtÚ

WÀlPÀ – 2. DzsÀÄ¤PÀvÉ

C.) ªÀÄÄA¨ÉÊ eÁvÀPÀ - f.J¸ï. ²ªÀgÀÄzÀæ¥Àà

D) ºÁ¢ºÁqÀÄ - PÉ.JA

ªÀ¸ÀÄAzsÀgÀ

2. qÁA§gÀÄ §AzÀÄzÀÄ - zÉÃªÀ£ÀÆgÀÄ

ªÀÄºÁzÉÃªÀ

3. mÉ°¥sÉÆÃ£ï - K. J£ï.

ªÀÄÆwðgÁªï

WÀlPÀ – 3 PÀÄlÄA§

1. C.) £ÁV - PÀÄªÉA¥ÀÄ *
   D) CªÀé - J¯ï.

   ºÀ£ÀÄªÀÄAvÀAiÀÄå
2. vÀÄA©zÀ PÉÆqÀ - wæªÉÃtÂ
3. UÀÈºÀ ²PÀët - ºÀqÉÃðPÀgï

   ªÀÄAd¥Àà

WÀlPÀ – 4 ¸ÀAQÃtð

1. C.) EAzÀæZÁ¥À - J¸ï.«.

   ¥ÀgÀªÉÄÃ±ÀégÀ ¨sÀlÖ *
   D.) AiÀÄÄzÀÞ - ¸À«vÁ

   £ÁUÀ¨sÀÆµÀt
2. ¸ÀA§¼ÀPÉÌ ¹QÌPÉÆAqÀ zÉªÀé -

   ¥ÀÆtðZÀAzÀæ vÉÃd¹é
3. ªÀiÁ£À«ÃAiÀÄvÉ- MAzÀÄ C¤¹PÉ -

   §gÀUÀÆgÀÄ gÁªÀÄZÀAzÀæ¥Àà

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¢éwÃAiÀÄ ZÀvÀÄªÀiÁð¸À ©J – 2021-22 £ÉÃ ¸Á°£À PÀ£ÀßqÀ ¨sÁµÁ ¥ÀoÀåPÀæªÀÄ

PÀ¯Á ¹j – 2 J£ï.E.¦. ¥ÀoÀåPÀæªÀÄ

WÀlPÀ -1 eÁUÀwÃPÀgÀt

3. C) PÀlÖqÀzÀ PÉ®¸ÀUÁgÀgÀÄ - JZï. J¸ï. ²ªÀ¥ÀæPÁ±ï

D) PÀÄAmÉÆÃ©¯Éè - J PÉ gÁªÀiÁ£ÀÄd£ï

2. ©qÀÄUÀqÉ - ZÀAzÀæPÁAvÀ ªÀqÀÄØ

3. ±ÀºÀgÀzÀ PÉÆA¨ÉUÀ¼À°è ºÀ¼À¢ J¯ÉUÀ¼ÀÄ - dAiÀÄAvÀ PÁ¬ÄÌtÂ

WÀlPÀ – 2 ¸ÀªÀiÁd

4. C. gÉÆnÖ ªÀÄvÀÄÛ PÉÆÃ« - ¸ÀÄ gÀA JPÀÄÌAr

D. £À£Àß ¦æÃwÃAiÀÄ PÀÄPÀÌgï - qÁ. ¸À©ÃºÁ ¨sÀÆ«ÄUËqÀ

2. §aÑÃ¸ÀÄ - zÀÄ. ¸ÀgÀ¸Àéw

3. £Á£ÁåjUÀ®èzÀªÀ¼ÀÄ - © « D£ÀAzÀªÀÄÆwð

WÀlPÀ – 3 ¦æÃw

3. C. ¨ÁgÉ, £À£Àß ±ÁgÀzÉ - PÉ J¸ï £ÀgÀ¹AºÀ¸Áé«Ä

D. ¦æÃw E®èzÀ ªÉÄÃ¯É - f.J¸ï. ²ªÀgÀÄzÀæ¥Àà

2. CªÀé - ¨É¸ÀUÀgÀºÀ½î gÁªÀÄtÚ

3. ¦æÃwAiÀÄ ¥ÀÆtðvÉ - UËjÃ±À PÁAiÀÄÌtÂ

WÀlPÀ – 4 ¸ÀAQÃtð

4. C. ©ü£Àß¨sÉÃzÀªÀ ªÀiÁqÀ¨ÁårgÉÆ - CeÁÕvÀ vÀvÀé¥ÀzÀPÁgÀ

D. ¥ÀgÀA¥ÀgÉ - qÁ. «dAiÀiÁzÀ¨Éâ

2. ¸ÀA§¼ÀPÉÌ ¹QÌPÉÆAqÀ zÉªÀé - ¥ÀÆtðZÀAzÀæ vÉÃd¹é

3. JzÉUÉ ©zÀÝ CPÀëgÀ PÀÈwAiÀÄ DAiÀÄÝ ¨sÁUÀUÀ¼ÀÄ - zÉÃªÀ£ÀÆgÀÄ ªÀÄºÁzÉÃªÀ

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¢éwÃAiÀÄ ZÀvÀÄªÀiÁð¸À ©.PÁA

2021-22 £ÉÃ ¸Á°£À PÀ£ÀßqÀ ¨sÁµÁ

¥ÀoÀåPÀæªÀÄ

ªÁtÂdå ¹j – 2 J£ï.E.¦. ¥ÀoÀåPÀæªÀÄ

WÀlPÀ -1 ¸ËAzÀAiÀÄð

D) PÀqÀ°UÉ PÀ½¹zÀ ¢Ã¥À - n. J®è¥Àà *

D) ºÀ½îAiÀÄ ºÀÆUÀ½UÉ - r.J¸ï. PÀQð

2. £À£Àß vÉÆÃlUÁjPÉ - gÁPÀÄ

3. ¸ËAzÀAiÀÄðªÀ ªÀÄvÀÄÛ ªÉÄÊ§tÚ - gÁªÀÄªÀÄ£ÉÆÃºÀgÀ ¯ÉÆÃ»AiÀiÁ

(C£ÀÄ: PÉ.«. ¸ÀÄ§âtÚ)

WÀlPÀ – 2 ¨sÀQÛ

C. ¨sÀQÛAiÉÄA§ ¥ÀÈyéAiÀÄ ªÉÄÃ¯É (ªÀZÀ£ÀUÀ¼ÀÄ) - §¸ÀªÉÃ±ÀégÀ

D. ¨sÉÆÃUÀ ºÀjzÀÄ ºÉÆÃUÀ° (PÉÊªÀ®å ¥ÀzÀ) - ªÀÄÄ¦à£À µÀqÀPÀëj

2. ºÀgÀPÉUÀ¼ÀÄ (¥Àæ§AzsÀ) - J.J£ï. ªÀÄÄÆwðgÁªï

3. ¨sÀQÛ ºÀÈzÀAiÀÄ – zÉÃªÀ ¤®AiÀÄ(aAvÀ£À) - ²æÃ ¹zÉÝÃ±ÀégÀ ¸Áé«ÄUÀ¼ÀÄ

WÀlPÀ – 3 zÉÃ¹AiÀÄvÉ

1. C. UÁæªÀÄzÉÃªÀvÉ - qÁ.¹zÀÝ°AUÀAiÀÄå

D. £É®ªÀÄÆ® - J¸ï.f. ¹zÀÝgÁªÀÄAiÀÄå

2. PÀxÉ PÉÃ¼ÀÄ UÀÄ§âPÀÌ ¤£Àß ªÀåxÉAiÀÄ PÀxÉ PÉÃ¼ÀÄ - PÉ.J¸ï. ¤¸Ágï CºÀªÀÄzï

3. ¨ÉÃ¸ÁAiÀÄ, ºÀ§âUÀ¼À gÀAUÀÄ, ¨Á§AiÀÄå£À eÁvÉæ CAUÀzÀ£À ¥ÁvÀæ(ªÀÄuÉUÁgÀ – DvÀäPÀvÉ) - vÀÄA¨Ár gÁªÀÄAiÀÄå

WÀlPÀ – 4 ¸ÀAQÃtð

5. C. ªÁtÂdå ¥ÀvÀæUÀ¼ÀÄ

D. ªÀgÀ¢UÀ¼ÀÄ

2. ªÀiÁgÀÄPÀmÉÖ ¤ªÀðºÀuÉAiÀÄ°è eÁ»gÁvÀÄUÀ¼À ¥ÁvÀæ

3. GzÀåªÀÄ ¯ÉÆÃPÀzÀ ¸ÁzsÀPÀgÀÄ (eÉ.Dgï.r ¨Á¨Á, qÁ. ªÀVð¸ï PÀÄjAiÀÄ£ï,

J£ï.Dgï. £ÁgÁAiÀÄt ªÀÄÆwð, KPÁÛ PÀ¥ÀÆgï, gË£ÀPï ¹AUï

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¢éwÃAiÀÄ ZÀvÀÄªÀiÁð¸À ©.J¹ì/©.ªÉÇÃPï
2021-22 £ÉÃ ¸Á°£À PÀ£ÀßqÀ ¨sÁµÁ
¥ÀoÀåPÀæªÀÄ
«eÁÕ£À ¹j –2 J£ï.E.¦. ¥ÀoÀåPÀæªÀÄ

WÀlPÀ – 1 fÃªÀ£À PÀ¯É

C. ¸ÀA§¼ÀzÀ ¸ÀAeÉ - PÉ.J¸ï. £ÀgÀ¹AºÀ¸Áé«Ä
D) CªÀé - ¦. ®APÉÃ±À

2. zÉÃ«æzÁÝ£É ©qÀ¥Áà - J.Dgï. ªÀÄtÂPÁAvï *
3. £Á£ÀÄ ¤®ÄèªÉ JªÀgÉ¸ïÖ JvÀÛgÀ¢ - £ÉÃ«ÄZÀAzÀæ (§zÀÄPÀÄ §zÀ°¸À§ºÀÄzÀÄ)

WÀlPÀ – 2 PÀ£À¸ÀÄ

5. C. wgÀÄPÀ£ÉÆÃªÀð£ÀÆgÀªÀÄÄAzÉ - ªÀÄÄ¦à£À µÀqÀPÀëj
D. J®è ºÀÄqÀÄVAiÀÄgÀ PÀ£À¸ÀÄ - ¸À«vÁ £ÁUÀ¨sÀÆµÀuï

2. MAzÀÄ ºÀÄqÀÄUÀ¤UÉ ©zÀÝ PÀ£À¸ÀÄ - ¨É¸ÀUÀgÀºÀ½î gÁªÀÄtÚ

3. PÀ£À¸ÀÄ PÁtÂj PÀ£À¸ÀÄUÀ¼À ±ÀQÛ - J ¦ eÉ C§ÄÝ¯ï PÀ¯ÁA

WÀlPÀ – 3 ªÀÄ¼É

1.C. vÉAPÀtUÁ½AiÀiÁl - ¥ÀAeÉ ªÀÄÄAUÉÃ±ÀgÁAiÀÄ

D. ªÀÄ¼É - f J¸ï ²ªÀgÀÄzÀæ¥Àà

2. §gÀ - AiÀÄÄ Dgï C£ÀAvÀªÀÄÆwð

3.D¢æ ªÀÄ¼ÉÃ° DzÀªÉßUÀAqÀ - £ÉA¥É zÉÃªÀgÁeï

WÀlPÀ – 4 ¸ÀAQÃtð

6. C. G¥ÁWÁvÀ - C.gÁ. «ÄvÀæ *
D. CgÀ½zÀ ¯ÉÃ¸ÀgïUÀ¼ÀÄ - ªÀÄtÂ ¨sË«ÄPï

2. ªÀiÁ»w vÀAvÀæeÁÕ£À ªÀÄvÀÄÛ PÀ£ÀßqÀ - n.f. ²æÃ¤¢ü

3. PÀ£ÀßqÀ ªÀÄvÀÄÛ UÀtPÀAiÀÄAvÀæ *

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¢éwÃAiÀÄ ZÀvÀÄªÀiÁð¸À ©¹J –

2021-22 £ÉÃ ¸Á°£À PÀ£ÀßqÀ ¨sÁµÁ ¥ÀoÀåPÀæªÀÄ

UÀtPÀ ¹j – 2 J£ï.E.¦. ¥ÀoÀåPÀæªÀÄ

WÀlPÀ -1 ªÁtÂdå

1. ªÀÄ£É¬ÄAzÀ ªÀÄ£ÉUÉ £ÀgÀ¹AºÀ¸Áé«Ä - PÉ.J¸ï.

D) PÀlÖqÀzÀ PÉ®¸ÀUÁgÀgÀÄ ²ªÀ¥ÀæPÁ±ï - JZï.J¸ï.

2. «Ä®Äè ªÀÄvÀÄÛ ºÀQÌ - ªÉÊzÉÃ»

3. eÁUÀwÃPÀgÀt ªÀÄvÀÄÛ ¸ÀA¸ÀÌøw - gÁeÉÃAzÀæ eÉ¤ß

WÀlPÀ – 2 vÀAvÀæeÁÕ£À

4. C. AiÀÄAvÀæ¶ð - PÀÄªÉA¥ÀÄ *
D. ¢PÀÄÌ - ¥Àæw¨sÁ £ÀAzÀPÀÄªÀiÁgï

2. PÉÆÃPÉÆÃ PÉÆÃ¯Á - D²µï £ÀA¢, (PÀ£ÀßqÀPÉÌ £ÀAiÀÄ£À PÀ±Åå¥ï)

3. vÀAvÀæeÁÐ£À ªÀÄvÀÄÛ PÀ£ÀßqÀ - PÉ.«. £ÁgÁAiÀÄt

WÀlPÀ – 3 zÁA¥ÀvÀå

1. C. ªÀÄ£ÀzÀ£Éß - zÀ.gÁ. ¨ÉÃAzÉæ
D. zÁA¥ÀvÀå - ¸À. GµÁ

2. VjeÁ PÀAqÀ ¹£ÉªÀiÁ - §¸ÀªÀgÁd PÀnÖÃªÀÄ¤ *
3. ºÉÆ£ÀßªÀÄä£À Q«ªÀiÁwUÉ MAzÀÄ ¥ÀæwQæAiÉÄ - qÁ. «dAiÀiÁzÀ¨Éâ

WÀlPÀ – 4 ¸ÀAQÃtð

1. C. EAlgï£Émï eÉÃqÀ - PÉ.«. wgÀÄªÀÄ¯ÉÃ±ï
   D. UÀtPÁ¸ÀÄgÀ - qÁ. ªÉÊ.ªÉÊ.
   PÉÆPÀÌ£ÀªÀgÀ

2. rfl¯ï ¸À¤ßªÉÃ±ÀzÀ°è

3. ¥Áj¨sÁ¶PÀ ¥ÀzÀUÀ¼À §¼ÀPÉ - qÁ. AiÀÄÄ.©. ¥ÀªÀ£Àd

Cj«£À eÁ®vÁt ªÀÄvÀÄÛ ¸ÁªÀiÁfPÀ eÁ¯ÁvÁtUÀ¼À°è PÀ£ÀßqÀzÀ §¼ÀPÉ

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¢éwÃAiÀÄ ZÀvÀÄªÀiÁð¸À ©.©.J
2021-22 £ÉÃ ¸Á°£À PÀ£ÀßqÀ ¨sÁµÁ

¥ÀoÀåPÀæªÀÄ

¤ªÀðºÀuÁ ¹j – 2 J£ï.E.¦. ¥ÀoÀåPÀæªÀÄ

WÀlPÀ -1 PÁAiÀÄPÀ

1. ªÀZÀ£ÀUÀ¼ÀÄ - C) DAiÀÄÝQÌ
   ªÀiÁgÀAiÀÄå
   D) DAiÀÄÝQÌ ®PÀÌªÀÄä
   D) £À£Àß d£ÀUÀ¼ÀÄ - ¹zÀÝ°AUÀAiÀÄå
2. ªÉÆÃa - ¨sÁgÀwÃ¦æAiÀÄ
3. gÀAUÀzÀ ªÉÄÃ¯É EgÀ° £À£Àß fÃªÀ - ©. dAiÀÄ²æÃ

WÀlPÀ – 2 ¸ÁªÀÄgÀ¸Àå

1. C. £ÁªÉ®ègÀÆ MAzÉÃ - JA. UÉÆÃ¥Á®PÀÈµÀÚ CrUÀ
   D. ªÀÄUÀÄ ªÀÄvÀÄÛ ºÀtÄÚUÀ¼ÀÄ - ºÉZï. J¸ï. ²ªÀ¥ÀæPÁ±ï
2. OzÁAiÀÄðzÀ £ÉgÀ½£À°è - qÁ. PÀÈµÀÚªÀÄÆwð ºÀ£ÀÆgÀÄ

3. PÀ£ÀßqÀzÀ ªÀiË°é - UÉÆgÀÆgÀÄ gÁªÀÄ¸Áé«Ä CAiÀÄåAUÁgï

WÀlPÀ – 3 CAvÀBPÀgÀt

4. C. ¤Ã »AUÀ £ÉÆÃqÀ¨ÁåqÀ £À£Àß - CA©PÁvÀ£ÀAiÀÄ zÀvÀÛ
5. D. ¤lÄÖ¹j£À° £ÀÄAVzÀ£ÀÄ ªÀÄ£ÀzÀ C£ÀÄ¨sÁªÀªÀ£ÀÄ - ¸ÀÄd£Á
6. CªÀé - VÃvÁ £ÁUÀ¨sÀÆµÀt
7. ªÉÆÃPÀë ºÀÄqÀÄPÀÄvÁÛ ¦æÃwAiÀÄ §AzsÀ£ÀzÀ° - ¦. ®APÉÃ±ï

WÀlPÀ – 4 ¸ÀAQÃtð

7. C. PÀ®Äè ¸ÀPÀÌgÉ PÉÆ½îgÉÆ - ¥ÀÄgÀAzÀgÀzÁ¸ÀgÀÄ
   D. ºÁUÁzÀgÉ 'ªÀiÁj©r' - JA. Dgï. PÀªÀÄ®
2. ¸ÁªÀiÁ£Àå ªÀÄ£ÀÄµÀå£ÀÄ ¨Á£ÀAUÀ¼ÀzÀ°è «ºÀj¸À° - PÁå¥ÀÖ£ï UÉÆÃ¦£Áxï
3. ¥Áj¨sÁ¶PÀ ¥ÀzÀUÀ¼ÀÄ - ¸ÁA§ªÀÄÆwð

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eÉJ¸ïJ¸ï ªÀÄºÁ«zÁå¦ÃoÀ

eÉJ¸ïJ¸ï PÀ¯Á,ªÁtÂdå ªÀÄvÀÄÛ «eÁÕ£À PÁ¯ÉÃdÄ (¸ÁéAiÀÄvÀÛ)

Hn gÀ¸ÉÛ , ªÉÄÊ¸ÀÆgÀÄ-25

©.J LaÒPÀ PÀ£ÀßqÀ ¥ÀwæPÉ (rJ¸ï¹)

¥ÀæxÀªÀÄ ZÀvÀÄªÀiÁð¸À

¥ÀwæPÉ-1

¥ÁæaÃ£À PÀ£ÀßqÀ ¸Á»vÀå ZÀjvÉæ ªÀivÀÄÛ ¥ÀoÀå

C. PÀ£ÀßqÀ ¸Á»vÀå ZÀjvÉæAiÀÄ ¸ÀÆÜ® ¥ÀjZÀAiÀÄ
D. ¥ÀÆªÀðzÀ ºÀ¼ÀUÀ£ÀßqÀ ±Á¸À£À ¸Á»vÀå ,PÀ«gÁdªÀiÁUÀð, ªÀqÁØgÁzsÀ£É
E. ¥ÀA¥À, £ÁUÀªÀªÀÄð, gÀ£Àß, zÀÄUÀð¹AºÀ, £ÁUÀZÀAzÀæ

¤UÀ¢vÀ ¥ÀoÀå:

1. **ºÀ°är ±Á¸À£À**
2. **¨ÁzÁ«Ä ±Á¸À£À**
3. **PÁªÀå ¥ÀæAiÉÆÃUÀ ¥ÀjtvÀ ªÀÄwUÀ¼ï**
4. **«zÀÄåZÉÆÒÃgÀ£ÉA§ j¹AiÀÄ PÀxÉ**
5. **¨sÉÃ¢¸À¯ÉAzÉ zÀ¯ï £ÀÄrzÀgÉ£ÀßgÏ**

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©.J LaÒPÀ PÀ£ÀßqÀ ¥ÀwæPÉ (rJ¸ï¹)
¥ÀæxÀªÀÄ ZÀvÀÄªÀiÁð¸À
¥ÀwæPÉ-2
ªÀÄzsÀåPÁ°Ã£À PÀ£ÀßqÀ ¸Á»vÀå ZÀjvÉæ

CzsÁåAiÀÄ 1
C) ªÀÄzsÀåPÁ°Ã£À PÀ£ÀßqÀ ¸Á»vÀå ZÀjvÉæAiÀÄ UÀÄt®PÀëtUÀ¼ÀÄ
D) ªÀÄzsÀåPÁ°Ã£À PÀ£ÀßqÀ ¸Á»vÀåzÀ gÀÆ¥ÀUÀ¼ÀÄ
ªÀZÀ£À, gÀUÀ¼É, µÀlà¢,QÃvÀð£É, ¸ÁAUÀvÀå, ±ÀvÀPÀ,wæ¥À¢

E)ªÀÄzsÀåPÁ°Ã£À PÀ£ÀßqÀ ¸Á»vÀåzÀ ¥ÀæªÀÄÄR PÀ«UÀ¼ÀÄ
eÉÃqÀgÀ zÁ¹ªÀÄAiÀÄå, ªÀiÁzÁgÀZÀ£ÀßAiÀÄå ,C®èªÀÄ¥Àæ¨sÀÄ,§¸ÀªÀtß ,CPÀÌªÀÄºÁzÉÃ« , ºÀjºÀgÀ,
gÁWÀªÁAPÀ ,PÀÄªÀiÁgÀªÁå¸À, ®QäÃ±À, £ÀAdÄAqÀPÀ« , ¸ÀAaºÉÆ£ÀßªÀÄä ,¸ÀªÀðdÕ ,gÀvÁßPÀgÀªÀtÂð.
CzsÁåAiÀÄ 2
1.DAiÀÄÝ PÁªÀå¨sÁUÀUÀ¼ÀÄ
ªÀZÀ£À ¸Á»vÀå
C) eÉÃqÀgÀ zÁ¹ªÀÄAiÀÄå£À ªÀZÀ£ÀUÀ¼ÀÄ:
1. E¼É ¤ªÀÄä zÁ£À ¨É¼É ¤ªÀÄä zÁ£À
2. §gÀÄ ±ÀoÀÄUÀ£À ¨sÀQÛ ¢lªÉAzÀÄ £ÀA§®Ä ¨ÉÃqÀ
D) ªÀiÁzÁgÀZÀ£ÀßAiÀÄå £À ªÀZÀ£ÀUÀ¼ÀÄ:
1. £ÀqÉ£ÀÄr ¹zÁÞAvÀªÁzÀ°è PÀÄ® ºÉÆ¯É ¸ÀÆvÀPÀ«®è
2. ±ÀÄPÀè, ±ÉÆÃtÂvÀ ,ªÀÄeÉÓ ,ªÀiÁA¸À , ºÀ¹ªÀÅ , vÀÈµÉ , ªÀå¸À£À «µÀAiÀiÁ¢UÀ¼ÉÆAzÉ ¨sÉÃzÀ
E) C®èªÀÄ¥Àæ¨sÀÄ À ªÀZÀ£ÀUÀ¼ÀÄ:
1. PÀ®è ªÀÄ£ÉAiÀÄ ªÀiÁr PÀ®èzÉÃªÀgÀ ªÀiÁr
2. PÀÈvÀAiÀÄÄUÀzÀ°è ²æÃUÀÄgÀÄ ²µÀåAUÉ §rzÀÄ §Ä¢ÞAiÀÄ PÀ°¹zÀqÉ
F) §¸ÀªÀtÚ£À ªÀZÀ£ÀUÀ¼ÀÄ:
1. zÉÃªÀ¯ÉÆÃPÀ ªÀÄvÀåð¯ÉÆÃPÀªÉA§ÄzÀÄ ¨ÉÃj®è PÁtÂgÉÆÃ
2. J£Àß avÀÛ ºÀwÛAiÀÄ ºÀtÄÚ £ÉÆÃqÀAiÀÄå
G) CPÀÌªÀÄºÁzÉÃ« ªÀZÀ£ÀUÀ¼ÀÄ:
1. vÉgÀtÂAiÀÄ ºÀÄ¼ÀÄ vÀ£Àß £ÉÃºÀ¢AzÀ ªÀÄ£ÉAiÀÄ ªÀiÁr
2. ZÀAzÀ£ÀªÀ PÀrzÀÄ PÉÆgÉzÀÄ vÉÃzÉÆqÉ £ÉÆAzÉ£ÉAzÀÄ PÀA¥À ©nÖvÉÛ
CzsÁåAiÀÄ 3
QÃvÀð£À ¸Á»vÀå:
C) ¥ÀÄgÀAzÀgÀzÁ¸ÀgÀ QÃvÀð£É
1. GzÀgÀªÉÊgÁUÀå«zÀÄ
D) PÀ£ÀPÀzÁ¸ÀgÀ QÃvÀð£É
2. PÀÄ® PÀÄ®ªÉ£Àß¢gÀÄ
CzsÁåAiÀÄ 4
µÀlà¢ ¸Á»vÀå: 1. gÁWÀªÁAPÀ- ºÀj±ÀÑAzÀæ PÁªÀåzÀ ¨sÁUÀ- ªÀÄÄwÛ£À ¸ÀwÛUÉAiÀÄ¤ßvÀÄÛ ¸À®ºÀÄ
2 PÀÄªÀiÁgÀªÁå¸À- PÀuÁðl¨sÁgÀvÀ PÀxÁªÀÄAdj- ¤mÉÆÖÃlzÀ° ºÁAiÀÄÝ£ÀÄ ©lÖ
ªÀÄAqÉAiÀÄ°

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eÉJ¸ïJ¸ï ªÀÄºÁ«zÁå¦ÃoÀ

eÉJ¸ïJ¸ï PÀ¯Á,ªÁtÂdå ªÀÄvÀÄÛ «eÁÕ£À PÁ¯ÉÃdÄ (¸ÁéAiÀÄvÀÛ)

Hn gÀ¸ÉÛ , ªÉÄÊ¸ÀÆgÀÄ-25

©.J LaÒPÀ PÀ£ÀßqÀ ¥ÀwæPÉ (rJ¸ï¹)

¢éwÃAiÀÄ ZÁvÀÄªÀiÁð¸À

¥ÀwæPÉ-3

DzsÀÄ¤PÀ ¥ÀÆªÀð PÀ£ÀßqÀ ¸Á»vÀå ZÀjvÉæ ªÀÄvÀÄÛ ¥ÀoÀå

¥ÀzÀå ¨sÁUÀ

1. **ªÀiÁw£À ¤Ãw w½AiÀÄ¨ÉÃPÀÄ - PÀqÀPÉÆÃ¼À ªÀÄrªÁ¼À¥Àà**
2. **¸ÀÆAiÀÄð ºÀÄnÖzÀ£ÀªÀé - dvÀÛ ²ªÀ°AUÀªÀé**
3. **¸ÉÆÃgÀÄwºÀÄzÀÄ ªÀÄ£ÉAiÀÄ ªÀiÁ½V - ¸ÀAvÀ ²±ÀÄ£Á¼À ±ÀjÃ¥sÀ**
4. **¸ÀvÀå¯ÉÆÃPÀ¢A¢½zÀ PÉÆgÀ« - ºÉ¼ÀªÀ£À PÀmÉÖ VjAiÀÄªÀÄä**
5. **PÀ£ÀßqÀ zÁ¸ÀAiÀÄå - ¸ÀPÀÌj ¨Á¼ÁZÁAiÀÄð(±ÁAvÀ PÀ«)**

UÀzÀå ¨sÁUÀ

6. **ZÁtPÀå ZÀAzÀæUÀÄ¥ÀÛgÀ PÀ¥ÀI PÀ®ºÀ PÀxÀ£ÀªÀÅ - PÉA¥ÀÄ£ÁgÁAiÀÄt**
7. **ªÁ°äÃQ zÀ±Àð£ÀA - ªÀÄÄzÀÝt**
8. **C©üeÁÕ£Á¨sÀgÀt ¥Àæ¸ÀAUÀ - §¸ÀªÀ¥Àà ±Á¹Ûç**

LaÒPÀ PÀ£ÀßqÀ ¥ÀwæPÉ -3

DzsÀÄ¤PÀ ¥ÀÆªÀð PÀ£ÀßqÀ ¸Á»vÀå ZÀjvÉæ

C) DzsÀÄ¤PÀ ¥ÀÆªÀð PÀ£ÀßqÀ ¸Á»vÀå ¸ÀégÀÆ¥À, ¥ÉæÃgÀuÉ, zsÉÆgÀuÉUÀ¼ÀÄ.

D) DzsÀÄ¤PÀ ¥ÀÆªÀð PÀ£ÀßqÀ ¸Á»vÀåzÀ gÀÆ¥ÀUÀ¼ÀÄ : vÀvÀÛ÷é¥ÀzÀUÀ¼ÀÄ ,UÀzÀå, £ÁlPÀ , PÁªÀå ªÀÄvÀÄÛ C£ÀÄªÁzÀ ¸Á»vÀå.

E) DzsÀÄ¤PÀ ¥ÀÆªÀð PÀ£ÀßqÀ ¸Á»vÀåzÀ ¥ÀæªÀÄÄR ¨gÀºÀUÁgÀgÀÄ : ¹AUÀgÁAiÀið , ºÉ¼ÀªÀ£ÀPÀmÉÖ VjAiÀÄªÀÄä ,PÉA¥ÀÄ £ÁgÁAiÀÄt, ¥sÀrð£ÁAqï QmÉÖ¯ï, JA.J¯ï. ²æÃPÀAoÉÃUËqÀ, ªÀÄÄzÀÝt,

©.ªÉAPÀmÁZÁAiÀið (zÉÃ¹ ¸Á»vÀå , ¸ÀA¸ÀÌøvÀ ¸Á»vÀå ªÀÄvÀÄÛ ¥Á±ÁÑvÀå ¸Á»vÀåzÀ ¥Àæ¨sÁªÀUÀ¼À »£Éß¯ÉAiÀÄ°è.)

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eÉJ¸ïJ¸ï ªÀÄºÁ«zÁå¦ÃoÀ

eÉJ¸ïJ¸ï PÀ¯Á,ªÁtÂdå ªÀÄvÀÄÛ «eÁÕ£À PÁ¯ÉÃdÄ

(¸ÁéAiÀÄvÀÛ)

Hn gÀ¸ÉÛ , ªÉÄÊ¸ÀÆgÀÄ-25

©.J LaÒPÀ PÀ£ÀßqÀ ¥ÀwæPÉ (rJ¸ï¹)

¢éwÃAiÀÄ ZÁvÀÄªÀiÁð¸À

¥ÀwæPÉ-4

DzsÀÄ¤PÀ PÀ£ÀßqÀ ¸Á»vÀå ZÀjvÉæ ªÀÄvÀÄÛ ¥ÀoÀå

¥ÀzÀå ¨sÁUÀ

1. **PÁtÂPÉ - ©.JA.²æÃ**
2. **CªÀé - ¦. ®APÉÃ±ï**
3. **¸Á«gÁgÀÄ £À¢UÀ¼ÀÄ - qÁ. ¹zÀÝ°AUÀAiÀÄå**
4. **²ªÀ£À«ÄÃ¸ÀÄªÀ ºÁqÀÄ - ªÉÊzÉÃ»**

UÀzÀå ¨sÁUÀ

5. **ªÉÆÃa - ¨sÁgÀwÃ¦æAiÀÄ**
6. **ZÉÆÃªÀÄ£À zÀÄr PÁzÀA§j¬ÄAzÀ DAiÀÄÝ ¨sÁUÀ - ²ªÀgÁªÀÄ PÁgÀAvÀ**
7. **£ÀªÀÄä JªÉÄäUÉ ªÀiÁvÀÄ w½ªÀÅzÉ - UÉÆgÀÆgÀÄ gÁªÀÄ¸Áé«Ä CAiÀÄåAUÁgï**
8. **«ZÁgÀ PÁæAwUÉ DºÁé£À - PÀÄªÉA¥ÀÄ**

LaÒPÀ PÀ£ÀßqÀ ¥ÀwæPÉ -4

DzsÀÄ¤PÀ PÀ£ÀßqÀ ¸Á»vÀå ZÀjvÉæ ªÀÄvÀÄÛ ¥ÀoÀå

DzsÀÄ¤PÀ PÀ£ÀßqÀ ¸Á»vÀå ZÀjvÉæ

C) DzsÀÄ¤PÀ PÀ£ÀßqÀ ¸Á»vÀå ¸ÀégÀÆ¥À, ¥ÉæÃgÀuÉ, zsÉÆgÀuÉUÀ¼ÀÄ.

D) DzsÀÄ¤PÀ PÀ£ÀßqÀ ¸Á»vÀå ¥ÀæªÀÄÄR WÀlÖUÀ¼ÀÄ £ÀªÉÇÃzÀAiÀÄ, ¥ÀæUÀw²Ã®, £ÀªÀå zÀ°vÀ - §AqÁAiÀÄ, ªÀÄ»¼Á ¸Á»vÀå (¥Àæ¨sÁªÀ, ¥ÉæÃgÀuÉ, vÁwéPÀvÉUÀ¼À ¸ÀÆÜ® ¥ÀjZÀAiÀÄ)

E) DzsÀÄ¤PÀ PÀ£ÀßqÀ ¸Á»vÀå - ¥ÀæªÀÄÄR ¨gÀºÀUÁgÀgÀÄ ¨ÉÃAzÉæ, PÀÄªÉA¥ÀÄ, C£ÀPÀÈ, UÉÆÃ¥Á®PÀÈµÀÚ CrUÀ, C£ÀAvÀªÀÄÆwð, zÉÃªÀ£ÀÆgÀ ªÀÄºÁzÉÃªÀ, «dAiÀiÁ zÀ¨Éâ, ¸ÁgÁ C§Æ§PÀÌgï.

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eÉJ¸ïJ¸ï ªÀÄºÁ«zÁå¦ÃoÀ

eÉJ¸ïJ¸ï PÀ¯Á, ªÁtÂdå ªÀÄvÀÄÛ «eÁÕ£ÀPÁ¯ÉÃdÄ, ªÉÄÊ¸ÀÆgÀÄ– 25

PÀ£ÀßqÀ ¨sÁµÁ ¥Àæ±Éß¥ÀwæPÉAiÀÄ ªÀiÁzÀj

CªÀ¢ü: 2.30 UÀAmÉUÀ¼ÀÄ UÀjµÀÖ CAPÀUÀ¼ÀÄ: 60

1. MAzÀÄ ¥Àæ±ÉßUÉ GvÀÛj¹. 10 CAPÀUÀ¼ÀÄ

(WÀlPÀ 1 jAzÀ JgÀqÀÄ ¥Àæ±ÉßUÀ¼À£ÀÄß PÉÃ¼À¨ÉÃPÀÄ)

2. MAzÀÄ ¥Àæ±ÉßUÉ GvÀÛj¹. 10 CAPÀUÀ¼ÀÄ

(WÀlPÀ 1 jAzÀ JgÀqÀÄ ¥Àæ±ÉßUÀ¼À£ÀÄß PÉÃ¼À¨ÉÃPÀÄ

3. MAzÀÄ ¥Àæ±ÉßUÉ GvÀÛj¹. 10 CAPÀUÀ¼ÀÄ

(WÀlPÀ 1 jAzÀ JgÀqÀÄ ¥Àæ±ÉßUÀ¼À£ÀÄß PÉÃ¼À¨ÉÃPÀÄ)

4. MAzÀÄ ¥Àæ±ÉßUÉ GvÀÛj¹. 10 CAPÀUÀ¼ÀÄ

(WÀlPÀ 1 jAzÀ JgÀqÀÄ ¥Àæ±ÉßUÀ¼À£ÀÄß PÉÃ¼À¨ÉÃPÀÄ)

5. JgÀqÀÄ ¥Àæ±ÉßUÀ½UÉ GvÀÛj¹ 2*5= 10 CAPÀUÀ¼ÀÄ

(WÀlPÀ 1,2,3,4 jAzÀ £Á®ÄÌ ¥Àæ±ÉßUÀ¼À£ÀÄß PÉÃ¼À¨ÉÃPÀÄ)

6. MAzÀÄ «µÀAiÀÄªÀ£ÀÄß PÀÄjvÀÄ ¸ÀéAvÀ C©ü¥ÁæAiÀÄªÀ£ÀÄß §gÉ¬Äj. 05 CAPÀUÀ¼ÀÄ

(¥ÀoÀåzÀ ¥ÀjPÀ®à£ÉAiÀÄ£ÀÄß UÀªÀÄ£ÀzÀ°èlÄÖPÉÆÌAqÀÄ ¥Àæ±Éß PÉÃ¼À¨ÉÃPÀÄ)

7. MAzÀÄ ªÁPÀåzÀ°è GvÀÛj¹. 05 CAPÀUÀ¼ÀÄ

(LzÀÄ ¥Àæ±ÉßUÀ¼À£ÀÄß PÉÃ¼À¨ÉÃPÀÄ)

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eÉJ¸ïJ¸ï ªÀÄºÁ«zÁå¦ÃoÀ

eÉJ¸ïJ¸ï PÀ¯Á, ªÁtÂdå ªÀÄvÀÄÛ «eÁÕ£ÀPÁ¯ÉÃdÄ, ªÉÄÊ¸ÀÆgÀÄ– 25

PÀ£ÀßqÀLaÒPÀ (I--IV SEM) ªÀÄvÀÄÛ ªÀÄÄPÀÛ DAiÉÄÌAiÀÄ

¥Àæ±Éß ¥ÀwæPÉAiÀÄ ¸ÀégÀÆ¥À

1. AiÀiÁªÀÅzÁzÀgÀÆJgÀqÀÄ ¥Àæ±ÉßUÀ½UÉ GvÀÛj¹.

2^x10 =20

(£Á®ÄÌ ¥Àæ±ÉßUÀ¼À£ÀÄß PÉÃ¼À¨ÉÃPÀÄ)

2. AiÀiÁªÀÅzÁzÀgÀÆJgÀqÀÄ ¥Àæ±ÉßUÀ½UÉ GvÀÛj¹.

2^x5 =10

(£Á®ÄÌ ¥Àæ±ÉßUÀ¼À£ÀÄß PÉÃ¼À¨ÉÃPÀÄ)

3. AiÀiÁªÀÅzÁzÀgÀÆJgÀqÀÄ ¥Àæ±ÉßUÀ½UÉ GvÀÛj¹.

2^x10 =20

(£Á®ÄÌ ¥Àæ±ÉßUÀ¼À£ÀÄß PÉÃ¼À¨ÉÃPÀÄ)

4. AiÀiÁªÀÅzÁzÀgÀÆJgÀqÀÄ ¥Àæ±ÉßUÀ½UÉ GvÀÛj¹.

2^x5 =10

(£Á®ÄÌ ¥Àæ±ÉßUÀ¼À£ÀÄß PÉÃ¼À¨ÉÃPÀÄ)

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eÉJ¸ïJ¸ï PÀ¯Á, ªÁtÂdå ªÀÄvÀÄÛ «eÁÕ£À PÁ¯ÉÃdÄ, ©. J£ï. gÀ¸ÉÛ, ªÉÄÊ¸ÀÆgÀÄ

¥ÀzÀ« vÀgÀUÀwUÀ¼À ¥ÀoÀåPÀæªÀÄ

DAiÉÄÌ DzsÁjvÀ UÀÄuÁAPÀ ¥ÀzÀÞw (¹.©.¹.J¸ï)

¥ÀzÀ« vÀgÀUÀwUÀ¼À PÀ£ÀßqÀ ¨sÁµÉ, PÀ£ÀßqÀ LaÒPÀ, PË±À¯Á©üªÀÈ¢Þ ªÀÄvÀÄÛ PÀ£ÀßqÀ ªÀÄÄPÀÛ LaÒPÀ ¥ÀwæPÉUÀ¼À ¥ÀoÀåPÀæªÀÄ

F ¥ÀoÀåPÀæªÀÄªÀÅ 2019-20£ÉÃ ±ÉÊPÀëtÂPÀ ¸Á°¤AzÀ ªÀÄÄA¢£À 2020-21, 2021-22gÀªÀgÉUÉ ZÁ°ÛAiÀÄ°ègÀÄvÀÛzÉ.

1. PÀ£ÀßqÀ ¨sÁµÉ ¥ÀwæPÉUÀ¼ÀÄ J.E.¹.¹. (A.E.C.C = Ability Enhancement Compulsory course)

PÀ¯Á ¹j : ©.J
ªÁtÂdå ¹j : ©.PÁA / ©.©.J
«eÁÕ£À ¹j : ©.J¹ì/ ©.¹.J

2. LaÒPÀ PÀ£ÀßqÀ (¹.©.¹.J¸ï)

C) r.J¸ï.¹ ¥ÀwæPÉUÀ¼ÀÄ (¤¢ðµÀÖ CzsÀåAiÀÄ£À ²¸ÀÄÛ ¥ÀwæPÉUÀ¼ÀÄ) 04

(D.S.C = Discipline Specific Course)

(ªÉÆzÀ®£ÉAiÀÄ, JgÀqÀ£ÉAiÀÄ, ªÀÄÆgÀ£ÉAiÀÄ ªÀÄvÀÄÛ £Á®Ì£ÉAiÀÄ ZÀvÀÄªÀiÁð¸ÀUÀ¼ÀÄ)

D) r.J¸ï.E (¤¢ðµÀÖ CzsÀåAiÀÄ£À LaÒPÀ ¥ÀwæPÉUÀ¼ÀÄ) (D.S.C = Discipline Specific Elective)

¥ÀwæPÉUÀ¼ÀÄ 05 + 05
(LzÀÄ ªÀÄvÀÄÛ DgÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸ÀUÀ¼ÀÄ)

3. J¸ï.E.¹ (PË±À¯Á©üªÀÈ¢Þ ¥ÀwæPÉ) (S.E.C =Skill Enhancement Course)

(ªÀÄÆgÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À)

3. f.E (ªÀÄÄPÀÛ LaÒPÀ ¥ÀwæPÉUÀ¼ÀÄ) (G.E =Generic Elective)

(LzÀÄ ªÀÄvÀÄÛ DgÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸ÀUÀ¼ÀÄ)

ªÀÄÆgÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À										
3	3	WÀlPÀ 1 : PÁªÀå ¨sÁUÀ - 1 WÀlPÀ 2 : PÀxÀ£À ¨sÁUÀ WÀlPÀ 3 : ¥ÀoÁåzsÁjvÀZÀlÄªÀnPÉ WÀlPÀ 4 : ¥ÀoÁåzsÁjvÀZÀlÄªÀnPÉ	DMC06001 DMC06002 DMC06003 DMC06004 DMC06005 DMC06006 DMC06007 DMC06008 ECC06001	01 01 01 2:1:0	03	1 1 2 04	03	40 30 - **70**	**30** (¹ -1 – 15 ªÀÄvÀÄ Û ¹ - 2 -15)	100
£Á®Ì£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À										
4	4	WÀlPÀ 1 : PÁªÀå ¨sÁUÀ - 2 WÀlPÀ 2 : UÀzÀå ¨sÁUÀ WÀlPÀ 3 : ¥ÀoÁåzsÁjvÀZÀlÄªÀnPÉ WÀlPÀ 4 : ¥ÀoÁåzsÁjvÀZÀlÄªÀnPÉ	DMD06001 DMD06002 DMD06003 DMD06004 DMD06005 DMD06006 DMD06007 DMD06008 ECD06001	01 01 01 2:1:0	03	1 1 2 04	03	40 30 - **70**	**30** (¹-1 – 15 ªÀÄvÀÄ Û ¹ - 2- 15)	100

PÀ£ÀßqÀ LaÒPÀ
ZÀvÀÄªÀiÁð¸À AiÉÆÃd£É
¥ÀoÀåPÀæªÀÄ ªÀÄvÀÄÛ ¥ÀjÃPÁë AiÉÆÃd£É 2019 jAzÀ 2022 gÀªÀgÉUÉ
rJ¸ï¹ - 04 ¥ÀwæPÉUÀ¼ÀÄ : (ªÉÆzÀ®£ÉAiÀÄ, JgÀqÀ£ÉAiÀÄ, ªÀÄÆgÀ£ÉAiÀÄ ªÀÄvÀÄÛ £Á®Ì£ÉAiÀÄ ZÀvÀÄªÀiÁð¸ÀUÀ¼ÀÄ)
BA(DSC) KEG

¸É« Ä¸À Ögï	¥ À w æ P É ¸À A S É å	¥ÀwæPÉ ²Ã¶ðPÉ	PÉÆÃ¸ïð PÉÆÃqï	PÉær mï «£Áå¸ À LTP	MlÄÖ PÉær mï	¨ÉÆÃzsÀ£ Á UÀAmÉUÀ ¼ÀÄ ¸É«Ä¸ÀÖgï UÉ	¥ÀjÃPÁë CªÀ¢ü (UÀAmÉUÀ¼ ÀÄ)	CAP ÀUÀ ¼À Ä	DAvÀj PÀ ªÀiË® åªÀiÁ¥ À£À CAPÀ UÀ¼À Ä	MlÄÖ CAPÀ UÀ¼ÀÄ
r J¸ï ¹ - 1 ªÉÆzÀ®£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À										
1	1	PÀ£ÀßqÀ ¸Á»vÀå ZÀjvÉæ ¥ÀÆgÀPÀ ¥ÀoÀå ¥ÀoÀå ¥ÀÆgÀPÀ ZÀlÄªÀnPÉ	**ELA25023**	03 02 01 **5:1:0**	06	48 32 32 **80+32=112**	03	40 30 - **70**	**30** (¹ -1 – 15 ªÀÄvÀÄÛ ¹ - 2- 15)	100
r J¸ï ¹ - 2 JgÀqÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À										
2	2	PÀ£ÀßqÀ ¨sÁµÁ ZÀjvÉæ ¥ÀÆgÀPÀ ¥ÀoÀå ¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉUÀ¼À Ä	**ELB25023**	03 02 01 **5:1:0**	06	48 32 32 **80+32=112**	03	40 30 - **70**	**30** (¹ -1 – 15 ªÀÄvÀÄÛ ¹ - 2- 15)	100
r J¸ï ¹ - 3 ªÀÄÆgÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À										
3	3	¨sÁgÀwÃAiÀÄ PÁªÀå«ÄÃªÀiÁA¸ É ¥ÀÆgÀPÀ ¥ÀoÀå ¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉUÀ¼À Ä	**ELC25023**	03 02 01 **5:1:0**	06	48 32 32 **80+32=112**	03	40 30 **-** **70**	**30** (¹ -1 – 15 ªÀÄvÀÄÛ ¹ - 2 15)	100
r J¸ï ¹ - 4 £Á®Ì£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À										
4	4	bÀAzÀ¸ÀÄì ¥ÀÆgÀPÀ ¥ÀoÀå ¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉUÀ¼À Ä	**ELD25023**	03 02 01 **5:1:0**	06	48 32 32 **80+32=112**	03	40 30 - **70**	**30** (¹ -1 – 15 ªÀÄvÀÄÛ ¹ - 2 15)	100

(LzÀÄ ªÀÄvÀÄÛ DgÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸ÀUÀ¼ÀÄ) BA (DSE) KEG

LzÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À

r J¸ï E – 5.1 LzÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À										
5	1	¸Á»vÀå «ªÀÄ±Éð ¥ÀÆgÀPÀ ¥ÀoÀå ¥ÀoÀå ¥ÀÆgÀPÀ ZÀlÄªÀnPÉ	**ELE250**	03 02 01 **5:1:0**	06	48 32 32 **80+32=112**	0 3	40 30 - **70**	**30** (¹ -1 – 15 ªÀÄvÀÄÛ ¹ - 2- 15)	100
r J¸ï E – 5..2 LzÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À										
5	2	«±ÉÃµÀ PÀ« PÁªÀå CzsÀåAiÀÄ£À ºÉÆ¸ÀUÀ£ÀßqÀ ¥ÀÆgÀPÀ ¥ÀoÀå ¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉUÀ¼ÀÄ	**ELE252**	03 02 01 **5:1:0**	06	48 32 32 **80+32=11 2**	03	40 30 - **70**	**30** (¹ -1 – 15 ªÀÄvÀÄÛ ¹ - 2- 15)	100
r J¸ï E – 5.3 LzÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À										
5	3	PÀ£ÀßqÀ £ÁlPÀ ¸Á»vÀå ¥ÀÆgÀPÀ ¥ÀoÀå ¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉUÀ¼ÀÄ	**ELE254**	03 02 01 **5:1:0**	06	48 32 32 **80+32=1 12**	03	40 30 - **70**	**30** (¹ -1 – 15 ªÀÄvÀÄÛ ¹ - 2- 15)	100
r J¸ï E – 5.4 LzÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À										
5	4	ªÀÄ»¼Á ¸Á»vÀå CzsÀåAiÀÄ£À ¥ÀÆgÀPÀ ¥ÀoÀå ¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉUÀ¼ÀÄ	**ELE256**	03 02 01 **5:1:0**	06	48 32 32 **80+32=1 12**	03	40 30 - **70**	**30** (¹ -1 – 15 ªÀÄvÀÄÛ ¹ - 2- 15)	100
r J¸ï E – 5.5 LzÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À										
5	5	PÀ£ÀßqÀ d£À¥ÀzÀ ¸Á»vÀå CzsÀåAiÀÄ£À ¥ÀÆgÀPÀ ¥ÀoÀå ¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉUÀ¼ÀÄ	**ELE258**	03 02 01 **5:1:0**	06	48 32 32 **80+32=1 12**	03	40 30 - **70**	**30** (¹ -1 – 15 ªÀÄvÀÄÛ ¹ - 2- 15)	100

DgÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À

r J¸ï E – 6.1 DgÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À										
6	1	°À¼ÉUÀ£ÀßqÀ ªÁåPÀgÀt ªÀÄvÀÄÛ ¥ÀæAiÉÆÃUÀ ¥ÀÆgÀPÀ ¥ÀoÀå ¥ÀoÀå ¥ÀÆgÀPÀ ZÀlÄªÀnPÉ	**ELF250**	03 02 01 **5:1:0**	06	48 32 32 **80+32=1 12**	03	40 30 - **70**	**30** (¹ -1 – 15 ªÀÄvÀÄÛ ¹ - 2 -15)	100
r J¸ï E – 6.2 DgÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À										
6	2	«±ÉÃµÀ PÀ« PÁªÀå CzsÀåAiÀÄ£À (°À¼ÀUÀ£ÀßqÀ) ¥ÀÆgÀPÀ ¥ÀoÀå ¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉUÀ¼ÀÄ	**ELF252**	03 02 01 **5:1:0**	06	48 32 32 **80+32=1 12**	03	40 30 - **70**	**30** (¹ -1 – 15 ªÀÄvÀÄÛ ¹ - 2- 15)	100
r J¸ï E – 6.3 DgÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À										
6	3	PÀ£ÀßqÀ ¸Á»vÀå ªÀÄvÀÄÛ ¹¤ªÀiÁ ¥ÀÆgÀPÀ ¥ÀoÀå ¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉUÀ¼ÀÄ	**ELF254**	03 02 01 **5:1:0**	06	48 32 32 **80+32=1 12**	03	40 30 **-** **70**	**30** (¹ -1 – 15 ªÀÄvÀÄÛ ¹ - 2- 15)	100
r J¸ï E – 6.4 DgÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À										
6	4	¥ÀæPÁgÀ PÉÃA¢ævÀ CzsÀåAiÀÄ£À ¥ÀÆgÀPÀ ¥ÀoÀå ¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉUÀ¼ÀÄ	**ELF256**	03 02 01 **5:1:0**	06	48 32 32 **80+32=1 12**	03	40 30 - **70**	**30** (¹ -1 – 15 ªÀÄvÀÄÛ ¹ - 2- 15)	100
r J¸ï E – 6.5 DgÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À										
6	5	PÀ£ÀßqÀ ¸Á»vÀå ªÀÄvÀÄÛ ¸ÀªÀÄÆºÀ ªÀiÁzsÀåªÀÄ ¥ÀÆgÀPÀ ¥ÀoÀå ¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉUÀ¼ÀÄ	**ELF258**	03 02 01 **5:1:0**	06	48 32 32 **80+32=1 12**	03	40 30 - **70**	**30** (¹ -1 – 15 ªÀÄvÀÄÛ ¹ - 2- 15)	100

¨sÁµÉ PÀ£ÀßqÀ

¹©¹J¸ï ¥ÀzÀÞwAiÀÄ ¥ÀoÀå«£Áå¸À

2019-20jAzÀ DgÀA¨sÀªÁUÀÄªÀ ±ÉÊPÀëtÂPÀ ªÀµÀðPÉÌ ¹©¹J¸ï ¥ÀzÀÞwAiÀÄ

¥ÁoÀPÀæªÀÄ ªÀÄvÀÄÛ ¥ÀjÃPÁë AiÉÆÃd£É

ªÀÄÄPÀÛ LaÒPÀ ¥ÀwæPÉ

eÉ.E - **Generic Elective(GE) HEG**

¸É«Ä¸ÀÖgï	¥ÀwæPÉ	PÉÆÃ¸ïð PÉÆÃqï	¥ÀwæPÉ ²Ã¶ðPÉ	PÉærmï «£Áå¸À LTP	MlÄÖ PÉærmï	¨ÉÆÃzsÀ£Á UÀAmÉ UÀ¼À ¸ÀASÉå (¸É«Ä¸ÀÖgïUÉ)	¥ÀjÃPÁë CªÀ¢ü (UÀAmÉUÀ¼ÀÄ)	CAPÀUÀ¼ÀÄ	DAvÀjPÀ ªÀiË®åªÀiÁ¥À£À CAPÀUÀ¼ÀÄ	MlÄÖ CAPÀUÀ¼ÀÄ
			LzÀÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À PÀ£ÀßqÀ ¸Á»vÀå ¥ÀjZÀAiÀÄ							
5	1	**ELE259**	**WÀlPÀ 1** : ¥ÁæaÃ£À PÀ£ÀßqÀ ¸Á»vÀå ¥ÀjZÀAiÀÄ **WÀlPÀ 2 :** DzsÀÄ¤PÀ PÀ£ÀßqÀ ¸Á»vÀå ¥ÀjZÀAiÀÄ	01 01 **2:0:0**	02	16 16 **32**	02	20 15 **35**	15 (¹ -1 – 10 ªÀÄvÀÄÛ ¹ - 2- 10)	**50**
			DgÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À PÀ£ÀßqÀ PÀ°PÉ – UÀ½PÉ							
6	1		**WÀlPÀ 1** : PÀ£ÀßqÀ ¸Á»vÀå	01 01	02	16 16	02	20 15	15 (¹ -1 – 10 ªÀÄvÀÄÛ ¹ - 2 -10)	**50**

			PÀ°PÉ **WÀlPÀ 2 :** PÀ£ÀßqÀ eÁÕ£ÀU À½PÉ	**2:0 :0**		**32**		**35**		

¨sÁµÉ PÀ£ÀßqÀ

ªÀÄÆgÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À (¸É«Ä¸ÀÖgï)

Course Code: ELC06025/ ELC06021/ELC0602/2ELC06023/ELC06024/ ELC06026

PÀ¯Á¤PÁAiÀÄ

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¨sÁ¶PÀ PÀ£ÀßqÀ J.E.¹.¹ - 3, 2 +1 = 3 PÉærmï **ªÁgÀPÉÌ**

JgÀqÀÄ PÉærmïUÀ¼À ¥ÁoÀ – MAzÀÄ PÉærmï¥ÀÆgÀPÀ ¥ÀoÀå ZÀlÄªÀnPÉ (lÄåmÉÆÃjAiÀÄ¯ï)

¤gÀAvÀgÀ ªÀiË®åªÀiÁ¥À£À, ¹– 1, (15 CAPÀUÀ¼ÀÄ) ªÀÄvÀÄÛ ¹- 2 (15 CAPÀUÀ¼ÀÄ)

ªÀÄÄRå ¥ÀjÃPÉë ¹ - 3 (70 CAPÀUÀ¼ÀÄ)

¥ÀoÀå : PÀ¯Á ¹j - 3

¥ÀwæPÉ : 3 PÁªÀå ¨sÁUÀ -1

WÀlPÀ 1 : PÁªÀå¨sÁUÀ

CAPÀUÀ¼ÀÄ : 40

1. CtÚ vÀAV : d£À¥ÀzÀ
2. ªÀZÀ£ÀUÀ¼ÀÄ : §¸ÀªÀtÚ, DAiÀÄÝQÌ ®PÀÌªÀÄä ªÀiÁzÁgÀ ZÉ£ÀßAiÀÄå, CPÀÌªÀÄä
3. ZÀAzÀæªÀÄwAiÀÄ ¥Àæ¯Á¥À : gÁWÀªÁAPÀ
4. ªÀÄÄ¸ÀÄqÀ£ÀªÀÄgÁ¢æAiÀÄ° vÉÃªÉ£ÀÄ zÉÃªÀ¸ÀAvÀwAiÀÄ : PÀÄªÀiÁgÀªÁå¸À
5. £ÀÈ¥Á®£À UÀªÀð ¸ÉÆÃjzÀÄzÀÄ : gÀvÁßPÀgÀªÀtÂð
6. J¼ÉUÀgÀÄA JvÁÛUÀzÉ : ¸ÉÆÃªÉÄÃ±ÀégÀ

WÀlPÀ 2 : ®QëöäÃ±À£À eÉÊ«Ä¤¨sÁgÀvÀ(DAiÀÄÝ ¨sÁUÀ)

CAPÀUÀ¼ÀÄ : 30

WÀlPÀ : 3 PÁªÀå ¨sÁUÀzÀ ¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉUÀ¼ÀÄ

- d£À¥ÀzÀ VÃvÉUÀ¼À ªÀÄÆ®ªÀÄlÄÖUÀ¼À£ÀÄß ¥ÀjZÀ¬Ä¸ÀÄªÀÅzÀÄ.
- «zÁåyðUÀ¼À ¥Àj¸ÀgÀzÀ°ègÀÄªÀ d£À¥ÀzÀ ¸Á»vÀåªÀ£ÀÄß ¸ÀAUÀæ»¸À®Ä ¸ÀÆa¸ÀÄªÀÅzÀÄ
- µÀlà¢PÁªÀåUÀ¼À£ÀÄß UÀªÀÄPÀ gÀÆ¥ÀzÀ°è ¥Àæ¸ÀÄÛvÀ ¥Àr¸ÀÄªÀÅzÀÄ.
- DAiÀÄÝ PÁªÀå¨sÁUÀzÀ £ÁlQÃAiÀÄ ¸À¤ßªÉÃ±ÀUÀ¼À£ÀÄß C©ü£À¬Ä¸À®Ä GvÉÛÃf¸ÀÄªÀÅzÀÄ.
- PÁªÀåzÀ ¨sÁUÀªÀ£ÀÄß £ÁlPÀ CxÀªÁ PÀxÉAiÀÄ gÀÆ¥ÀPÉÌ ¥ÀjªÀwð¸À®Ä ¸ÀÆa¸ÀÄªÀÅzÀÄ.
- DAiÀÄÝ ªÀZÀ£ÀPÁgÀgÀ §zÀÄPÀÄ ªÀÄvÀÄÛ ¸Á»vÀå PÀÄjvÀAvÉ «ZÁgÀUÉÆÃ¶× £ÀqÉ¸ÀÄªÀÅzÀÄ.
- PÁªÀå¨sÁUÀzÀ PÀxÉUÉ ¸ÀA§A¢ü¹zÀ ¹¤ªÀiÁ ¥ÀæzÀ±Àð£À ºÁUÀÆ UÁAiÀÄ£ÀUÀ¼À£ÀÄß PÉÃ½¸ÀÄªÀÅzÀÄ.

¨sÁµÉ PÀ£ÀßqÀ

£Á®Ì£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À (¸É«Ä¸ÀÖgï)

Course Code: ELD06025/ELD06021/ELD06022/ELD06023/ELD06024/ ELD06026

PÀ¯ Á¤PÁAiÀÄ

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¨sÁ¶PÀ PÀ£ÀßqÀ J.E.¹.¹ - 4 2 +1 = 3 PÉærmï **ªÁgÀPÉÌ JgÀqÀÄ**

PÉærmïUÀ¼À ¥ÁoÀ – MAzÀÄ PÉærmï ¥ÀÆgÀPÀ ¥ÀoÀå ZÀlÄªÀnPÉ

(lÄåmÉÆÃjAiÀÄ¯ï)

¤gÀAvÀgÀ ªÀiË®åªÀiÁ¥À£À, ¹– 1, (15 CAPÀUÀ¼ÀÄ) ªÀÄvÀÄÛ ¹- 2 (15 CAPÀUÀ¼ÀÄ)

ªÀÄÄRå ¥ÀjÃPÉë ¹ - 3 (70 CAPÀUÀ¼ÀÄ)

¥ÀoÀå – PÀ¯ Á ¹j - 4

¥ÀwæPÉ : 4 PÁªÀå ¨sÁUÀ – 2 ªÀÄvÀÄÛ UÀzÀå¨sÁUÀ

WÀlPÀ 1 : PÁªÀå¨sÁUÀ - 2

CAPÀUÀ¼ÀÄ : 40

1. ¤Ã¯ ÁAd£ÉAiÀÄ £ÀÈvÀå0 : ¥ÀA¥À
2. zÀÄAiÉÆÃðzsÀ£À «¯ Á¥ÀA : gÀ£Àß
3. £À¼ÀPÀÆ§gÀ£À ¥Àæ¸ÀAUÀ : £ÁUÀZÀAzÀæ
4. PÉÆ¯ÉÆéqÉ PÁªÀgÁgÉ®ªÉÇ : gÀÄzÀæ¨sÀlÖ
5. vÀÄ¥ÉàÃjzÀ zÀ¥ÀðtzÉÆ¼ï ¥ÀdÓ½¸À¯ Á¥ÀÄðzÉ ¥Àæw©A§A : d£Àß

6. vÀÄgÀÄPÁtåzÀAiÀÄå£À ªÀZÀ£À (ªÀÄAmÉÃ¸Áé«Ä PÁªÀå) : ¸ÀA. ¦. PÉ. gÁd±ÉÃRgÀ

WÀlPÀ 2 : UÀzÀå¨sÁUÀ

CAPÀUÀ¼ÀÄ : 30

1. vÀÄì£Á«Ä : ¥ÀÆtðZÀAzÀæ vÉÃd¹é
2. D¸ÀàvÉæ : JZï.J¸ï.PÉ
3. G¥ÀWÁvÀ : C.gÁ. «ÄvÀæ
4. ¨ÁV°UÉ §AzÀ £À«®Ä ; PÀÈ¥ÁPÀgÀ ¸ÉÃ£Á¤
5. §zÀÄPÉA§ CVß¢ªÀå : PÉ. µÀjÃ¥sÁ

WÀlPÀ : 3 PÁªÀå ¨sÁUÀ – 2 : ¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉUÀ¼ÀÄ

- °À¼ÀUÀ£ÀßqÀ ¥ÀzÀåUÀ¼À£ÀÄß CxÀðPÉÌ C£ÀÄUÀÄtªÁV ©r¹ NzÀÄªÀÅzÀÄ
- °À¼ÀUÀ£ÀßqÀ ¥ÀzÀåUÀ¼À°è §gÀÄªÀ PÀpt/«±ÉÃµÀ ¥ÀzÀUÀ½UÉ CxÀð§gÉAiÀÄ®Ä ¸ÀÆa¸ÀÄªÀÅzÀÄ ªÀÄvÀÄÛ £ÀÄrUÀlÄÖUÀ¼À£ÀÄß «ªÀj¸À®Ä w½¸ÀÄªÀÅzÀÄ.
- ªÀ¸ÀÄÛ ªÀÄvÀÄÛ D±ÀAiÀÄUÀ¼À£ÀÄß ¥Àæ¸ÀÄÛvÀ ¸ÀAzÀ¨sÀðPÉÌ vÀPÀÌAvÉ C£Àé¬Ä¹ «ZÁgÀ ªÀÄAr¸À®Ä UÀÄA¥ÀÄ ZÀZÉð £ÀqÉ¸À®Ä CªÀPÁ±À PÀ°à¸ÀÄªÀÅzÀÄ.
- °À¼ÀUÀ£ÀßqÀ PÀ«vÉUÉ UÀªÀÄPÀ ªÁåSÁå£À ªÀiÁr¸ÀÄªÀÅzÀÄ,.
- °À¸ÀÛ¥ÀæwUÀ¼À£ÀÄß vÉÆÃj¸ÀÄªÀÅzÀÄ.

WÀlPÀ : 4 UÀzÀå¨sÁUÀzÀ ¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉUÀ¼ÀÄ

- ¥Àj¸ÀgÀ ¸ÀAgÀPÀëuÉAiÀÄ°è «zÁåyðAiÀÄÄ vÀ£Àß ¥ÁvÀæ PÀÄjvÀÄ w½AiÀÄ ¥Àr¸ÀÄªÀÅzÀÄ.
- ¥Àj¸ÀgÀ ¸ÀAgÀPÀëuÉ PÀÄjvÀÄ ZÀZÉð ªÀÄvÀÄÛ C©ü¥ÁæAiÀÄ ªÀÄAqÀ£É

- «zÁåyðUÀ½AzÀ CªÀgÀ fÃªÀ£ÀzÀ C£ÀÄ¨sÀªÀ PÀÄjvÀÄ ¯ÉÃR£ÀUÀ¼À£ÀÄß §gÉ¸ÀÄªÀÅzÀÄ.
  - «zÁåyðAiÀÄÄ vÁ£ÀÄ PÉÊUÉÆAqÀ ¥ÀæªÁ¸ÀzÀ C£ÀÄ¨sÀªÀUÀ¼À£ÀÄß C©üªÀåPÀÛ¥Ar¸ÀÄªÀÅzÀÄ.
- «zÁåyðUÀ¼ÀÄ vÁªÀÅ w½¢gÀÄªÀ ºÁ¸Àå ¸À¤ßªÉÃ±ÀUÀ¼À£ÀÄß ªÀtÂð¸ÀÄªÀÅzÀÄ.
- PÀ¯Á¸ÁzsÀPÀgÀ£ÀÄß UÀÄgÀÄw¹ ¥ÀjZÀ¬Ä¸À®Ä ¸ÀÆa¸ÀÄªÀÅzÀÄ.
- vÀªÀÄä ¥Àj¸ÀgÀzÀ°ègÀÄªÀ «±ÉÃµÀ ªÀåQÛUÀ¼À£ÀÄß (¸Á»w, PÀ¯Á«zÀ, «eÁÕ¤, ¥Àj¸ÀgÀ ¥ÉæÃ«Ä EvÁå¢.,) ¸ÀAzÀ²ð¸ÀÄªÀÅzÀÄ.

¨sÁµÉ PÀ£ÀßqÀ

ªÀÄÆgÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À (¸É«Ä¸ÀÖgï)

Course Code: CDC06001/ ENC06001

ªÁtÂdå ¤PÁAiÀÄ

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¨sÁ¶PÀ PÀ£ÀßqÀ J.E.¹.¹ - 3, 2 +1 = 3 PÉærmï

ªÁgÀPÉÌ JgÀqÀÄ PÉærmïUÀ¼À ¥ÁoÀ – MAzÀÄ PÉærmï ¥ÀÆgÀPÀ ¥ÀoÀå

ZÀlÄªÀnPÉ (lÄåmÉÆÃjAiÀÄ¯ï)

¤gÀAvÀgÀ ªÀiË®åªÀiÁ¥À£À, ¹– 1, (15 CAPÀUÀ¼ÀÄ) ªÀÄvÀÄÛ ¹- 2 (15 CAPÀUÀ¼ÀÄ)

ªÀÄÄRå ¥ÀjÃPÉë ¹ - 3 (70 CAPÀUÀ¼ÀÄ)

¥ÀoÀå : ªÁtÂdå ¹j - 3

¥ÀwæPÉ : 3 PÁªÀå ¨sÁUÀ -1

WÀlPÀ 1 : PÁªÀå¨sÁUÀ

CAPÀUÀ¼ÀÄ : 40

1. ªÀZÀ£ÀUÀ¼ÀÄ : eÉÃqÀgÀ zÁ¹ªÀÄAiÀÄå, C®èªÀÄ ¥Àæ¨sÀÄ CªÀÄÄUÉ gÁAiÀÄªÀÄä, °AUÀªÀÄä
2. ¸ÀªÀðdÕ£À wæ¥À¢UÀ¼ÀÄ : ¸ÀªÀðdÕ
3. ºÀgÀ£ÉA§ÄzÉÃ ¸ÀvÀå ¸ÀvÀåªÉA§ÄzÉÃ ºÀgÀ£ÀÄ : gÁWÀªÁAPÀ
4. ªÀiÁ£ÀªÀ d£Àä : ¥ÀÄgÀAzÀgÀ zÁ¸ÀgÀÄ
5. zsÀªÀÄðAiÀÄÄzÀÞ ; gÀvÁßPÀgÀªÀtÂð
6. PÀÄªÀjAiÀiÁzÉÆqÉ PÀÄAzÉÃ£ÀÄ : ¸ÀAaAiÀÄ ºÉÆ£ÀßªÀÄä

WÀlPÀ 2 : «gÁl ¥ÀªÀð ¸ÀAUÀæºÀ (DAiÀÄÝ ¨sÁUÀ)

CAPÀUÀ¼ÀÄ : 30

(**QÃZÀPÀ ªÀzsÁ ¥Àæ¸ÀAUÀ**)

¸ÀA. vÀ.¸ÀÄ. ±ÁªÀÄgÁAiÀÄ

WÀlPÀ : 3 PÁªÀå ¨sÁUÀzÀ ¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉUÀ¼ÀÄ

- d£À¥ÀzÀ VÃvÉUÀ¼À ªÀÄÆ®ªÀÄlÄÖUÀ¼À£ÀÄß ¥ÀjZÀ¬Ä¸ÀÄªÀÅzÀÄ.

- «zÁåyðUÀ¼À ¥Àj¸ÀgÀzÀ°ègÀÄªÀ d£À¥ÀzÀ ¸Á»vÀåªÀ£ÀÄß ¸ÀAUÀæ»¸À®Ä ¸ÀÆa¸ÀÄªÀÅzÀÄ
- µÀlà¢ PÁªÀåUÀ¼À£ÀÄß UÀªÀÄPÀ gÀÆ¥ÀzÀ°è ¥Àæ¸ÀÄÛvÀ ¥Àr¸ÀÄªÀÅzÀÄ.
- DAiÀÄÝ PÁªÀå¨sÁUÀzÀ £ÁlQÃAiÀÄ ¸À¤ßªÉÃ±ÀUÀ¼À£ÀÄß C©ü£À¬Ä¸À®Ä GvÉÛÃf¸ÀÄªÀÅzÀÄ.
- PÁªÀåzÀ ¨sÁUÀªÀ£ÀÄß £ÁlPÀ CxÀªÁ PÀxÉAiÀÄ gÀÆ¥ÀPÉÌ ¥ÀjªÀwð¸À®Ä ¸ÀÆa¸ÀÄªÀÅzÀÄ.
- DAiÀÄÝ ªÀZÀ£ÀPÁgÀgÀ §zÀÄPÀÄ ªÀÄvÀÄÛ ¸Á»vÀå PÀÄjvÀAvÉ «ZÁgÀUÉÆÃ¶× £ÀqÉ¸ÀÄªÀÅzÀÄ.
- PÁªÀå¨sÁUÀzÀ PÀxÉUÉ ¸ÀA§A¢ü¹zÀ ¹¤ªÀiÁ ¥ÀæzÀ±Àð£À °ÁUÀÆ UÁAiÀÄ£ÀUÀ¼À£ÀÄß PÉÃ½¸ÀÄªÀÅzÀÄ.

¨sÁµÉ PÀ£ÀßqÀ
£Á®Ì£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À (¸É«Ä¸ÀÖgï)

Course Code: END06001/CDD06001

ªÁtÂdå ¤PÁAiÀÄ

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¨sÁ¶PÀ PÀ£ÀßqÀ J.E.¹.¹ - 4, 2 +1 = 3 PÉærmï

ªÁgÀPÉÌ JgÀqÀÄ PÉærmïUÀ¼À ¥ÁoÀ – MAzÀÄ PÉærmï ¥ÀÆgÀPÀ ¥ÀoÀå ZÀlÄªÀnPÉ (lÄåmÉÆÃjAiÀÄ¯ï)

¤gÀAvÀgÀ ªÀiË®åªÀiÁ¥À£À, ¹– 1, (15 CAPÀUÀ¼ÀÄ) ªÀÄvÀÄÛ ¹- 2 (15 CAPÀUÀ¼ÀÄ)

ªÀÄÄRå ¥ÀjÃPÉë ¹ - 3 (70 CAPÀUÀ¼ÀÄ)

¥ÀoÀå : ªÁtÂdå ¹j - 4

¥ÀwæPÉ : 4 PÁªÀå ¨sÁUÀ – 2 ªÀÄvÀÄÛ UÀzÀå¨sÁUÀ

WÀlPÀ 1 : PÁªÀå¨sÁUÀ - 2

CAPÀUÀ¼ÀÄ : 40

1. UÀA©üÃgÉAiÉÄA§ ªÀÈzÀÞ¹ÛçÃAiÀÄ PÀxÉ : ¨sÁæfµÀÄÚ
2. £ÉvÀÛªÀÄ£Ár ¨sÁ£ÀÄªÀÄw ¸ÉÆÃ¯ÉÆÛqÉ : ¥ÀA¥À
3. ¤ÃgÉÆ¼ÀVzÀÄðA ¨ÉªÀÄvÀð£ÀÄgÀUÀ¥ÀvÁPÀA : gÀ£Àß
4. gÁªÀÄ£ÀA------PÉÆmÉÖ¥ÉA ¹ÃvÉAiÀÄA : £ÁUÀZÀAzÀæ
5. ¨sÀQÛAiÉÄ ¨sÀªÀ ¸À¤ß¢üAiÉÆ¼ï gÀÆ¥ÀUÉÆAqÀAwzÀð¼ï : MAzÀ£É £ÁUÀªÀªÀÄð
6. «¢ü«¼À¸À£ÀzÀ £ÉgÀA§qÉAiÉÄ PÉÆAzÀÄ PÀÆUÀzÉ £ÀgÀgÀA : d£Àß

WÀlPÀ 2 : UÀzÀå¨sÁUÀ

CAPÀUÀ¼ÀÄ : 30

1. ºÉ¤æ µÀÄ¯ Áä£ï zÀA¥ÀwUÀ¼À **dUÀvÀÛ£ÀÄß ¨ÉaÑ¹zÀ ¸ÀA±ÉÆÃzsÀ£É** : PÉ.¦. ¥ÀÆtðZÀAzÀæ vÉÃd¹é
2. £ÀªÀÄÆägÀ ¨É¼À¢AUÀ¼À PÉgÉAiÀÄAvÀºÀ ¨Á®åzÀ £É£À¥ÀÄ : ¸ÀAfÃªÀgÁAiÀÄ
3. ªÀÄ¸Á¯ï zÉÆÃ¸É : ¥ÀÄ.w. £ÀgÀ¹AºÀZÁgï
4. ¸ÉÆ¸ÉAiÀÄgÀ ¸ÀA¸ÁgÀ : n. ¸ÀÄ£ÀAzÀªÀÄä
5. PÀÄtÂAiÀÄÄªÀ PÀÄgÀÄqÀÄ PÁAZÁt : f. ZÀAzÀæ±ÉÃRgÀ

WÀlPÀ : 3 PÁªÀå¨sÁUÀ – 2 : ¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉUÀ¼ÀÄ

- ºÀ¼ÉUÀ£ÀßqÀ ¥ÀzÀåUÀ¼À£ÀÄß CxÀðPÉÌ CxÉÊð¸ÀÄªÀÅzÀÄ, C£Àé¬Ä¸ÀÄªÀÅzÀÄ, ªÁåSÁå£À ªÀiÁqÀ®Ä ºÉÃ¼ÀÄªÀÅzÀÄ.
- ºÀ¼ÀUÀ£ÀßqÀ ¥ÀzÀåUÀ¼À°è §gÀÄªÀ ¥ÀzÀUÀ½UÉ CxÀð ªÀÄvÀÄÛ £ÀÄrUÀlÄÖUÀ¼À£ÀÄß «ªÀj¸ÀÄªÀÅzÀÄ.
- ¥ËgÁtÂPÀ ¸À¤ßªÉÃ±ÀUÀ¼À »£Éß¯ÉAiÀÄ£ÀÄß «ªÀj¸ÀÄªÀÅzÀÄ.
- ªÀ¸ÀÄÛ ªÀÄvÀÄÛ D±ÀAiÀÄUÀ¼À£ÀÄß ¥Àæ¸ÀÄÛvÀ ¸ÀAzÀ¨sÀðPÉÌ vÀPÀæPÀAvÉ C£Àé¬Ä¹ «ZÁgÀ ªÀÄAr¸À®Ä UÀÄA¥ÀÄ ZÀZÉð £ÀqÉ¸À®Ä CªÀPÁ±À PÀ°à¸ÀÄªÀÅzÀÄ.
- ºÀ¼ÉUÀ£ÀßqÀ PÀ«vÉUÉ UÀªÀÄPÀ ªÁåSÁå£À ªÀiÁr¸ÀÄªÀÅzÀÄ,.
- ºÀ¸ÀÛ¥ÀæwUÀ¼À£ÀÄß vÉÆÃj¸ÀÄªÀÅzÀÄ.

WÀlPÀ : 4 UÀzÀå¨sÁUÀzÀ ¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉUÀ¼ÀÄ

- ¥Àj¸ÀgÀ ¸ÀAgÀPÀëuÉAiÀÄ°è «zÁåyðAiÀÄÄ vÀ£Àß ¥ÁvÀæ PÀÄjvÀÄ w½AiÀÄ ¥Àr¸ÀÄªÀÅzÀÄ.
- ¥Àj¸ÀgÀ ¸ÀAgÀPÀëuÉ PÀÄjvÀÄ ZÀZÉð ªÀÄvÀÄÛ C©ü¥ÁæAiÀÄ ªÀÄAqÀ£É
- «zÁåyðUÀ½AzÀ CªÀgÀ fÃªÀ£ÀzÀ C£ÀÄ¨sÀªÀ PÀÄjvÀÄ ¯ÉÃR£ÀUÀ¼À£ÀÄß §gÉ¸ÀÄªÀÅzÀÄ.
- «zÁåyðAiÀÄÄ vÁ£ÀÄ PÉÊUÉÆAqÀ ¥ÀæªÁ¸ÀzÀ C£ÀÄ¨sÀªÀUÀ¼À£ÀÄß C©üªÀåPÀÛ¥Àr¸ÀÄªÀÅzÀÄ.
- «zÁåyðUÀ¼ÀÄ vÁªÀÅ w½¢gÀÄªÀ ºÁ¸Àå ¸À¤ßªÉÃ±ÀUÀ¼À£ÀÄß ªÀtÂð¸ÀÄªÀÅzÀÄ.

- ªÁtÂdå PÉëÃvÀæzÀ ¸ÁzsÀPÀgÀ£ÀÄß UÀÄgÀÄw¹ ¥ÀjZÀ¬Ä¸À®Ä ¸ÀÆa¸ÀÄªÀÅzÀÄ.

¨sÁµÉ PÀ£ÀßqÀ

ªÀÄÆgÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À (¸É«Ä¸ÀÖgï)

Course Code:DMC06001/DMC06002/DMC06003/DMC06004/DMC06005/DMC06006/DMC06007/DMC06008

«eÁÐ£À ¤PÁAiÀÄ

©.J¹ì/©.¹.J

¨sÁ¶PÀ PÀ£ÀßqÀ J.E.¹.¹ - 1, 2 +1 = 3 PÉærmï

ªÁgÀPÉÌ JgÀqÀÄ PÉærmïUÀ¼À ¥ÁoÀ – MAzÀÄ PÉærmï ¥ÀÆgÀPÀ ¥ÀoÀå ZÀlÄªÀnPÉ (lÄåmÉÆÃjAiÀÄ¯ï)

¤gÀAvÀgÀ ªÀiË®åªÀiÁ¥À£À, ¹– 1, (15 CAPÀUÀ¼ÀÄ) ªÀÄvÀÄÛ ¹- 2 (15 CAPÀUÀ¼ÀÄ)

ªÀÄÄRå ¥ÀjÃPÉë ¹ - 3 (70 CAPÀUÀ¼ÀÄ)

¥ÀwæPÉ : 3 £ÀqÀÄUÀ£ÀßqÀ PÁªÀåUÀ¼ÀÄ (DAiÀÄÝ ¨sÁUÀ)

¥ÀoÀå : «eÁÕ£À ¹j - 3

WÀlPÀ 1 : PÁªÀå¨sÁUÀ

CAPÀUÀ¼ÀÄ : 40

1. ©ü£Àß ¨sÉÃzÀªÀ ªÀiÁqÀ¨ÁårgÉÆÃ : d£À¥ÀzÀ
2. ªÀZÀ£ÀUÀ¼ÀÄ : CPÀÌªÀÄºÁzÉÃ«

Cj«£À ªÀiÁjvÀAzÉ
ªÉÆÃ½UÉ ªÀÄºÁzÉÃ«
Gj°AUÀ¥É¢Ý

3. E£ÀÄß °ÀÄlÖ¢gÀ° £ÁjAiÀÄgÉ£ÀßªÉÇ®Ä :
   PÀÄªÀiÁgÀªÁå¸À
4. PÉÆÃ¥À ¥ÉÊ¸Àj¹vÀÄ °ÀÈzÀAiÀÄ vÀA¥ÁAiÀÄÄÛ :
   gÀvÁßPÀgÀªÀtÂð
5. ªÀÄ¼ÉAiÀÄ zÀAiÀÄªÀiÁqÉÆÃ gÀAUÀAiÀÄå :
   ºÉ¼ÀªÀ£À PÀmÉÖ VjAiÀÄªÀÄä
6. ²æÃ UÀÄgÀÄ ªÀZÀ£ÉÆÃ¥ÀzÉÃ±À : ¤dUÀÄt
   ²ªÀAiÉÆÃV

WÀlPÀ – 2 gÁªÀÄzsÁ£Àå ZÀjvÉ **CAPÀUÀ¼ÀÄ: 30**

¸ÀA. ¸ÀtÚAiÀÄå

WÀlPÀ : 3 PÁªÀå ¨sÁUÀ – 2 : ¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉUÀ¼ÀÄ

- °À¼ÉUÀ£ÀßqÀ ¥ÀzÀåUÀ¼À£ÀÄß CxÀðPÉÌ C£ÀÄUÀÄtªÁV ©r¹ NzÀÄªÀÅzÀÄ.
- °À¼ÀUÀ£ÀßqÀ ¥ÀzÀåUÀ¼À°è §gÀÄªÀ ¥ÀzÀUÀ½UÉ CxÀð ªÀÄvÀÄÛ £ÀÄrUÀlÄÖ, ¥ËgÁtÂPÀ ¸À¤ßªÉÃ±ÀUÀ¼À
  »£Éß¯ÉAiÀÄ£ÀÄß «ªÀj¸ÀÄªÀÅzÀÄ.
- ªÀ¸ÀÄÛ ªÀÄvÀÄÛ D±ÀAiÀÄUÀ¼À£ÀÄß ¥Àæ¸ÀÄÛvÀ ¸ÀAzÀ¨sÀðPÉÌ vÀPÀÌAvÉ C£Àé¬Ä¹ «ZÁgÀ ªÀÄAr¸À®Ä UÀÄA¥ÀÄ ZÀZÉð
  £ÀqÉ¸À®Ä CªÀPÁ±À PÀ°à¸ÀÄªÀÅzÀÄ.
- °À¼ÉUÀ£ÀßqÀ PÀ«vÉUÉ UÀªÀÄPÀ ªÁåSÁå£À ªÀiÁr¸ÀÄªÀÅzÀÄ.
- °À¸ÀÛ¥ÀæwUÀ¼À£ÀÄß vÉÆÃj¸ÀÄªÀÅzÀÄ.

¨sÁµÉ PÀ£ÀßqÀ

£Á®Ì£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À (¸É«Ä¸ÀÖgï)

Course Code:ECD06001/ DMD06001/DMD 06002/DMD 06003/DMD 06004/DMD 06005/DMD06006/DMD06007/DMD06008

«eÁÕ£À ¤PÁAiÀÄ

©.J¹ì / ©.¹J

¨sÁ¶PÀ PÀ£ÀßqÀ J.E.¹.¹ - 4, 2

+1 = 3 PÉærmï

ªÁgÀPÉÌ JgÀqÀÄ PÉærmïUÀ¼À ¥ÁoÀ – MAzÀÄ PÉærmï ¥ÀÆgÀPÀ ¥ÀoÀå ZÀlÄªÀnPÉ (lÄåmÉÆÃjAiÀÄ¯ï)

¤gÀAvÀgÀ ªÀiË®åªÀiÁ¥À£À, ¹– 1, (15 CAPÀUÀ¼ÀÄ) ªÀÄvÀÄÛ ¹- 2 (15 CAPÀUÀ¼ÀÄ)

ªÀÄÄRå ¥ÀjÃPÉë ¹ - 3 (70 CAPÀUÀ¼ÀÄ)

¥ÀwæPÉ : 4 PÁªÀå ¨sÁUÀ ªÀÄvÀÄÛ UÀzÀå¨sÁUÀ

¥ÀoÀå : «eÁÕ£À ¸ËgÀ¨sÀ - 4

WÀlPÀ 1 : PÁªÀå¨sÁUÀ - 2

CAPÀUÀ¼ÀÄ : 40

1. PÀÄjvÉÆÃzÀzÉAiÀÄÄA PÁªÀå ¥ÀæAiÉÆÃUÀ ¥Àjtv À ªÀÄwUÀ¼ï : ²æÃ«dAiÀÄ
2. £À¯ÉäUÉ ¢§åA©rªÀ0vÉªÉÇ¯ ï : ¥ÀA¥À
3. ©üÃªÀÄ¸ÉÃ£À ¥ÀæweÁÕ ªÀtð£ÀA : gÀ£Àß
4. PÁªÀgÉ PÀuÉUÉÆ¼ÉÆéqÀ¨Éâ ¨Áj¥ÀgÉÆ¼ÀgÉÃ : d£Àß
5. C©ÝAiÀÄÄªÉÆªÉÄð PÁ®ªÀ±À¢A ªÀÄAiÀiÁðzÉAiÀÄA zÁAlzÉÃ : £ÁUÀZÀAzÀæ
6. zsÀgÉUÉ M§â£É zÁ£À±ÀÆgÀ PÀtð (d£À¥ÀzÀ ªÀÄºÁ¨sÁgÀvÀ) : ¸ÀA. ¦.PÉ. gÁd±ÉÃRgÀ

WÀlPÀ 2 : UÀzÀå¨sÁUÀ CAPÀUÀ¼ÀÄ: 30

1. gÁªÀÄgÁªÀtgÀ AiÀÄÄzÀÞ : PÀÄªÉA¥ÀÄ
2. aUÀÄgÉÆqÉAiÀÄÄwÛgÀÄªÀ VqÀzÀ vÀ£ÀäAiÀÄvÉ : QëÃgÀ¸ÁUÀgÀ
3. ªÀiÁzsÀ«Ã®vÉ, ¸ÁPÉðÃAqÀæ : ©.f.J¯ï ¸Áé«Ä
4. gÉÆÃ¨ÁmïUÀ½UÉ £ÁUÀjPÀvÉAiÀÄ ªÉÆzÀ® ¢ÃPÉë : £ÁUÉÃ±ï ºÉUÀqÉ
5. PÀqÀ® UÀ¨sÀðzÀ C¥ÀgÀA¥ÁgÀ : gÀºÀªÀÄvï vÀjPÉgÉ

WÀlPÀ : 3 PÁªÀå ¨sÁUÀzÀ ¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉUÀ¼ÀÄ

- d£À¥ÀzÀ VÃvÉUÀ¼À ªÀÄÆ®ªÀÄlÄÖUÀ¼À£ÀÄß ¥ÀjZÀ¬Ä¸ÀÄªÀÅzÀÄ.
- «zÁåyðUÀ¼À ¥Àj¸ÀgÀzÀ°ègÀÄªÀ d£À¥ÀzÀ ¸Á»vÀåªÀ£ÀÄß ¸ÀAUÀæ»¸À®Ä ¸ÀÆa¸ÀÄªÀÅzÀÄ
- µÀlà¢PÁªÀåUÀ¼À£ÀÄß UÀªÀÄPÀ gÀÆ¥ÀzÀ°è ¥Àæ¸ÀÄÛvÀ ¥Àr¸ÀÄªÀÅzÀÄ.
- DAiÀÄÝ PÁªÀå¨sÁUÀzÀ £ÁlQÃAiÀÄ ¸À¤ßªÉÃ±ÀUÀ¼À£ÀÄß C©ü£À¬Ä¸À®Ä GvÉÛÃf¸ÀÄªÀÅzÀÄ.
- PÁªÀåzÀ ¨sÁUÀªÀ£ÀÄß £ÁlPÀ CxÀªÁ PÀxÉAiÀÄ gÀÆ¥ÀPÉÌ ¥ÀjªÀwð¸À®Ä ¸ÀÆa¸ÀÄªÀÅzÀÄ.

- DAiÀÄÝ ªÀZÀ£ÀPÁgÀgÀ §zÀÄPÀÄ ªÀÄvÀÄÛ ¸Á»vÀå PÀÄjvÀAvÉ «ZÁgÀUÉÆÃ¶× £ÀqÉ¸ÀÄªÀÅzÀÄ.

WÀlPÀ : 4 UÀzÀå¨sÁUÀzÀ ¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉUÀ¼ÀÄ

- ¥Àj¸ÀgÀ ¸ÀAgÀPÀëuÉAiÀÄ°è «zÁåyðAiÀÄÄ vÀ£Àß ¥ÁvÀæ PÀÄjvÀÄ w½AiÀÄ ¥Àr¸ÀÄªÀÅzÀÄ.
- ¥Àj¸ÀgÀ ¸ÀAgÀPÀëuÉ PÀÄjvÀÄ ZÀZÉð ªÀÄvÀÄÛ C©ü¥ÁæAiÀÄ ªÀÄAqÀ£É
- «zÁåyðUÀ½AzÀ CªÀgÀ fÃªÀ£ÀzÀ C£ÀÄ¨sÀªÀ PÀÄjvÀÄ ¯ÉÃR£ÀUÀ¼À£ÀÄß §gÉ¸ÀÄªÀÅzÀÄ.
- «zÁåyðAiÀÄÄ vÁ£ÀÄ PÉÊUÉÆAqÀ ¥ÀæªÁ¸ÀzÀ C£ÀÄ¨sÀªÀUÀ¼À£ÀÄß C©üªÀåPÀÛ¥Àr¸ÀÄªÀÅzÀÄ.
- «zÁåyðUÀ¼ÀÄ vÁªÀÅ w½¢gÀÄªÀ ºÁ¸Àå ¸À¤ßªÉÃ±ÀUÀ¼À£ÀÄß ªÀtÂð¸ÀÄªÀÅzÀÄ.
- «eÁÐ£À PÉëÃvÀæzÀ ¸ÁzsÀPÀgÀ£ÀÄß UÀÄgÀÄw¹ ¥ÀjZÀ¬Ä¸À®Ä ¸ÀÆa¸ÀÄªÀÅzÀÄ.

¹©¹J¸ï - ¥ÀoÀåPÀæªÀÄzÀ ¨sÁµÁ ¥ÀwæPÉUÀ¼À ¥Àæ±Éß ¥ÀwæPÉ ªÀiÁzÀj

PÀ¯Á, ªÁtÂdå ªÀÄvÀÄÛ «eÁÕ£À – ªÀÄÆgÀÄ ¤PÁAiÀÄUÀ½UÀÆ

C£ÀéAiÀÄªÁUÀÄªÀAvÉ

¸ÀªÀÄAiÀÄ: 3 UÀAmÉUÀ¼ÀÄ

UÀjµÀÖ CAPÀUÀ¼ÀÄ: 70

¥ÀzÀå / £ÁlPÀ / PÁªÀå ¨sÁUÀ -1 / PÁªÀå ¨sÁUÀ -2

CAPÀUÀ¼ÀÄ: 40

1. C) MAzÀÄ ¥ÀzÀå ¨sÁUÀzÀ ¨sÁªÀªÀ£ÀÄß ¸ÀAzÀ¨sÀð ¸À»vÀ «ªÀj¹

1 X 5 = 5

(JgÀqÀÄ ¥ÀzÀå ¨sÁUÀUÀ¼À£ÀÄß PÉÃ¼ÀÄªÀÅzÀÄ)

D) MAzÀÄ ªÁPÀåzÀ°è GvÀÛj¹ (LzÀÄ ¥Àæ±ÉßUÀ¼À£ÀÄß PÉÃ¼ÀÄªÀÅzÀÄ)

5 X 1 = 5

2. £Á®ÄÌ ªÁPÀåUÀ¼À£ÀÄß ¸ÀAzÀ¨sÀð ¸À»vÀ «ªÀj¹ (DgÀÄ ªÁPÀåUÀ¼À£ÀÄß PÉÃ¼ÀÄªÀÅzÀÄ) 2. 1/2 X 4= 10

3. MAzÀÄ ¥Àæ±ÉßUÉ GvÀÛj¹ (JgÀqÀÄ ¥Àæ±ÉßUÀ¼À£ÀÄß PÉÃ¼ÀÄªÀÅzÀÄ)

1 X 10 = 10

1. JgÀqÀÄ ¥Àæ±ÉßUÀ½UÉ GvÀÛj¹ (£Á®ÄÌ ¥Àæ±ÉßUÀ¼À£ÀÄß PÉÃ¼ÀÄªÀÅzÀÄ) 2 X 5 = 10

PÀxÉ / PÁzÀA§j / UÀzÀåªÉÊ«zsÀå **30**

CAPÀUÀ¼ÀÄ

2. MAzÀÄ ¥Àæ±ÉßUÉ GvÀÛj¹ (JgÀqÀÄ ¥Àæ±ÉßUÀ¼À£ÀÄß PÉÃ¼ÀÄªÀÅzÀÄ)

1 X 10 = 10

3. MAzÀÄ ¥Àæ±ÉßUÉ GvÀÛj¹ (JgÀqÀÄ ¥Àæ±ÉßUÀ¼À£ÀÄß PÉÃ¼ÀÄªÀÅzÀÄ)

1 X 10 = 10

4. JgÀqÀ£ÀÄß PÀÄjvÀÄ ¸ÀAQë¥ÀÛªÁV GvÀÛj¹ (£Á®ÄÌ ¥Àæ±ÉßUÀ¼À£ÀÄß PÉÃ¼ÀÄªÀÅzÀÄ) 2 X 5 = 10

ªÀÄÆgÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À
LaÒPÀ PÀ£ÀßqÀ(DSC)
Course Code:ELC 25023 ELC25026
r.J¸ï.¹ - ¥ÀwæPÉ -3
¨sÁgÀwÃAiÀÄ PÁªÀå«ÄÃªÀiÁA¸É ªÀÄvÀÄÛ ¥ÀÆgÀPÀ ¥ÀoÀå

WÀlPÀ 1 :

C) ¨sÁgÀwÃAiÀÄ PÁªÀå«ÄÃªÀiÁA¸ÉAiÀÄ GUÀªÀÄ ªÀÄvÀÄÛ «PÁ¸À: ¨sÀgÀvÀ, ¨sÁªÀÄºÀ, zÀAr, ªÁªÀÄ£À, D£ÀAzÀªÀzsÀð£À, PÀÄAvÀPÀ, PÉëÃªÉÄÃAzÀæ, F ¥ÀæªÀÄÄR C®APÁjPÀgÀÄ ªÀÄvÀÄÛ CªÀgÀ PÀÈwUÀ¼À ¸ÀAQë¥ÀÛ ¥ÀjZÀAiÀÄ.

D) PÁªÀåzÀ DPÀgÀ (¥Àæw¨sÉ) ªÀÄvÀÄÛ ¥ÀjPÀgÀ (ªÀÅåvÀàwÛ)UÀ¼ÀÄ, PÁªÀå, ®PÀët, PÁªÀå ¥ÀæAiÉÆÃd£ÀUÀ¼ÀÄ, PÀ« ªÀÄvÀÄÛ ¸ÀºÀÈzÀAiÀÄ

WÀlPÀ 2 - ¨sÁgÀwÃAiÀÄ PÁªÀå«ÄÃªÀiÁA¸ÉAiÀÄ ¥ÀæªÀÄÄR ¥Àæ¸ÁÜ£ÀUÀ¼ÀÄ

C) C®APÁgÀ ¥Àæ¸ÁÜ£À : ¨sÁªÀÄºÀ£À£ÀÄß ªÀÄÄRåªÁVlÄÖPÉÆAqÀÄ C®APÁgÀ ¥Àæ¸ÁÜ£ÀzÀ ¸ÁªÀiÁ£Åå ¸À«ÄÃPÉë

±À¨ÁÝ®APÁgÀUÀ¼ÀÄ : C£ÀÄ¥Áæ¸À, AiÀÄªÀÄPÀ

CxÁð®APÁgÀUÀ¼ÀÄ : 1. G¥ÀªÉÄ 2. ¢Ã¥ÀPÀ 3. gÀÆ¥ÀPÀ 4. zÀÈµÁÖAvÀ

5. GvÉàçÃPÉë 6. CxÁðAvÀgÀ£Áå¸À 7. ±ÉèÃµÉ

8. Cw±ÀAiÉÆÃQÛ 9. ¸Àé¨sÁªÉÇÃQÛ

D) jÃw (±ÉÊ°) ¥Àæ¸ÁÜ£À : ªÁªÀÄ£À£ÀÄß ªÀÄÄRåªÁVlÄÖPÉÆAqÀÄ jÃw ¥Àæ¸ÁÜ£ÀzÀ ¸ÁªÀiÁ£Åå ¸À«ÄÃPÉë

WÀlPÀ : 3

C) zsÀé¤¥Àæ¸ÁÜ£À : ±À§Ý, CxÀð, ªÁZÁåxÀð – C©üZÁªÀÈwÛ, ®PÁëxÀð - ®PÀëuÁªÀÈwÛ,

ªÀåAUÁåxÀð – ªÀåAd£ÁªÀÈwÛ; D£ÀAzÀªÀzsÀð£À£À£ÀÄß ªÀÄÄRåªÁVlÄÖPÉÆAqÀÄ zsÀé¤AiÀÄ ¸ÁªÀiÁ£Åå

¸ÀégÀÆ¥ÀzÀ ¥ÀjZÀAiÀÄ, zsÀé¤ ¥Àæ¨sÉÃzÀUÀ¼ÀÄ: ªÀ¸ÀÄÛzsÀé¤, C®APÁgÀ zsÀé¤, gÀ¸ÀzsÀé¤

D) gÀ¸À¥Àæ¸ÁÜ£À : ¨sÁªÀ, ¸ÁÜ¬ÄÃ¨sÁªÀ, «¨sÁªÀ, C£ÀÄ¨sÁªÀ, ¸ÀAZÁj ¨sÁªÀUÀ¼ÀÄ. C£ÀÄPÁAiÀÄÄð,

C£ÀÄPÀvÀð ªÀÄvÀÄÛ ¸ÁªÀiÁfPÀgÀÄ, ¨sÀgÀvÀ£À gÀ¸À¸ÀÆvÀæ, ¨sÀlÖ¯ÉÆ®èl, (GvÀàwÛªÁzÀ) ²æÃ±ÀAPÀÄPÀ

(C£ÀÄ«ÄwªÁzÀ) ¨sÀlÖ£ÁAiÀÄPÀ (¨sÀÄQÛªÁzÀ) ªÀÄvÀÄÛ C©ü£ÀªÀUÀÄ¥ÀÛ (ªÀåQÛªÁzÀ) PÁªÀåzÀ DvÀäªÁV

gÀ¸À, gÀ¸À ¥Àæ¨sÉÃzÀUÀ¼ÀÄ

E) ªÀPÉÆæÃQÛ ªÀÄvÀÄÛ OavÀå ¥Àæ¸ÁÜ£ÀUÀ¼À ¸ÁªÀiÁ£Åå ¥ÀjZÀAiÀÄ

¥ÀÆgÀPÀ ¥ÀoÀå : «ÄÃªÀiÁA¸ÉAiÀÄ ¸ÀAUÁw

WÀlPÀ : 4 ªÀiÁzÀj CzsÀåAiÀÄ£À (DAiÀÄÝ ¨sÁUÀUÀ¼ÀÄ)

C) C®APÁgÀ PÁªÀå 1. PÀªÀÄ®zÀ¼À £ÀAiÀÄ£À : ®Qëöä㱣À eÉÊ«Ä¤¨sÁgÀvÀ

2. PÀuÉÆÚÃl ²ªÀ£À PÉÊAiÀÄ®UÀÄ : d£À¥ÀzÀ

3. ¨É¼ÀUÀÄ : ¨ÉÃAzÉæ °ÁUÀÆ E¤ßvÀgÀ PÀ«UÀ¼À DAiÀÄÝ PÀ«vÉUÀ¼ÀÄ

D) zsÀé¤PÁªÀå 1. ¸ÀÆ¼ÀàqÉAiÀÄ®¥ÀÄàzÀÄ PÁuÁ ªÀÄ°ÁfgÀAUÀzÉÆ¼ï: ¥ÀA¥À¨sÁgÀvÀ

2. ¸ÀÄwÛ ¸ÀÄwÛ §gÀÄwAiÀiÁ AiÀiÁvÀPÁÌV : vÀªÀgÀ §tÚ : d£À¥ÀzÀ

3. PÀ°Ì : PÀÄªÉA¥ÀÄ °ÁUÀÆ E¤ßvÀgÀ PÀ«UÀ¼À DAiÀÄÝ PÀ«vÉUÀ¼ÀÄ

WÀlPÀ : 5 ªÀiÁzÀj CzsÀåAiÀÄ£À (DAiÀÄÝ ¨sÁUÀUÀ¼ÀÄ)

C) gÀ¸À PÁªÀå: 1, ¤ÃgÉÆ¼ÀVzÀÄð ¨ÉªÀÄvÀð£ï GgÀUÀ¥ÀvÁPÀ£ï : gÀ£Àß£À UÀzÁAiÀÄÄzÀÞ

2. §qÀªÀjUÉ ¸ÁªÀ PÉÆqÀ¨ÉÃqÀ – d£À¥ÀzÀ

3. AiÀÄzÀÄVjAiÀÄ ªÀiË£À«PÁ¸À : ¥ÀÄw£À ªÀÄvÀÄÛ E¤ßvÀgÀ PÀ«UÀ¼À DAiÀÄÝ PÀ«vÉUÀ¼ÀÄ

D) OavÀå PÁªÀå : 1. zÀ±Á¸Àå¤ÃQë¹zÀA : £ÁUÀZÀAzÀæ£À gÁªÀÄZÀAzÀæ ZÀjvÀ ¥ÀÄgÁtA

2. £ÀgÀ¸ÀgÀ dÄAdÄºÉÆ¼ÉAiÀÄ° ºÁgÀÄªÀ£ÉÃ eÁ°Àß«ÃzsÀgÀ : PÀÄªÀiÁgÀªÁå¸À

3. ¸Á«gÀ PÉÆ½î M¯ÉAiÀiÁUÀ : d£À¥ÀzÀ

4. CªÀÄä DZÁgÀ ªÀÄvÀÄÛ £Á£ÀÄ PÉ. J¸ï. ¤¸Ágï °ÁUÀÆ EvÀgÀ PÀ«UÀ¼À DAiÀÄÝ PÀ«vÉUÀ¼ÀÄ

WÀlPÀ – 6 ªÀÄvÀÄÛ WÀlPÀ 7 : ¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉUÀ¼ÀÄ (lÄåmÉÆÃjAiÀÄ¯ï)

- PÉ®ªÀÅ C®APÁgÀUÀ¼À£ÀÄß §¼À¹ ¥ÀzÀå gÀZÀ£É ªÀiÁr¸ÀÄªÀÅzÀÄ.
- ¨sÁgÀwÃAiÀÄ C®APÁjPÀgÀ eÉÆvÉUÉ PÀ£ÀßqÀ «ÄÃªÀiÁA¸ÉAiÀÄ C®APÁjPÀgÀ£ÀÄß UÀÄgÀÄw¸À®Ä ¸ÀÆa¸ÀÄªÀÅzÀÄ
- PÉ®ªÀÅ ¥ÀæªÀÄÄR PÀ«vÉUÀ¼À¤ßlÄÖPÉÆAqÀÄ zsÀé¤, gÀ¸À, jÃwUÀ¼À£ÀÄß UÀÄgÀÄw¸ÀÄªÀÅªÀÅzÀÄ
- PÁªÀåzÀ ZÀZÉðUÉ CªÀPÁ±À PÀ°à¹PÉÆqÀÄªÀÅzÀÄ
- PÁªÀåªÀ£ÀÄß gÀ¸ÀPÉÌ C£ÀÄUÀÄtªÁV N¢¸ÀÄªÀÅzÀÄ
- PÁªÀå«ÄÃªÀiÁA¸ÉAiÀÄ ¥ÀjPÀ®à£ÉUÀ¼À »£Éß¯ÉAiÀÄ°è «zÁåyðUÀ¼À°è PÀ«vÉ, UÀzÀå, PÀxÉ, ¥Àæ§AzsÀ EvÁå¢ ¸Á»vÀå ¥ÀæPÁgÀUÀ¼À gÀZÀ£ÉUÉ ¥ÉæÃgÉÃ¦¸ÀÄªÀÅzÀÄ.

¥ÀgÁªÀÄ±Àð£À UÀæAxÀUÀ¼ÀÄ

1. ¨sÁgÀwÃAiÀÄ PÁªÀå«ÄÃªÀiÁA¸É : wÃ.£ÀA.²æÃ
2. PÀ£ÀßqÀ PÉÊ¦r (¸ÀA 1 ªÀÄvÀÄÛ 2 : ªÉÄÊ¸ÀÆgÀÄ «.«
3. C®APÁgÀ ±Á¸ÀÛç : ©.PÉ ²ªÀgÁªÀÄAiÀÄå
4. vË®¤PÀ PÁªÀå«ÄÃªÀiÁA¸É : JZï. w¥ÉàÃgÀÄzÀæ¸Áé«Ä
5. PÁªÁåxÀð ¥ÀzÀPÉÆÃ±À : f.J¸ï. ²ªÀgÀÄzÀæ¥Àà ªÀÄvÀÄÛ PÉ. «., £ÁgÁAiÀÄt

6. PÁªÁåxÀð aAvÀ£À ; f. J¸ï. ²ªÀgÀÄzÀæ¥Àà
7. ¨sÁgÀwÃAiÀÄ PÁªÀå±Á¸ÀÛç ¥Àj¨sÁµÉ : ªÀÄ¯ÉèÃ¥ÀÄgÀA f. ªÉAPÀmÉÃ±À
8. PÁªÀå¥ÀjPÀgÀUÀ¼ÀÄ : qÁ. J£ï. JA. VjeÁ¥Àw

£Á®Ì£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À
LaÒPÀ PÀ£ÀßqÀ
r.J¸ï.¹ - ¥ÀwæPÉ -4(DSC)
Course Code: ELD 25023 ELD25026

bÀAzÀ¸ÀÄì ªÀÄvÀÄÛ ¥ÀÆgÀPÀ ¥ÀoÀå

WÀlPÀ 1 :

C) bÀAzÀ¸ÀÄì - ¸ÁªÀiÁ£Àå ¸ÀégÀÆ¥À, CzsÀåAiÀÄ£À CUÀvÀå, UÀÄgÀÄ, ®WÀÄ ªÀiÁvÉæUÀ¼À ¸ÀégÀÆ¥À,

D) ¥Áæ¸ÀzÀ ¸ÀégÀÆ¥À, «zsÀUÀ¼ÀÄ, D¢ ¥Áæ¸À (¹A°À, UÀd, ªÀÈµÀ¨sÀ, ±ÀgÀ¨sÀ, Cd, °ÀAiÀÄ) CAvÀå¥Áæ¸À, AiÀÄw – EªÀÅUÀ¼À ¥ÀjZÀAiÀÄ

E) ªÀtðªÀÈvÀÛUÀ¼ÀÄ – SÁåvÀ PÀuÁðlPÀUÀ¼ÀÄ : ZÀA¥ÀPÀ, GvÀà®, ªÀÄvÉÛÃ¨sÀ, ±ÁzÀÆð®, ¸ÀæUÀÞgÁ, ªÀÄ°Á¸ÀæUÀÞgÁ ªÀÈvÀÛUÀ¼ÀÄ

WÀlPÀ 2 :

C) ªÀiÁvÁæªÀÈvÀÛUÀ¼ÀÄ : PÀAzÀ, gÀUÀ¼É, GvÁì°À, ªÀÄAzÁ¤®, ®°vÀ gÀUÀ¼ÉUÀ¼ÀÄ, wæ¥À¢ ªÀÄvÀÄÛ

µÀlà¢AiÀÄ ¥ÀjZÀAiÀÄzÉÆqÀ£É ±ÀgÀ, PÀÄ¸ÀÄªÀÄ, ¨sÉÆÃUÀ, ¨sÁ«Ä¤, ¥ÀjªÀ¢üð¤, ªÁzsÀðPÀ ªÀÄvÀÄÛ

GzÀÞAqÀ F ªÀiÁvÁæ µÀlà¢UÀ¼À ¥ÀjZÀAiÀÄ EªÀÅUÀ¼À ®PÀët ªÀÄvÀÄÛ ¸ÀAQë¥ÀÛ Ew°Á¸À

D) CA±ÀªÀÈvÀÛUÀ¼ÀÄ ; UÀtUÀ¼ÀÄ, §æ°Àä, «µÀÄÚ, gÀÄzÀæ, DAiÀiÁ UÀtUÀ½UÉ ¥Àæ¸ÁÛgÀ °ÁPÀÄªÀ «zsÁ£À,

wæ¥À¢, ¦jAiÀÄPÀÌgÀ, µÀlà¢ ªÀÄvÀÄÛ ¸ÁAUÀvÀå – EªÀÅUÀ¼À ®PÀëößt ªÀÄvÀÄÛ ¸ÀAQë¥ÀÛ Ew°Á¸À

WÀlPÀ : 3

C) °ÉÆ¸ÀUÀ£ÀßqÀ bÀAzÀ¸ÀÄì : UÀtUÀ¼ÀÄ ªÀÄvÀÄÛ «©ü£Àß ®AiÀÄUÀ¼ÀÆ - ¥ÀÄèvÀ, PÀA¦vÀ,

ªÀiË£À, UÀt¥ÀjªÀÈwÛ, C£ÁUÀvÀ, ªÀÄÄr, ¥ÀzÀäUÀt, «µÀªÀÄUÀt EªÀÅUÀ¼À ¸ÀAQë¥ÀÛ ¥ÀjZÀAiÀÄ.

E) °ÉÆ¸ÀUÀ£ÀßqÀ bÀAzÀ¹ì£À ¸ÀégÀÆ¥ÀUÀ¼ÀÄ : ¸ÀÄ¤ÃvÀ, ¸ÀgÀ¼À gÀUÀ¼É, ¥ÀæUÁxÀ, ªÀÄÄPÀÛbÀAzÀ¸ÀÄì

WÀlPÀ : 4

¥ÀÆgÀPÀ ¥ÀoÀå : bÀAzÉÆÃ ¸ÀAUÁw

WÀlPÀ : 4 ªÀiÁzÀj CzsÀåAiÀÄ£À (DAiÀÄÝ ¨sÁUÀUÀ¼ÀÄ)

PÁªÀå¨sÁUÀUÀ¼ÀÄ:

1. SÁåvÀ PÀuÁðlPÀUÀ¼ÀÄ (PÁªÀå¢AzÀ DAiÀÄÝ¥ÀzÀåUÀ¼ÀÄ)
2. PÀAzÀ, gÀUÀ¼É ªÀÄvÀÄÛ µÀlà¢ (PÁªÀå¢AzÀ DAiÀÄÝ¥ÀzÀåUÀ¼ÀÄ)
3. wæ¥À¢ ªÀÄvÀÄÛ ¸ÁAUÀvÀå (PÁªÀå¢AzÀ DAiÀÄÝ¥ÀzÀåUÀ¼ÀÄ)
4. °ÉÆ¸ÀUÀ£ÀßqÀ bÀAzÀ¸ÀÄì (PÁªÀå¢AzÀ DAiÀÄÝ¥ÀzÀåUÀ¼ÀÄ)

WÀlPÀ : 5 ªÀiÁzÀj CzsÀåAiÀÄ£À (DAiÀÄÝ ¨sÁUÀUÀ¼ÀÄ)

¯ÉÃR£ÀUÀ¼ÀÄ

1. r.J¸ï. PÀQðAiÀÄªÀgÀ PÀ£ÀßqÀ bÀAzÉÆÃ«PÁ¸À PÀÈw¬ÄAzÀ DAiÀÄÝ ¨sÁUÀ
2. wÃ.£ÀA.²æÃ CªÀgÀ ¸ÀªÀiÁ¯ÉÆÃPÀ£À PÀÈw¬ÄAzÀ DAiÀÄÝ¨sÁUÀ
3. n.«.ªÉAPÀmÁZÀ® ±Á¹Ûç CªÀgÀ PÀ£ÀßqÀ bÀAzÀB¸ÀégÀÆ¥À PÀÈw¬ÄAzÀ DAiÀÄÝ¨sÁUÀ
4. ¸Á.² ªÀÄgÀÄ¼ÀAiÀÄå£ÀªÀgÀ ªÀgÀ¸ÉUÀ¼ÀÄ PÀÈw¬ÄAzÀ DAiÀÄÝ¨sÁUÀ

WÀlPÀ – 6 ªÀÄvÀÄÛ WÀlPÀ 7 : ¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉUÀ¼ÀÄ (lÄåmÉÆÃjAiÀÄ¯ï)

- °À¼ÀUÀ£ÀßqÀ ¥ÀzÀåUÀ½UÉ ¥Àæ¸ÁÛgÀ °ÁQ bÀAzÉÆÃ¥ÀæPÁgÀªÀ£ÀÄß UÀÄgÀÄw¸ÀÄªÀÅzÀÄ.
- ¥ÀzÀåUÀ¼À£ÀÄß ©r¹N¢¸ÀÄªÀÅzÀÄ
- vÁ¼À ®AiÀÄ UÀwUÀ¼À£ÀÄß C£ÀÄ¸Àj¹ PÀ«vÉUÀ¼À£ÀÄß gÁUÀ§zÀÞªÁV °ÁqÀÄªÀAvÉ ¥ÉæÃgÉÃ¦¸ÀÄªÀÅzÀÄ.
- °À¼ÀUÀ£ÀßqÀ bÀAzÀ¹ìUÉ C£ÀéAiÀÄ ¥ÀzÀå gÀZÀ£É ªÀiÁqÀÄªÀÅzÀÄ
- ºÉÆ¸ÀUÀ£ÀßqÀ bÀAzÀ¸Àì£ÀÄß C£Àé¬Ä¹ ¥ÀzÀå gÀZÀ£É

¥ÀgÁªÀÄ±Àð£À UÀæAxÀUÀ¼ÀÄ

1. PÀ£ÀßqÀ bÀAzÉÆÃ«PÁ¸À : r. J¸ï. PÀQð
2. ¸ÀªÀiÁ¯ÉÆÃPÀ£À : wÃ.£ÀA.²æÃ
3. PÀ£ÀßqÀ bÀAzÀ¹ì£À ZÀjvÉæ ¨sÁUÀ 1 ªÀÄvÀÄÛ 2 : ¸ÀA ¹.¦.PÉ
4. PÀ£ÀßqÀ bÀAzÀB¸ÀégÀÆ¥À ªÉAPÀmÁZÀ®±Á¹Ûç : n. «.
5. bÀAzÉÆÃ«ÄvÀæ : C.gÁ,«ÄvÀæ
6. PÀ£ÀßqÀ bÀAzÉÆÃzÀ¥Àðt VjeÁ¥Àw : qÁ. J£ï. JA.
7. PÀ£ÀßqÀ bÀAzÀB¸ÀìA¥ÀzÀ VjeÁ¥Àw : qÁ. J£ï. JA.
8. PÀ£ÀßqÀ bÀAzÀ¹ì£À ¨É¼ÀªÀtÂUÉ ªÀÄvÀÄÛ Ewº¸À JA. VjeÁ¥Àw : qÁ. J£ï.

LzÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À
(DAiÉÄÌ ªÀiÁzÀj ²¸ÀÄÛ r.J¸ï.E CzsÀåAiÀÄ£À)
LaÒPÀ PÀ£ÀßqÀ
r.J¸ï.E - ¥ÀwæPÉ -5.1(DSE)
Course code : ELE25023 ELE25026

¸Á»vÀå «ªÀÄ±Éð ªÀÄvÀÄÛ ¥ÀÆgÀPÀ ¥ÀoÀå

WÀlPÀ 1

C) ¸Á»vÀå «ªÀÄ±ÉðAiÀÄ ¸ÀégÀÆ¥À ªÀÄvÀÄÛ ®PÀëtUÀ¼ÀÄ

D) ¸Á»vÀå «ªÀÄ±Éð ¨É¼ÉzÀÄ §AzÀ zÁj, ¥ÉèÃmÉÆÃ, Cj¸ÁÖl¯ï, ºÉÆgÉ¸ï, ¯ÁAeÉÊ£À¸ï, PÉÆÃ®jeï,

L.J. jZÀqïîð, n. J¸ï. E°AiÀÄmï EªÀgÀ ¥ÀæªÀÄÄR ¹zÁÞAvÀUÀ¼À£ÀÄß ¥ÀjZÀ¬Ä¸ÀÄªÀÅzÀÄ.

WÀlPÀ 2 – DzsÀĤPÀ «ªÀÄ±Áð ¥Àæ¸ÁÜ£ÀUÀ¼À ¸ÀÆÜ® ¥ÀjZÀAiÀÄ

PÀvÀÈð¤µÀ× «ªÀÄ±Éð, PÀÈw¤µÀ×, ªÀÄ£ÉÆÃªÉÊeÁÕ¤PÀ, ZÁjwæPÀ, ªÀiÁPïðªÁ¢ ªÀÄvÀÄÛ ¹ÛçÃ ¤µÀ× «ªÀÄ±Éð

WÀlPÀ : 3
PÀ£ÀßqÀ ¸Á»vÀå «ªÀÄ±Éð

C) £ÀªÉÇÃzÀAiÀÄ «ªÀÄ±Éð ¸ÀégÀÆ¥À, ®PÀët, ¤®ÄªÀÅUÀ¼ÀÄ - ¥ÀæªÀÄÄR «ªÀÄ±ÀðPÀgÀ£ÀÄß C£ÀÄ®Që¹

D) £ÀªÀå «ªÀÄ±Éð - ¥Àæ¨sÁªÀ, ¥ÉæÃgÀuÉ, zÀÈ¶ÖPÉÆÃ£À ¥ÀæªÀÄÄR «ªÀÄ±ÀðPÀgÀ£ÀÄß C£ÀÄ®Që¹

E) zÀ°vÀ, §AqÁAiÀÄ «ªÀÄ±Éð - ¸ÉÊzÁÞAwPÀ ¤®ÄªÀÅUÀ¼ÀÄ ¥ÀæªÀÄÄR «ªÀÄ±ÀðPÀgÀ£ÀÄß C£ÀÄ®Që¹

F) ¹ÛçÃªÁ¢ «ªÀÄ±Éð - ¥Àæ¨sÁªÀ, ¥ÉæÃgÀuÉ, D±ÀAiÀÄUÀ¼ÀÄ ¥ÀæªÀÄÄR «ªÀÄ±ÀðPÀgÀ£ÀÄß C£ÀÄ®Që¹

G) ¸ÁA¸ÀÌøwPÀ «ªÀÄ±Éð ©ü£Àß £É¯ÉUÀ¼ÀÄ ¥ÀæªÀÄÄR «ªÀÄ±ÀðPÀgÀ£ÀÄß C£ÀÄ®Që¹

WÀlPÀ : 4

¥ÀÆgÀPÀ ¥ÀoÀå : «ªÀÄ±Áð ¸ÀAUÁw

C) «ªÀi±Áð ªÀiÁzÀj CzsÀåAiÀÄ£À

1. ¸ÀgÉÆÃªÀgÀzÀ ¹jUÀ£ÀßrAiÀÄ°è – PÀÄªÉA¥ÀÄ
2. ¥ÀæeÉÕ ªÀÄvÀÄÛ ¥Àj¸ÀgÀ MAzÀÄ n¥ÀàtÂ – AiÀÄÄ.Dgï. C£ÀAvÀªÀÄÆwð
3. ¸Á»vÁå©üªÀåQÛAiÀÄ°è ¸ÁªÀiÁ£Åå ªÀÄ£ÀÄµÀå - ¹zÀÝ°AUÀAiÀÄå
4. PÀ£ÀßqÀ ¸Á»vÅå MAzÀÄ ¹ÛçÃ¥ÀgÀzÀÈ¶Ö : ©.J£ï. ¸ÀÄ«ÄvÁæ¨Á¬Ä

WÀlPÀ : 5

D) «ªÀÄ±ÉðAiÀÄ C¨sÁå¸ÀPÁÌV DAiÀÄÝ ¥ÀoÀå ¨sÁUÀUÀ¼ÀÄ

1. ¥ÀzÀå¨sÁUÀUÀ¼ÀÄ

UÉÆ§âgÀ : PÀÄªÉA¥ÀÄ

CªÀé : ¦. ®APÉÃ±ï

ªÀiÁA¸ÀzÀAUÀrAiÀÄ £À«®Ä : J£ï.PÉ. °À£ÀÄªÀÄAvÀAiÀÄå

zÉÃ« ªÀÄºÁvÉä : ®°vÀ ¹zÀÝ§¸ÀªÀAiÀÄå

2.PÀvÉUÀ¼ÀÄ

¸ÉgÉ : AiÀÄ±ÀªÀAvÀ avÁÛ®

zÉÃªÀgÀ zÁj : ªÉÆUÀ½î UÀuÉÃ±À

WÀlPÀ – 6 ªÀÄvÀÄÛ WÀlPÀ 7 : ¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉUÀ¼ÀÄ (lÄåmÉÆÃjAiÀÄ¯ï)

- «ªÀÄ±ÉðAiÀÄ £É¯ÉUÀ¼À£ÀÄß UÀªÀÄ¤¸ÀÄªÀÅzÀÄ ªÀÄvÀÄÛ ¥ÁæAiÉÆÃVPÀ «ªÀÄ±Éð ªÀiÁqÀÄªÀÅzÀÄ
- ¥ÀÆgÀPÀ «ªÀÄ±ÉðAiÀÄ ¯ÉÃR£ÀUÀ¼À ¸ÀAUÀæºÀ
- «ªÀÄ±ÀðPÀgÀ£ÀÄß ¸ÀAzÀ²ð¸ÀÄªÀÅzÀÄ, ¸ÀAªÁzÀ £ÀqÉ¸ÀÄªÀÅzÀÄ
- «zÁåyðUÀ¼ÀÄ ¸ÀévÀB «ªÀÄ±Éð §gÉAiÀÄÄªÀAvÉ ¥ÉÆæÃvÁì»¸ÀÄªÀÅzÀÄ.
- PÀ£ÀßqÀzÀ ¥ÀæªÀÄÄR «ªÀÄ±ÀðPÀgÀ£ÀÄß, ¥Á±ÁÑvÀå «ªÀÄ±ÀðPÀgÀ£ÀÄß UÀÄgÀÄw¸ÀÄªÀÅzÀÄ ªÀÄvÀÄÛ «ªÀgÀUÀ¼À£ÀÄß ¸ÀAUÀæ»¸ÀÄªÀÅzÀÄ.

- «zÁåyðUÀ½AzÀ «ªÀÄ±Éð PÀÄjvÀÄ ¥Àæ§AzsÀUÀ¼À£ÀÄß ¹zÀÞ¥Àr¸ÀÄªÀÅzÀÄ CzÀ£ÀÄß ªÀÄAr¸À®Ä GvÉÛÃf¸ÀÄªÀÅzÀÄ.

¥ÀgÁªÀÄ±Àð£À UÀæAxÀUÀ¼ÀÄ

1. vË®¤PÀ PÁªÀå«ÄÃªÀiÁA¸É : JZï. w¥ÉàÃgÀÄzÀæ¸Áé«Ä
2. ¥Á±ÁÑvÀå PÁªÀå«ÄÃªÀiÁA¸É : E£ÁAzÁgï. «,JA
3. «ªÀÄ±ÉðAiÀÄ ¥Àj¨sÁµÉ : N.J¯ï. £ÁUÀ¨sÀÆµÀt¸Áé«Ä
4. ¦æ¤î¥À¯ îì D¥sï °lgÀj Qæn¹dA : L. J. jZÀqïð
5. ¢ ¥sÀAPÀë£ï D¥sï Qæn¹dA : n. J¸ï. E°AiÀÄmï
6. Cj¸ÁÖl®£À PÁªÀå«ÄÃªÀiÁA¸É : J£ï. ¨Á®¸ÀÄ§æºÀätå
7. ¥Á±ÁÑvÀå «ªÀÄ±ÉðAiÀÄ ¥ÀQë£ÉÆÃl : ¸ÀA. f. ±ÀAPÀgÀAiÀÄå
8. ¸ÁA¸ÀÌøwPÀ CzsÀåAiÀÄ£À : gÀºÀªÀÄvï vÀjPÉgÉ
9. ¸Á»vÀå «ªÀÄ±Éð : ¹.J£ï. gÁªÀÄZÀAzÀæ£ï
10. ªÀZÀ£À «£Áå¸À : VgÀrØ UÉÆÃ«AzÀgÁeï

LzÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À
LaÒPÀ PÀ£ÀßqÀ
r.J¸ï.E - ¥ÀwæPÉ -5.2(DSE)
Course code : ELE25223 ELE25226

«±ÉÃµÀ PÀ« PÁªÀå CzsÀåAiÀÄ£À ªÀÄvÀÄÛ ¥ÀÆgÀPÀ ¥ÀoÀå
«±ÉÃµÀ PÀ« : PÀÄªÉA¥ÀÄ

WÀlPÀ 1 : PÀ«PÁªÀå »£Éß¯É : ¸ÀÆÜ® ¥ÀjZÀAiÀÄ

C) PÁ®, ¸ÀAzÀ¨sÀð ªÀÄvÀÄÛ ¥ÉæÃgÀuÉ ¥Àæ¨sÁªÀUÀ¼ÀÄ
D) PÀ«AiÀÄ fÃªÀ£À ªÀÄvÀÄÛ ¸Á»vÀåPÀ ¸ÁzsÀ£ÉUÀ¼ÀÄ
E) ¸Á»vÀå gÀZÀ£ÉAiÀÄ ¸ÀégÀÆ¥À ªÀÄvÀÄÛ ®PÀëtUÀ¼ÀÄ
F) ¸ÀªÀÄPÁ°Ã£À ¸ÀàAzÀ£À ªÀÄvÀÄÛ ZÁjwæPÀ ªÀÄºÀvÀé

WÀlPÀ 2 – ¥ÀzÀå £ÁlPÀ (DAiÀÄÝ ¨sÁUÀUÀ¼ÀÄ)

C) ¥ÀæeÁ¥Àæ¨sÀÄvÀé vÀvÀé : CvÀÛ¯ Á zÉÊvÀå ¸À¨sÉAiÉÆÃ¼ï (ªÀÄºÁPÁªÀå)
D) ¹ÛçÃ ¸ÀAªÉÃzÀ£É : £ÁV (PÀxÀ£À PÀªÀ£À)
E) fÃªÀ¥Àj¸ÀgÀzÀ ¥ÀæeÉÕ : ¨sÁªÀVÃvÉUÀ¼ÀÄ
F) ¸ÀªÉÇÃðzÀAiÀÄ : d®UÁgÀ (£ÁlPÀ)

WÀlPÀ : 3 – UÀzÀå PÀxÀ£À (DAiÀÄÝ ¨sÁUÀUÀ¼ÀÄ)

C) vÀ¼À ¯ÉÆÃPÀzÀ £ÁAiÀÄPÀvÀé : ªÀÄ¯ÉUÀ¼À°è ªÀÄzÀÄªÀÄUÀ¼ÀÄ (PÁzÀA§j)

D) C£ÀßzÁvÀ£À ¸ÀªÀÄ¸Éå : zsÀ£ÀéAvÀj aQvÉì (PÀxÉ)

E) ªÉÊZÁjPÀvÉ : «ZÁgÀPÁæAwUÉ DºÁé£À (aAvÀ£É)

F) £ÁqÀÄ £ÀÄr «ZÁgÀ : ¨Áj¸ÀÄ PÀ£ÀßqÀ rArªÀÄ (¯ÉÃR£À)

WÀlPÀ : 4

¥ÀÆgÀPÀ ¥ÀoÀå : PÀÄªÉA¥ÀÄ ¸Á»vÀå ¸ÀAUÁw

DvÀäPÀxÀ£ÁvÀäPÀ §gÀºÀUÀ¼ÀÄ: ªÀiÁzÀj CzsÀåAiÀÄ£À (DAiÀÄÝ ¨sÁUÀUÀ¼ÀÄ)

C. CtÚ£À £É£À¥ÀÄ : PÉ. ¦. ¥ÀÆtðZÀAzÀæ vÉÃd¹é

D. ªÀÄUÀ¼ÀÄ PÀAqÀ PÀÄªÉA¥ÀÄ : vÁjtÂ azÁ£ÀAzÀ

E. PÀÄªÉA¥ÀÄUÉ ¥ÀÄlÖ PÀ£Àßr : PÉ.«. ¸ÀÄ§âtÚ

F. PÀÄªÉA¥ÀÄ CªÀgÀ PÉÆ£ÉAiÀÄ ¢£ÀUÀ¼ÀÄ : zÉÃdUË

WÀlPÀ : 5

¸Á»vÀå CªÀ¯ÉÆÃPÀ£À §gÀºÀUÀ¼ÀÄ : ªÀiÁzÀj CzsÀåAiÀÄ£À (DAiÀÄÝ ¨sÁUÀUÀ¼ÀÄ)

C) PÀÄªÉA¥ÀÄ PÀÈw ¥ÀæªÉÃ±À : ¸ÀÄd£Á

D) PÀÄªÉA¥ÀÄ PÁªÀå«ÄÃªÀiÁA¸É : f. J¸ï. ²ªÀgÀÄzÀæ¥Àà

E) PÀÄªÉA¥ÀÄ £ÁlPÀUÀ¼ÀÄ : £ÀgÀºÀ½î ¨Á®¸ÀÄ§æºÀätå

F) PÀÄªÉA¥ÀÄ PÁzÀAzÀjUÀ¼ÀÄ : ©.J£ï. ¸ÀÄ«ÄvÁæ¨Á¬Ä

WÀlPÀ – 6 ªÀÄvÀÄÛ WÀlPÀ 7 : ¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉUÀ¼ÀÄ (lÄåmÉÆÃjAiÀÄ¯ï)

- PÀÄªÉA¥ÀÄ CªÀjUÉ ¸ÀA§A¢ü¹zÀ ªÀiÁ»wUÀ¼À£ÀÄß ¸ÀAUÀæ»¸À®Ä ¸ÀÆa¸ÀÄªÀÅzÀÄ.
- PÀÄªÉA¥ÀÄ CªÀgÀ PÀÈwUÀ¼À£ÀÄß ¸ÀAUÀæ»¸À®Ä ¸ÀÆa¸ÀÄªÀÅzÀÄ.
- PÀÄªÉA¥ÀÄ CªÀgÀ ¨sÁµÀtUÀ¼À DrAiÉÆÃUÀ¼À£ÀÄß PÉÃ½¸ÀÄªÀÅzÀÄ
- PÀÄªÉA¥ÀÄ CªÀjUÉ ¸ÀA§A¢ü¹zÀ «rAiÉÆÃUÀ¼À£ÀÄß ¥ÀæzÀ²ð¸ÀÄªÀÅzÀÄ.
- PÀÄªÉA¥ÀÄ VÃvÉUÀ½UÉ gÁUÀ¸ÀAAiÉÆÃd£É ªÀiÁr¹ °Ár¸ÀÄªÀÅzÀÄ.
- PÀÄªÉA¥ÀÄ £ÁlPÀUÀ¼À£ÀÄß C©ü£À¬Ä¸À®Ä ¥ÉæÃgÉÃ¦¸ÀÄªÀÅzÀÄ.
- PÀÄªÉA¥ÀÄ CªÀgÀ °ÀÄlÆÖjUÉ ¥ÀæªÁ¸À PÀÈUÉÆ¼ÀÄîªÀÅzÀÄ
- PÀÄªÉA¥ÀÄ CªÀgÀ «±ÀéªÀiÁ£ÀªÀ ¸ÀAzÉÃ±ÀªÀ£ÀÄß ¥Àæ¸ÁgÀ ªÀiÁqÀ®Ä ¸À®ºÉ ¤ÃqÀÄªÀÅzÀÄ.

- EvÀgÀ PÀ«UÀ¼ÀÄ PÀAqÀ PÀÄªÉA¥ÀÄ avÀætUÀ¼À£ÀÄß ¸ÀAUÀæ»¸ÀÄªÀÅzÀÄ.

¥ÀgÁªÀÄ±Àð£À UÀæAxÀUÀ¼ÀÄ

1. PÀÄªÉA¥ÀÄ ¥ÀÄ£ÀgÁªÀ¯ÉÆÃPÀ£À : qÁ. f. J¸ï. ²ªÀgÀÄzÀæ¥Àà
2. »ÃVzÀÝgÀÄ PÀÄªÉA¥ÀÄ : qÁ. ¥Àæ¨sÀÄ±ÀAPÀgÀ
3. ¥ÀgÀA¥ÀgÉ ªÀÄvÀÄÛ PÀÄªÉA¥ÀÄ : ¸ÀÄd£Á
4. PÀÄªÉA¥ÀÄ zÀ±Àð£À : zÉÃdUË
5. vÀgÀUÀwAiÀÄ°è PÀÄªÉA¥ÀÄ : ªÀÈµÀ¨sÉÃAzÀæ ¸Áé«Ä
6. M®ªÀÅ - ¤®ªÀÅ : ºÀjºÀgÀ ¦æAiÀÄ
7. PÀÄªÉA¥ÀÄ ¸ÀªÀÄUÀæ ¸Á»vÀå ¸ÀA¥ÀÄlUÀ¼ÀÄ : ¸ÀA : PÉ. ¹. ²ªÁgÉrØ
8. PÀÄªÉA¥ÀÄ PÀÈw «ªÀÄ±Éð : ¸ÀA. CgÀ«AzÀ ªÀiÁ®UÀwÛ
9. C¤PÉÃvÀ£À : ¸ÀA. ¸Á². ªÀÄgÀÄ¼ÀAiÀÄå
10. PÀÄªÉA¥ÀÄ MAzÀÄ ¥ÀÄ£ÀgÀ£ÉéÃµÀuÉ : ¸ÀA. r.J¸ï. £ÁUÀ¨sÀÆµÀt
11. ²æÃ PÀÄªÉA¥ÀÄ ; ¨ÉAUÀ¼ÀÆgÀÄ «±Àé«zÁå®AiÀÄ
12. ªÀÄ¯ÉUÀ¼À°è ªÀÄzÀÄªÀÄUÀ¼ÀÄ ¸ÁA¸ÀÌøwPÀ ªÀÄÄSÁªÀÄÄT _ ¸ÀA: gÀºÀªÀÄvï vÀjPÉgÉ
13. PÀÄªÉA¥ÀÄ PÁzÀA§jUÀ¼À ¸ÁA¸ÀÌøwPÀ CzsÀåAiÀÄ£À : ¸ÀA : UÀÄgÀÄ¥ÁzÀ ªÀÄjUÀÄ¢Ý

PÀ£ÀßqÀzÀ ªÀÄÄRå «ªÀÄ±ÀðPÀgÀ J®è ¥ÀjPÀ®à£ÁvÀäPÀ CzsÀåAiÀÄ£ÀzÀ ¯ÉÃR£ÀUÀ¼ÀÄ

LzÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À
LaÒPÀ PÀ£ÀßqÀ
r.J¸ï.E - ¥ÀwæPÉ -5.3(DSE)
Course code : ELE25423 ELE25426

PÀ£ÀßqÀ £ÁlPÀ ¸Á»vÀå ªÀÄvÀÄÛ ¥ÀÆgÀPÀ ¥ÀoÀå

WÀlPÀ 1 : £ÁlPÀzÀ ¥ÀjPÀ®à£É ªÀÄvÀÄÛ ¥ÀgÀA¥ÀgÉ

C) ¸ÀégÀÆ¥À. ®PÀët

D) £ÁlPÀ ¸Á»vÀå ¨É¼ÉzÀÄ §AzÀ §UÉ

- ¸ÀA¸ÀÌøvÀ £ÁlPÀUÀ¼À ¸ÀAQë¥ÀÛ ZÀjvÉæ
- VæÃPï ªÀivÀÄÛ ¥Á±ÁÑvÀå £ÁlPÀUÀ¼À ¸ÀAQë¥ÀÛ ZÀjvÉæ
- d£À¥ÀzÀ gÀAUÀ¨sÀÆ«ÄAiÀÄ ¸ÀAQë¥ÀÛ ZÀjvÉæ

.

WÀlPÀ 2 – £ÁlPÀ ¸Á»vÀå ¥ÀjZÀAiÀÄ

C) ¸ÀA¸ÀÌøvÀ £ÁlPÀUÀ¼ÀÄ : C±ÀéWÉÆÃµÀ, PÁ½zÁ¸À, ¨sÀlÖ£ÁgÁAiÀÄt

D) ¥Á±ÁÑvÀå £ÁlPÀUÀ¼ÀÄ : ¸ÉÆÃ¥ÉÆÃQë¸ï, F¹Ì®¸ï, AiÀÄÆj¦rÃ¸ï, µÉÃPÀì¦AiÀÄgï

E) d£À¥ÀzÀ gÀAUÀ¨sÀÆ«Ä : ¥ÀUÀgÀt, §AiÀÄ¯Ál AiÀÄPÀëUÁ£À

WÀlPÀ : 3 – PÀ£ÀßqÀ £ÁlPÀ ¸Á»vÀå ZÀjvÉæ

C) ¸ÀA¸ÀÌøvÀzÀ ¥Àæ¨sÁªÀ : §¸ÀªÀ¥Àà ±Á²Ûç (C©üeÁÕ£À ±ÁPÀÄAvÀ®)

D) ¥Á±ÁÑvÀå ¥Àæ¨sÁªÀ : ©.JA.²æÃ (C±ÀévÁÜªÀÄ£ï)

E) d£À¥ÀzÀzÀ ¥Àæ¨sÁªÀ : VjÃ±ï PÁ£Áðqï (£ÁUÀªÀÄAqÀ®)

WÀlPÀ : 4

¥ÀÆgÀPÀ ¥ÀoÀå : £ÁlPÀ ¸ÀAUÁw

ªÀiÁzÀj CzsÀåAiÀÄ£À DAiÀÄÝ ¨sÁUÀUÀ¼ÀÄ

C) ²æÃgÀAUÀgÀ ±ÉÆÃPÀZÀPÀæ

D) ZÀAzÀæ±ÉÃRgÀ PÀA¨ÁgÀ : ¸ÀAUÁå¨Á¼Åå

E) JZï. J¸ï. ªÉAPÀmÉÃ±ï ªÀÄÆwð : GjAiÀÄ GAiÀiÁå¯É

WÀlPÀ : 5

ªÀiÁzÀj CzsÀåAiÀÄ£À (EwÛÃa£À ¥ÀæªÀÈwÛUÀ¼ÀÄ)

KPÁAPÀ, ©Ã¢£ÁlPÀ, gÉÃrAiÉÆÃ (¨Á£ÀÄ°) £ÁlPÀ,

QgÀÄ ¥Àæ°À¸À£À EvÁå¢UÀ¼À ¥ÀjZÀAiÀÄ

WÀlPÀ – 6 ªÀÄvÀÄÛ WÀlPÀ 7 :

¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉUÀ¼ÀÄ (lÄåmÉÆÃjAiÀÄ¯ï)

- £ÁlPÀzÀ C©ü£ÀAiÀÄ ¥ÀÆªÀðPÀ NzÀÄ (¸ÁªÀÄÆ»PÀªÁV ©ü£Àß ¥ÁvÀæUÀ¼À£ÀÄß ¤ªÀð»¸ÀÄ«PÉ).
- £ÁlPÀzÀ ¥ÀjPÀgÀ ¹zÀÞ¥Àr¸ÀÄªÀÅzÀÄ (¨É¼ÀPÀÄ, gÀAUÀ«£Áå¸À EvÁå¢)
- £ÁlPÀ gÀAUÀ¥ÀæzÀ±Àð£À
- QgÀÄ£ÁlPÀ gÀZÀ£ÉUÉ GvÉÛÃd£À
- KPÀ¥ÁvÁæ©ü£ÀAiÀÄPÉÌ ¥ÉÆæÃvÁì°À

¥ÀgÁªÀÄ±Àð£À UÀæAxÀUÀ¼ÀÄ

1. £Ál幱Á¸ÀÛç : ¨sÀgÀvÀ

2. zÀ±ÀgÀÆ¥ÀPÀ : zsÀ£ÀAdAiÀÄ
3. C©ü£ÀAiÀÄ zÀ¥Àðt : £ÀA¢PÉÃ±ÀégÀ
4. ¨sÁgÀwÃAiÀÄ PÁªÀå «ÄÃªÀiÁA¸É : wÃ.£ÀA. ²æÃPÀAoÀAiÀÄå
5. Cj¸ÁÖl¯ï£À PÁªÀå«ÄÃªÀiÁA¸É : J£ï. ¸ÀÄ§æºÀätå
6. jPÀÛ gÀAUÀ¨sÀÆ«Ä : §mÉÆÃð¯ïÖ ¨ÉæPïÖ
7. £Àl£ÉAiÀÄ ¥ÁoÀUÀ¼ÀÄ : ¥Àæ¸À£Àß
8. PÀ£ÀßqÀ gÀAUÀ¨sÀÆ«Ä : ªÀÄgÀÄ¼ÀÄ ¹zÀÞ¥Àà.PÉ
9. gÀAUÀ¥ÀæAiÉÆÃUÀ : PÉ.«.CPÀëgÀ
10. VæÃPï gÀAUÀ¨sÀÆ«Ä ªÀÄvÀÄÛ £ÁlPÀUÀ¼ÀÄ : J¯ï. J¸ï. ±ÉÃµÀVjgÁªï
11. ²PÀëtzÀ°è £ÁlPÀ ªÀÄvÀÄÛ PÀ¯É : qÁ. J£ï. JA. VjeÁ¥Àw

LzÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À
LaÒPÀ PÀ£ÀßqÀ
r.J¸ï.E - ¥ÀwæPÉ -5.4(DSE)
Course code : ELE25623/ELE25626

ªÀÄ»¼Á ¸Á»vÀåzÀ CzsÀåAiÀÄ£À ªÀÄvÀÄÛ ¥ÀÆgÀPÀ ¥ÀoÀå

WÀlPÀ 1 : C) ªÀÄ»¼Á ¸Á»vÀå :

¸ÀégÀÆ¥À. GUÀªÀÄ, «PÁ¸À ªÀÄvÀÄÛ CzsÀåAiÀÄ£ÀzÀ CUÀvÀåvÉ

.

WÀlPÀ 2 – ªÀÄ»¼Á ¸Á»vÀå CzsÀåAiÀÄ£À ««zsÀ ºÀAvÀUÀ¼ÀÄ

C) d£À¥ÀzÀ

D) ªÀZÀ£À ªÀÄvÀÄÛ zÁ¸À¸Á»vÀå

E) MqÉAiÀÄgÀ PÁ®zÀ¸Á»vÀå

WÀlPÀ : 3 – E¥ÀàvÀÛ£ÉAiÀÄ ±ÀvÀªÀiÁ£ÀzÀ ªÀÄ»¼Á ¸Á»vÀå

C) ¸ÁévÀAvÀæöå ¥ÀÆªÀð¸Á»vÀå

D) d£À¦æAiÀÄ ªÀÄ»¼Á¸Á»vÀå

E) ¸ÁévÀAvÉÆæöåÃvÀÛgÀ ªÀÄ»¼Á¸Á»vÀå

F) ¹ÛçÃªÁzÀ - ¥Àæ¨sÁªÀ, ¥ÉæÃgÀuÉUÀ¼ÀÄ

G) §AqÁAiÀÄ, zÀ°vÀ, ªÀÄÄ¹èA ¸ÀAªÉÃzÀ£ÉUÀ¼ÀÄ

H) EwÛÃa£À ¥ÀæªÀÈwÛUÀ¼ÀÄ

IÄ) ¹ÛçÃ C£À£ÀåvÉAiÀÄ °ÀÄqÀÄPÁl

WÀlPÀ : 4

¥ÀÆgÀPÀ ¥ÀoÀå : ªÀÄ»¼Á ¸Á»vÀå ¸ÀAUÁw

ªÀiÁzÀj CzsÀåAiÀÄ£À (DAiÀÄÝ ¨sÁUÀUÀ¼ÀÄ)

DAiÀÄÝ PÀ«vÉUÀ¼ÀÄ

1. ¨É¼ÉUÉgÉ eÁ£ÀPÀªÀÄä2. ¸À. GµÁ 3. J¸ï. ªÀiÁ®w
4. JA.Dgï. PÀªÀÄ® 5. ¸À©ÃºÁ ¨sÀÆ«ÄUËqÀ 6. PÀ«vÁ gÉÊ

WÀlPÀ : 5

ªÀiÁzÀj CzsÀåAiÀÄ£À (DAiÀÄÝ ¨sÁUÀUÀ¼ÀÄ)

DAiÀÄÝ PÀvÉUÀ¼ÀÄ:

1. . «ÃuÁ ±ÁAvÉÃ±ÀégÀ 2. ¨Á£ÀÄªÀÄÄµÁÛPï

DAiÀÄÝ UÀzÀå¨sÁUÀUÀ¼ÀÄ

1. . ªÉÊzÉÃ» 2. ¨sÀÄªÀ£ÉÃ±Àéj ºÉUÀqÉ

DvÀäPÀxÀ£À DAiÀÄÝ ¨sÁUÀUÀ¼ÀÄ

1. E¼Á«dAiÀÄ 2. dAiÀÄ²æÃ

WÀlPÀ – 6 ªÀÄvÀÄÛ WÀlPÀ 7 : ¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉUÀ¼ÀÄ (lÄåmÉÆÃjAiÀÄ¯ï)

- ªÀÄ»¼Á C©üªÀåQÛAiÀÄ «±ÉÃóµÀ UÀÄtUÀ¼À£ÀÄß (¨sÁµÉ, £ÀÄrUÀlÄÖ, ±ÉÊ° EvÁå¢) UÀÄgÀÄgw¸À®Ä ¸ÀÆa¸ÀÄªÀÅzÀÄ.
- ¸ÁzsÀQAiÀÄgÀ ªÀÄvÀÄÛ ¯ÉÃRQAiÀÄgÀ §zÀÄPÀÄ, ¸ÁzsÀ£É PÀÄjvÀÄ «ZÁgÀ UÉÆÃ¶×UÀ¼À£ÀÄß £ÀqÉ¸ÀÄªÀÅzÀÄ.

- ªÀÄ»¼Á PÉÃA¢ævÀ «µÀAiÀÄUÀ¼À §UÉÎ PÀ«vÉ, PÀvÉ §gÉAiÀÄ®Ä GvÉÛÃf¸ÀÄªÀÅzÀÄ
- ªÀÄ»¼Á ¸Á»vÀå ªÀÄvÀÄÛ ªÀÄÄRå ¸Á»vÀåªÀ£ÀÄß vË®¤PÀªÁV CzsÀåAiÀÄ£À ªÀiÁqÀ®Ä GvÉÛÃf¸ÀÄªÀÅzÀÄ.
- «zÁåyðUÀ½UÉ CªÀgÀ ¥Àj¸ÀgÀzÀ°è «±ÉÃµÀªÁV UÀÄgÀÄw¹PÉÆArgÀÄªÀ ªÀÄ»¼ÉAiÀÄgÀ/ ªÀÄ»¼Á ¸ÁzsÀQAiÀÄgÀ §UÉÎ ¥Àæ§AzsÀ §gÉAiÀÄ®Ä ¸ÀÆa¸ÀÄªÀÅzÀÄ.

¥ÀgÁªÀÄ±Àð£À UÀæAxÀUÀ¼ÀÄ

1. PÀ£ÀßqÀ ªÀÄ»¼Á ¸Á»vÀå ZÀjvÉæ : JZï. J¸ï. ²æÃªÀÄw
2. DzsÀÄ¤PÀ ªÀÄ»¼Á ¸Á»vÀå ZÀjvÉæ : ¸ÀA. JA. GµÁ
3. PÀ£ÀßqÀ ¸Á»vÀå ªÀÄvÀÄÛ ¹ÛçÃªÁ¢ aAvÀ£É : ««zsÀ ¯ÉÃRQAiÀÄgÀÄ
4. ZÀºÀgÉ : JZï. J¸ï. ²æÃªÀÄw
5. PÀ£ÀßqÀ ¸Á»vÀå ªÀÄvÀÄÛ ªÀÄ»¼É : ¸À©ºÁ ¨sÀÆ«ÄUËqÀ
6. ¹ÛçÃ ªÁzÀ : ©.J£ï. ¸ÀÄ«ÄvÁæ¨Á¬Ä

LzÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À
LaÒPÀ PÀ£ÀßqÀ
r.J¸ï.E - ¥ÀwæPÉ -5.5(DSE)
Course code : ELE25823/ELE25826
PÀ£ÀßqÀ d£À¥ÀzÀ ¸Á»vÀå CzsÀåAiÀÄ£À

WÀlPÀ 1 :

C) PÀ£ÀßqÀ d£À¥ÀzÀ ¸Á»vÀå CzsÀåAiÀÄ£À ¸ÀégÀÆ¥À

D) PÀ£ÀßqÀ ¸Á»vÀå ªÀÄvÀÄÛ d£À¥ÀzÀzÀ CAvÀgï ¸ÀA§AzsÀUÀ¼ÀÄ

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WÀlPÀ 2 –

C) d£À¥ÀzÀ PÁªÀå : VÃvÉUÀ¼ÀÄ, PÀxÀ£ÀPÀªÀ£À, ¯ÁªÀtÂ, ªÀÄºÁPÁªÀå – EªÀÅUÀ¼À ¸ÀégÀÆ¥À, ®PÀët (ªÀiÁzÀj ¥ÀjZÀAiÀÄzÉÆA¢UÉ)

WÀlPÀ : 3

C) d£À¥ÀzÀ UÀzÀå : UÁzÉ, MUÀlÄ, Lwºå, £ÀÄrUÀlÄÖ – EªÀÅUÀ¼À ¸ÀégÀÆ¥À, ®PÀët

(ªÀiÁzÀj ¥ÀjZÀAiÀÄzÉÆA¢UÉ)

D) d£À¥ÀzÀ PÀxÉ: ¸ÀégÀÆ¥À, ®PÀëtUÀ¼ÀÄ, ªÀVÃðPÀgÀt, d£À¥ÀzÀ PÀxÉUÀ¼À «zsÀUÀ¼ÀÄ –

gÀªÀÄå PÀxÉUÀ¼ÀÄ, «£ÉÆÃzÀ PÀxÉUÀ¼ÀÄ, ¤Ãw PÀvÉUÀ¼ÀÄ

WÀlPÀ : 4

¥ÀÆgÀPÀ ¥ÀoÀå : d£À¥ÀzÀ ¸Á»vÀå ¸ÀAUÁw

ªÀiÁzÀj CzsÀåAiÀÄ£À DAiÀÄÝ ¨sÁUÀUÀ¼ÀÄ

C) d£À¥ÀzÀ PÁªÀå – DAiÀÄÝ d£À¥ÀzÀ VÃvÉ, ¯ÁªÀtÂ, PÀxÀ£À PÀªÀ£ÀUÀ¼À CzsÀåAiÀÄ£À

D) d£À¥ÀzÀ UÀzÀå – UÁzÉ, MUÀlÄ, Lwºå, £ÀÄrUÀlÄÖUÀ¼À CzsÀåAiÀÄ£À

E) d£À¥ÀzÀ ªÀÄºÁPÁªÀå – DAiÀÄÝ ªÀÄºÁPÁªÀåUÀ¼À CzsÀåAiÀÄ£À

WÀlPÀ : 5

¥ÀÆgÀPÀ ¯ÉÃR£ÀUÀ¼ÀÄ

C) d£ÀªÁtÂ ¨ÉÃgÀÄ PÀ«ªÁtÂ ºÀÆªÀÅ - ©.JA.²æÃ

D) d£À¥ÀzÀ ¸Á»vÀå CzÀgÀ ¸ÀégÀÆ¥À - ºÁªÀiÁ £ÁAiÀÄPÀ

E) eÁ£À¥ÀzÀ ªÀÄvÀÄÛ DzsÀÄ¤PÀ ¸Á»vÀå - Q.gÀA. £ÁUÀgÁd

F) PÉ®ªÀÅ HgÀ ºÉ¸ÀgÀÄUÀ¼ÀÄ ªÀÄvÀÄÛ CªÀÅUÀ¼À »£Éß¯É - ºÀ.PÀ. gÁeÉÃUËqÀ

WÀlPÀ – 6 ªÀÄvÀÄÛ WÀlPÀ 7

¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉUÀ¼ÀÄ (lÄåmÉÆÃjAiÀÄ¯ï)

- PÀ£ÀßqÀzÀ°è ¥ÀæPÀlUÉÆArgÀÄªÀ d£À¥ÀzÀ ¸Á»vÀåPÉÌ ¸ÀA§A¢ü¹zÀ ¥ÀÄ¸ÀÛPÀUÀ¼À£ÀÄß ¸ÀAUÀæ»¸À®Ä ¸ÀÆa¸ÀÄªÀÅzÀÄ.
- d£À¥ÀzÀ VÃvÉUÀ¼À£ÀÄß CªÀÅUÀ¼À ªÀÄÆ®ªÀÄlÄÖUÀ¼À°è ºÁqÀ®Ä GvÉÛÃf¸ÀÄªÀÅzÀÄ.
- MUÀlÄUÀ¼À£ÀÄß ºÉÃ½ CªÀÅUÀ¼ÉÆ¼ÀV£À ¤UÀÆqsÀ CxÀðªÀ£ÀÄß UÀæ»¹ w½¸ÀÄªÀ ZÀlÄªÀnPÉAiÀÄ£ÀÄß £ÀqÉ¸ÀÄªÀÅzÀÄ.
- d£À¥ÀzÀ UÁzÉUÀ¼À CxÀðªÀ£ÀÄß «¸ÀÛj¸À®Ä ¸ÀÆa¸ÀÄªÀÅzÀÄ.
- vÀªÀÄä ¥Àj¸ÀgÀzÀ PÀ¯Á«zÀgÀ£ÀÄß ¸ÀAzÀ²ð¹ ¸ÀA§A¢ü¹zÀ ªÀiÁ»wUÀ¼À£ÀÄß zÁR°¸À®Ä w½¸ÀÄªÀÅzÀÄ.

- d£À¥ÀzÀ PÀgÀPÀÄ±À® PÀ¯ ÁPÀÈwUÀ¼À£ÀÄß ¸ÀAUÀæ»¸À®Ä ¸ÀÆa¸ÀÄªÀÅzÀÄ.
- MAzÀÄ ¤¢ðµÀÖ «µÀAiÀiªÀ£ÀÄß ¸ÀÆa¹ CzÀ£ÀÄß PÀÄjvÀÄ UÁæ«ÄÃt ¨sÁµÉAiÀÄ°è ªÀiÁvÀ£ÁqÀ®Ä w½¸ÀÄªÀÅzÀÄ.

¥ÀgÁªÀÄ±Àð£À UÀæAxÀUÀ¼ÀÄ

1. eÁ£À¥ÀzÀ CzsÀåAiÀÄ£À : zÉÃ.d.UË
2. eÁ£À¥ÀzÀ ¸ÀégÀÆ¥À : ºÁ.ªÀiÁ. £ÁAiÀÄPÀ
3. eÁ£À¥ÀzÀ ¥ÀÄgÁtUÀ¼ÀÄ : gÁUË
4. d£À¥ÀzÀ ¥ÀæªÉÃ²PÉ : ¹.¦.PÉ
5. D¢ªÀÄ d£À¥ÀzÀ : ªÉÆUÀ½î UÀuÉÃ±À
6. UÁæªÀÄzÉÃªÀvÉUÀ¼ÀÄ : ¹zÀÝ°AUÀAiÀÄå
7. eÁ£À¥ÀzÀ CzsÀåAiÀÄ£À ¸ÀAQë¥ÀÛ EwºÁ¸À vÀ¥À¹éÃPÀÄªÀiÁgï : £ÀA.
8. zÀQët PÀ£ÁðlPÀzÀ d£À¥ÀzÀ PÁªÀå ¥ÀæPÁgÀUÀ¼ÀÄ : fÃ.±ÀA.¥ÀgÀªÀÄ²ªÀAiÀÄå

DgÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À
LaÒPÀ PÀ£ÀßqÀ
r.J¸ï.E - ¥ÀwæPÉ -6.1(DSE)
Course code : ELF25026 ELF25023

¥ÀoÀå (C) ºÀ¼ÀUÀ£ÀßqÀ ªÁåPÀgÀt - ¥ÀoÀå ªÀÄvÀÄÛ ¥ÀæAiÉÆÃUÀ WÀlPÀ 1 :

C) PÉÃ²gÁd£À PÁ®, zÉÃ±À, ªÀåQÛvÀé, PÀÈw ¥ÀjZÀAiÀÄ, ªÁåPÀgÀt CzsÀåAiÀÄ£ÀzÀ CªÀ±ÀåPÀvÉ

D) ªÀtðªÀiÁ¯É : CPÀÌgÀ, ªÀtð, ±ÀæªÀt, ZÁPÀëÄµÀ, ¸ÀégÀUÀ¼ÀÄ, ªÀåAd£ÀUÀ¼ÀÄ, ªÀVÃðAiÀÄ ªÀåAd£ÀUÀ¼ÀÄ, AiÉÆÃUÀªÁºÀUÀ¼ÀÄ, zÉÃ²ÃAiÀÄ CPÀëgÀUÀ¼ÀÄ, ªÀÄºÁ¥ÁætUÀ¼ÀÄ, ¾¼À, PÀÄ¼À, PÀë¼À «ZÁgÀ, ¥ÀAZÀ«zsÀ ±ÀÄzÀÞUÉUÀ¼ÀÄ, ªÀtðªÀiÁ¯ÉAiÀÄ ªÀtðUÀ¼À ¸ÀASÁå¤tðAiÀÄ **¸ÀÆvÀæUÀ¼ÀÄ:** 1, 2 , 3, 6, 7, 8, 10, 12, 14, 18, 22, 23, 24, 25, 26, 27, 41, 42, 43,- 20 ¸ÀÆvÀæUÀ¼ÀÄ

WÀlPÀ 2

C) ¸ÀA¢üUÀ¼ÀÄ : ¸ÀA¢ü«ZÁgÀ, ¯ÉÆÃ¥À, DUÀªÀÄ, DzÉÃ±À, ¢évÀé ¸ÀA¢üUÀ¼ÀÄ, ¥ÀæPÀÈw ¨sÁªÀ, ±ÀÄæwPÀµÀÖ, ±ÀÄæw ¸À°Åå, ¸ÀA¢ü«PÀ®à **¸ÀÆvÀæUÀ¼ÀÄ:** 53, 55, 56, 57, 58, 59, 60, 62, 63, 65, 66, 73 – 13 ¸ÀÆvÀæUÀ¼ÀÄ

E) **£ÁªÀÄ¥ÀæPÀgÀt** : £ÁªÀÄ¥ÀzÀ – gÀÆqsÀ, C£ÀéxÀð, CAQvÀ, ¸ÀªÀð£ÁªÀÄ ¨sÉÃzÀUÀ¼ÀÄ, ¸ÀªÀÄ¸ÀA¸ÀÌøvÀ °AUÀªÉÆA§vÀÄÛ vÉ¾A, ªÀZÀ£ÀUÀ¼À «ZÁgÀ, ªÀZÀ£À ¥À®èl, «¨sÀQÛ, - ¸À¥ÀÛ«zsÀ «¨sÀQÛUÀ¼ÀÄ ªÀÄvÀÄÛ CªÀÅUÀ¼À §¼ÀPÉ, «¨sÀQÛ ¥À®èl, ¥ÀPÁgÀPÉÌ °ÀPÁgÀ

¸ÀÆvÀæUÀ¼ÀÄ: 75, 76, 77, 81, 85, 86, 87, 88, 89, 100, 103, 106 – 18 ¸ÀÆvÀæUÀ¼ÀÄ

WÀlPÀ : 3

C) **¸ÀªÀiÁ¸À: ¸ÀªÀiÁ¸À ªÀÄvÀÄÛ CzÀgÀ ¨sÉÃzÀUÀ¼ÀÄ**: vÀvÀÄàgÀÄµÀ, ¢éUÀÄ, PÀªÀÄðzsÁgÁAiÀÄ, §ºÀÄ«æÃ», zÀéAzÀé, CªÀå¬ÄÃ¨sÁªÀ (CA²Ã) QæAiÀiÁ, UÀªÀÄPÀ ªÀÄvÀÄÛ Cj¸ÀªÀiÁ¸À

¸ÀÆvÀæUÀ¼ÀÄ: 107, 109, 110, 111, 112, 114 – 06 ¸ÀÆvÀæUÀ¼ÀÄ

F) CSÁåvÀ – zsÁvÀÄ, CSÁåvÀ ¥ÀævÀåAiÀÄUÀ¼ÀÄ, zÀ – zÀ¥À – ªÀ JA§ PÁ®¸ÀÆZÀPÀ ¥ÀævÀåAiÀÄUÀ¼ÀÄ, ¥ÀæwµÉÃzsÀ, ¥ÀÄgÀÄµÀvÀæAiÀÄUÀ¼À°è QæAiÀiÁ¥ÀzÀzÀ gÀZÀ£É, ¥ÀævÀåAiÀÄUÀ¼ÀÄ, PÁ®vÀæAiÀÄUÀ¼À°è QæAiÀiÁ¥ÀzÀUÀ¼À gÀZÀ£É, ¸Àw¸À¥ÀÛ«Ä

¸ÀÆvÀæUÀ¼ÀÄ: 115, 116, 127, - 04 ¸ÀÆvÀæUÀ¼ÀÄ

G) zsÁvÀÄ : vÀ¢ÝvÁAvÀ ®PÀëtUÀ¼ÀÄ, C¥À¨sÀæA±À, CªÀåAiÀÄUÀ¼À ¸ÁªÀiÁ£Àå «ZÁgÀ, PÀ£ÀßqÀzÀ C¸ÁzsÁgÀt ®PÀëtUÀ¼À «ªÉÃZÀ£É

WÀlPÀ : 4

¥ÀÆgÀPÀ ¥ÀoÀå : ªÁåPÀgÀt ¸ÀAUÁw

ªÀiÁzÀj CzsÀåAiÀÄ£À

n.«. ªÉAPÀmÁZÀ® ±Á¹ÛçAiÀÄªÀgÀÄ ¸ÀA¥Á¢¹gÀÄªÀ ±À§ÝªÀÄtÂzÀ¥ÀðtA PÀÈwAiÀÄ°è£À DAiÀÄÝ 16 ®PÀëöå ¥ÀzÀåUÀ¼ÀÄ

WÀlPÀ : 5

ªÀiÁzÀj CzsÀåAiÀÄ£À

ªÁåPÀgÀt ¸ÀAUÀwUÀ¼À£ÀÄß PÀÄjvÀ DAiÀÄÝ 4 ¨sÁUÀUÀ¼ÀÄ

WÀlPÀ – 6 ªÀÄvÀÄÛ WÀlPÀ 7 : ¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉUÀ¼ÀÄ (lÄåmÉÆÃjAiÀÄ¯ï)

- ¸ÀÆvÀæUÀ¼À£ÀÄß PÀæªÀÄ§zÀPªÁV N¢¸ÀÄªÀÅzÀÄ.
- ¸ÀÆvÀæzÀ «ZÁgÀUÀ½UÉ ¥ÀæAiÉÆÃUÀUÀ¼À£ÀÄß C£Àé¬Ä¸À®Ä ¸ÀÆa¸ÀÄªÀÅzÀÄ.
- PÁªÀåUÀ¼À ¨sÁUÀUÀ¼À£ÀÄß ¤Ãr C°ègÀÄªÀ ªÁåPÀgÀuÁA±ÀUÀ¼À£ÀÄß UÀÄgÀÄw¸À®Ä w½¸ÀÄªÀÅzÀÄ.
- ¸ÀA¢ü ªÀÄvÀÄÛ ¸ÀªÀiÁ¸À ¥ÀzÀUÀ¼À £ÀqÀÄªÀt ªÀåvÁå¸ÀUÀ¼À£ÀÄß ¥ÀnÖ ªÀiÁr¸ÀÄªÀÅzÀÄ.
- PÀ£ÀßqÀ ªÁåPÀgÀtPÁgÀgÀ §zÀÄPÀÄ - §gÀºÀ PÀÄjvÀ «ZÁgÀ UÉÆÃ¶× K¥Àðr¸ÀÄªÀÅzÀÄ.
- ¥ÀzÀ§AzsÀUÀ¼À£ÀÄß gÀa¸À®Ä ªÀÄvÀÄÛ ©r¸À®Ä ¸ÀÆa¸ÀÄªÀÅzÀÄ.

¥ÀgÁªÀÄ±Àð£À UÀæAxÀUÀ¼ÀÄ

1. PÉÃ²ÃgÁd£À ±À§ÝªÀÄtÂ zÀ¥Àðt : r.J¯ï £ÀgÀ¹AºÁZÁgï
2. PÉÃ²gÁd£À ±À§ÝªÀÄtÂzÀ¥Àðt : n.«. ªÉAPÀmÁZÀ® ±Á¹Ûç
3. ±À§ÝªÀÄtÂzÀ¥Àðt : J¯ï . §¸ÀªÀgÁdÄ
4. ±À§ÝªÀÄtÂzÀ¥Àðt : eÉ. J¸ï. PÀÄ½î
5. C¯ÉÆÃPÀ : JZï. J¸ï. ©½Vj
6. ±À§ÝªÀÄtÂ zÀ¥ÀðtzÀ 101 ¸ÀÆvÀæUÀ¼ÀÄ : J.J¸ï. dAiÀÄgÁA ªÀÄvÀÄÛ PÉ ªÀÄºÀzÉÃªÀ¥Àà

7. zÀ¥Àðt ¢Ã¦PÉ : C§ÄÝ¯ï §¶Ãgï

8. °À¼ÀUÀ£ÀßqÀ vË®¤PÀ CzsÀåAiÀÄ£À : PÉ. PÀÄ±Á®¥Àà UËqÀ

DgÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À
LaÒPÀ PÀ£ÀßqÀ
r.J¸ï.E - ¥ÀwæPÉ -6.2(DSE)
Course code :ELF25226 ELF25223

«±ÉÃµÀ PÀ« PÁªÀå CzsÀåAiÀÄ£À ªÀÄvÀÄÛ ¥ÀÆgÀPÀ ¥ÀoÀå
«±ÉÃµÀ PÀ« : ¥ÀA¥À

WÀlPÀ 1 : ¥ÀA¥À£À PÁ®, zÉÃ±À, ZÁjwæPÀvÉ ªÀÄvÀÄÛ AiÀÄÄUÀzsÀªÀÄð

WÀlPÀ 2 – ¥ÀA¥À£À PÁªÀåUÀ¼ÀÄ

C) D¢ ¥ÀÄgÁt – DPÀgÀ, ªÀ¸ÀÄÛ, ¸ÀégÀÆ¥À, ¥ÁvÀæ avÀæt, ¸À¤ßªÉÃ±À ¸ÀÈ¶Ö

D) «PÀæªÀiÁdÄð£À «dAiÀÄ - DPÀgÀ, ªÀ¸ÀÄÛ, ¸ÀégÀÆ¥À, ¥ÁvÀæ avÀæt, ¸À¤ßªÉÃ±À ¸ÀÈ¶Ö

WÀlPÀ : 3 – C. D¢ ¥ÀÄgÁt – DAiÀÄÝ ¨sÁUÀUÀ¼À CzsÀåAiÀÄ£À

D) «PÀæªÀiÁdÄð£À «dAiÀÄ - DAiÀÄÝ ¨sÁUÀUÀ¼À CzsÀåAiÀÄ£À

WÀlPÀ : 4

¥ÀÆgÀPÀ ¥ÀoÀå : ¥ÀA¥À ¸Á»vÀå ¸ÀAUÁw

ªÀiÁzÀj CzsÀåAiÀÄ£À (DAiÀÄÝ ¨sÁUÀUÀ¼ÀÄ)

C. £ÁqÉÆÃd ¥ÀA¥À : ªÀÄÄ½AiÀÄ wªÀÄä¥ÀàAiÀÄå

D. ¥ÀA¥À : wÃ.£ÀA.²æÃ

E. ¥ÀA¥À PÉ®ªÀÅ ªÀÄÄRUÀ¼ÀÄ : ¹.¦.PÉ

F. ªÀÄvÉÛ ªÀÄvÉÛ ¥ÀA¥À : f. JZï. £ÁAiÀÄPÀ

WÀlPÀ : 5

ªÀiÁzÀj CzsÀåAiÀÄ£À (DAiÀÄÝ ¨sÁUÀUÀ¼ÀÄ)

¥ÀA¥À£À PÁªÀå PÀÄjvÀ «ªÀÄ±Áð¯ÉÃR£ÀUÀ¼ÀÄ

C) ¥ÀA¥À£À JgÀqÀÄ ¥ÀzÀåUÀ¼ÀÄ : n. J¸ï. ªÉAPÀtÚAiÀÄå

D) ¥ÀA¥À£À°è ¨sÀªÀåvÉ : PÀÄªÉA¥ÀÄ

E) ¥ÀA¥À ¨sÁgÀvÀzÀ ªÀ¸ÀÄÛ «£Áå¸À : ¸ÀÄd£Á

F) ¥ÀA¥À MAzÀÄ ªÀiË®å «ªÉÃZÀ£É : PÉ. ¦. ¥ÀÆtðZÀAzÀæ vÉÃd¹é

WÀlPÀ – 6 ªÀÄvÀÄÛ WÀlPÀ 7 : ¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉUÀ¼ÀÄ (lÄåmÉÆÃjAiÀÄ¯ï)

- ¥ÀA¥À¤UÉ ¸ÀA§A¢ü¹zÀ ±Á¸À£ÀzÀ ªÀiÁ»wUÀ¼À£ÀÄß ¸ÀAUÀæ»¸À®Ä ¸ÀÆa¸ÀÄªÀÅzÀÄ.
- ¥ÀA¥À£À PÀÈwUÀ½UÉ ¸ÀA§A¢ü¹zÀ «ªÀÄ±ÉðUÀ¼À£ÀÄß ¸ÀAUÀæ»¸À®Ä ¸ÀÆa¸ÀÄªÀÅzÀÄ.
- ¥ÀA¥À£À PÁªÀåUÀ¼À UÀªÀÄPÀªÁZÀ£ÀªÀ£ÀÄß PÉÃ½¸ÀÄªÀÅzÀÄ
- ¥ÀA¥À£À PÁªÀåUÀ½UÉ ¥Àæ¸ÁÛgÀ °ÁPÀ®Ä ¸ÀÆa¸ÀÄªÀÅzÀÄ.
- ¥ÀA¥À£À §£ÀªÁ¹AiÀÄ PÀÄjvÀÄ ªÀiÁ»w ¸ÀAUÀæ»¸ÀÄªÀÅzÀÄ.
- ¥ÀA¥À£À PÁªÀåUÀ¼À zsÀé¤, gÀ¸À, C®APÁgÀUÀ¼À£ÀÄß UÀÄgÀÄw¸À®Ä w½¸ÀÄªÀÅzÀÄ.
- ¥ÀA¥À£À PÁªÀåUÀ¼À ¨sÁ¶PÀ CzsÀåAiÀÄ£ÀªÀ£ÀÄß PÉÊUÉÆ¼Àî®Ä ¸ÀÆa¸ÀÄªÀÅzÀÄ.

¥ÀgÁªÀÄ±Àð£À UÀæAxÀUÀ¼ÀÄ

1. ¥ÀA¥À¨sÁgÀvÀ ¢Ã¦PÉ : r.J¯ï. J£ï.
2. ¸ÀgÀ¼À ¥ÀA¥À ¨sÁgÀvÀ : J¯ï. §¸ÀªÀgÁeï
3. ¸ÀgÀ¼À D¢¥ÀÄgÁt : J¯ï. §¸ÀªÀgÁeï
4. ¥ÀA¥À£À ¸ÀªÀÄ¸ÀÛ ¨sÁgÀvÀ PÀxÁªÀÄÈvÀ : J¯ï.§¸ÀªÀgÁeï
5. D¢¥ÀÄgÁt PÀxÁªÀÄÈvÀ : J¯ï.§¸ÀªÀgÁeï
6. ¥ÀA¥À ªÀÄºÁPÀ« : «.¹Ã
7. D¢¥ÀÄgÁt ¢Ã¦PÉ : vÀ.¸ÀÄ. ±ÁªÀÄgÁAiÀÄ
8. ¥ÀA¥À MAzÀÄ CzsÀåAiÀÄ£À : f. J¸ï. ²ªÀgÀÄzÀæ¥Àà
9. ¥ÀA¥À¨sÁgÀvÀ ¸ÁA¸ÀÌøwPÀ CzsÀåAiÀÄ£À : ±ÁAw£ÁxÀ ¢§âzÀ
10. ¥ÀA¥À ¨sÁgÀvÀ (£ÁlPÀ) : PÉ. ªÉÊ. £ÁgÁAiÀÄt ¸Áé«Ä
11. gÀÆ¥ÀªÀÄA zsÀj¬Ä¹ ¤AzÀÄzÀ®ÄÛ®â : dAiÀÄ¥ÀæPÁ±ï ±ÉnÖ. JZï.
12. ªÀZÀ£À ¥ÀA¥À ¨sÁgÀvÀ : ¹zÀÞ°AUÀAiÀÄå
13. D¢¥ÀÄgÁt : f. §æºÀä¥Àà
14. D¢¥ÀÄgÁt ¸ÀAUÀæºÀ : J¯ï. UÀÄAqÀ¥Àà

DgÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À
LaÒPÀ PÀ£ÀßqÀ
r.J¸ï.E - ¥ÀwæPÉ -6.3(DSE)
Course code :ELF25426 ELF25423

PÀ£ÀßqÀ ¸Á»vÀå ªÀÄvÀÄÛ PÀ£ÀßqÀ ¹¤ªÀiÁ

WÀlPÀ 1 : ¹¤ªÀiÁ ¥ÀjPÀ®à£É ªÀÄvÀÄÛ EwºÁ¸À

C. ¹¤ªÀiÁzÀ ¸ÀégÀÆ¥À, ®PÀët

D. PÀ£ÀßqÀ ¹¤ªÀiÁ ¨É¼ÉzÀÄ §AzÀ §UÉ

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WÀlPÀ 2 – ¸Á»vÀå ªÀÄvÀÄÛ ¹¤ªÀiÁ CAvÀgï ¸ÀA§AzsÀ

C. d£À¥ÀzÀ ¸Á»vÀå ªÀÄvÀÄÛ ¹¤ªÀiÁ

D. ¥ËgÁtÂPÀ – ZÁjwæPÀ ¸Á»vÀå ªÀÄvÀÄÛ ¹¤ªÀiÁ

WÀlPÀ : 3 – ¹¤ªÀiÁ ªÀiÁzsÀåªÀÄzÀ ªÀ¸ÀÄÛUÀ¼ÁV ¸Á»vÀå ¥ÀæPÁgÀUÀ¼ÀÄ

C) PÀxÉ PÁzÀA§j DzsÁjvÀ ¹¤ªÀiÁUÀ¼ÀÄ : ¨sÀÆvÀAiÀÄå£À ªÀÄUÀ CAiÀÄÄå, £ÁUÀgÀºÁªÀÅ,

QgÀUÀÆj£À UÀAiÀiÁå½UÀ¼ÀÄ

D) £ÁlPÀ, PÀ«vÉ, ¹¤ªÀiÁUÀ¼ÀÄ - £ÁUÀªÀÄAqÀ®, GzÀãªÀ, ¸ÀAUÁå¨Á¼Àå, ªÉÄÊ¸ÀÆgÀÄ ªÀÄ°èUÉ, PÉgÉUÉ °ÁgÀ

E) fÃªÀ£À ZÀjvÉæ DzsÁjvÀ ¹¤ªÀiÁUÀ¼ÀÄ : ²±ÄÄ£Á¼À µÀjÃ¥sÀ, dUÀeÉÆåÃw §¸ÀªÉÃ±ÀégÀ, ¨sÀPÀÛ PÀ£ÀPÀzÁ¸À

WÀlPÀ : 4

¥ÀÆgÀPÀ ¥ÀoÀå : ¹¤ªÀiÁ ¸ÀAUÁw

ªÀiÁzÀj CzsÀåAiÀÄ£À (DAiÀÄÝ ¨sÁUÀUÀ¼ÀÄ)

C) ¸ÀA¨sÁµÀuÉ gÀZÀ£É

D) avÀæPÀxÉ gÀZÀ£É

E) VÃvÀ gÀZÀ£É

WÀlPÀ : 5

PÀ£ÀßqÀzÀ ¹¤ªÀiÁUÀ¼ÀÄ : ªÀiÁzÀj CzsÀåAiÀÄ£À (DAiÀÄÝ ¨sÁUÀUÀ¼ÀÄ)

C. ¨sÁµÉ : d£À¥ÀzÀ, ¥ËgÁtÂPÀ - ¨Á®£ÁUÀªÀÄä §§ÄæªÁºÀ£À

D. ªÀ¸ÀÄÛ : ¸ÁªÀiÁfPÀ, PÀ¯ ÁvÀäPÀ - ¥sÀtÂAiÀÄªÀÄä, vÀ§gÀ£À PÀxÉ

E. ±ÉÊ° : £ÉÃgÀ ¤gÀÆ¥ÀuÉ, »£ÉÆßÃl vÀAvÀæ, (DAiÀÄÝ ¹¤ªÀiÁ ¨sÁUÀUÀ¼À ªÀiÁzÀj CzsÀåAiÀÄ£À)

WÀlPÀ – 6 ªÀÄvÀÄÛ WÀlPÀ 7 : ¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉUÀ¼ÀÄ (lÄåmÉÆÃjAiÀÄ¯ï)

- ¥ÀoÀåPÉÌ ¥ÀÆgÀPÀªÁzÀ ¹¤ªÀiÁ ¥ÀæzÀ±Àð£ÀªÀ£ÀÄß K¥Àðr¸ÀÄªÀÅzÀÄ,
- ¹¤ªÀiÁ gÀ¸ÀUÀæºÀt ²©gÀUÀ¼À£ÀÄß K¥Àðr¸ÀÄªÀÅzÀÄ.
- ¹¤ªÀiÁzsÀ ªÀ¸ÀÄÛ, D±ÀAiÀÄ, ¥ÁvÀæ avÀætUÀ¼À£ÀÄß PÀÄjvÀ UÀÄA¥ÀÄ ZÀZÉðUÀ¼À£ÀÄß K¥Àðr¸ÀÄªÀÅzÀÄ.
- DAiÀÄÝ PÀxÉUÀ¼À£ÀÄß ¸ÀÆa¹ CªÀÅUÀ½UÀ avÀæPÀxÉ ªÀÄvÀÄÛ ¸ÀA¨sÁµÀuÉUÀ¼À£ÀÄß §gÉ¸ÀÄªÀÅzÀÄ.
- ¹¤ªÀiÁ ¥ÀÄgÀªÀtÂUÀ¼À°è §gÀÄªÀ ZÀ®£À avÀæ «ªÀÄ±ÉðUÀ¼À£ÀÄß ¸ÀAUÀæ»¸ÀÄªÀÅzÀÄ.
- VÃvÀ gÀZÀ£É ªÀiÁqÀÄªÀAvÉ ¥ÉæÃgÉÃ¦¸ÀÄªÀÅzÀÄ.

¥ÀgÁªÀÄ±Àð£À UÀæAxÀUÀ¼ÀÄ

1. PÀ£ÀßqÀ ¹¤ªÀiÁ : UÀAUÁzsÀgï ªÉÆzÀ°AiÀiÁgï
2. CªÉÄjPÁ CªÉÄjPÁ avÀæPÀxÉ : £ÁUÀwºÀ½î ZÀAzÀæ±ÉÃRgï
3. PÀxÉ , avÀæPÀxÉ, ¸ÀA¨sÁµÀuÉ : eÉÆÃV
4. ¹¤ªÀiÁ ¸ÀAPÀxÀ£À : Dgï. ¹. UÉÆÃ«AzÀgÁdÄ,
5. ¹¤ªÀiÁAiÀiÁ£À : ¥ÀÄlÖ¸Áé«Ä.PÉ
6. ¥ÀÄlÖtÚ PÀtUÁ¯ï: ¹¤ªÀiÁUÀ¼ÀÄ : J¸ï. ¥Àæ¸Ázï ¸Áé«Ä
7. ¸Á»vÀå ªÀÄvÀÄÛ ZÀ®£ÀavÀæ : PÉ. «. ¸ÀÄ§âtÚ

8. ¸ÁAiÀÄÄªÀ ªÀÄÄ£Àß £ÉÆÃqÀ¯ÉÃ¨ÉÃPÁzÀ 101 PÀ£ÀßqÀ ¹¤ªÀiÁUÀ¼ÀÄ : gÀ«ÃAzÀæ
9. PÀ£ÀßqÀ avÀægÀAUÀ MAzÀÄ «ªÉÃZÀ£É : J¸ï. ²æÃzsÀgÀ ªÀÄÆwð
10. qÁ. gÁdPÀÄªÀiÁgï ¸ÀªÀÄUÀæ ZÀjvÉæ : zÉÆqÀØºÀÄ®ÆègÀÄ gÀÄPÉÆÌÃf

DgÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À
LaÒPÀ PÀ£ÀßqÀ
r.J¸ï.E - ¥ÀwæPÉ -6.4(DSE)
Course code : ELF25623/ELF25626
¥ÀæPÁgÀ PÉÃA¢ævÀ CzsÀåAiÀÄ£À : PÀ£ÀßqÀ ¸Á»vÀå ¥ÀæPÁgÀ - ¸ÀtÚ PÀxÉ

WÀlPÀ 1 : PÀxÉAiÀÄ ¸ÀégÀÆ¥À. ªÀÄvÀÄÛ ®PÀët

C. ¸ÀtÚPÀxÉ ¨É¼ÉzÀÄ §AzÀ zÁj
1. ¸ÀA¸ÀÌøvÀ PÀxÉUÀ¼À »£Éß¯É
2. ¥Á±ÁÑvÀå ¥Àæ¨sÁªÀ ¥ÉæÃgÀuÉ
3. d£À¥ÀzÀ ¥ÀgÀA¥ÀgÉ

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WÀlPÀ 2 – PÀ£ÀßqÀ ¸ÀtÚPÀxÉ ¸Á»vÀå ¥ÀæPÁgÀzÀ ¥ÀjZÀAiÀÄ

C) °À¼ÀUÀ£ÀßqÀ, £ÀqÀÄUÀ£ÀßqÀ PÀvÉUÀ¼ÀÄ : ªÀqÁØgÁzsÀ£É, zsÀªÀiÁðªÀÄÈvÀ, ¥ÀAZÀvÀAvÀæ, gÁdgÀvÀßA PÀxÉ

D) ¸ÁªÀiÁfPÀ PÀxÉUÀ¼ÀÄ : £À£Àß aPÀÌvÁ¬Ä, zsÀ¤AiÀÄgÀ ¸ÀvÀå£ÁgÁAiÀÄt

WÀlPÀ : 3 – PÀ£ÀßqÀ ¸ÀtÚ PÀvÉUÀ¼À ¨É¼ÀªÀtÂUÉAiÀÄ EwºÁ¸À

C) ¥ÀAeÉ ªÀÄAUÉÃ±ÀgÁAiÀÄjAzÀ EA¢£À ªÀgÉUÀÆ DAiÀÄÝ PÀvÉUÁgÀgÀ ¥ÀjZÀAiÀÄ

D) PÀ£ÀßqÀ ¸ÀtÚ PÀvÉUÀ¼À ¨sÁµÉ, «£Áå¸À, vÀAvÀæUÀ¼À CzsÀåAiÀÄ£À (ªÀiÁzÀj PÀxÉUÀ¼ÉÆA¢UÉ)

WÀlPÀ : 4

¥ÀÆgÀPÀ ¥ÀoÀå : PÀxÁ ¸Á»vÀå ¸ÀAUÁw

PÀ£ÀßqÀ ¸ÀtÚ PÀvÉUÀ¼ÀÄ : ªÀiÁzÀj CzsÀåAiÀÄ£À DAiÀÄÝ ¨sÁUÀUÀ¼ÀÄ

C. ¸ÉÃrAiÀiÁ¥ÀÄ PÀÈµÀÚ¨sÀlÖ : ZÉ£ÉßªÀÄuÉ

D. D£ÀAzÀ : £Á PÉÆAzÀ °ÀÄqÀÄV

E. ±ÁAw£ÁxÀ zÉÃ¸Á¬Ä : Qëwd

F. £ÉÃ«ÄZÀAzÀæ B DAiÉÄÌ £ÀªÀÄä PÉÊ°zÉ

G. CªÀÄgÉÃ±ï £ÀÄUÀqÉÆÃtÂ : ¸ÀªÁj

H. gÁWÀªÉÃAzÀæ ¥ÁnÃ® : zÉÃ¸ÀUÀw

WÀlPÀ : 5

ªÀiÁzÀj CzsÀåAiÀÄ£À (DAiÀÄÝ ¨sÁUÀUÀ¼ÀÄ)

EwÛÃa£À ¥ÀæªÀÈwÛUÀ¼À CzsÀåAiÀÄ£À

C. MAzÀÄ ¥ÀÄlzÀ PÀxÉ

D. «Ä¤ PÀxÉ

E. °À¤ PÀxÉ

F. ªÁmïï¥ï ªÀÄvÀÄÛ ¥sÉÃ¸ï§ÄPï PÀxÉUÀ¼ÀÄ

WÀlPÀ – 6 ªÀÄvÀÄÛ WÀlPÀ 7 : ¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉUÀ¼ÀÄ

(lÄåmÉÆÃjAiÀÄ¯ï)

- PÀxÉUÀ¼À£ÀÄß N¢¸ÀÄªÀÅzÀÄ.
- PÀxÉUÀ¼À£ÀÄß gÀa¸ÀÄªÀAvÉ ¥ÉæÃgÉÃ¡ªÀÅzÀÄ.
- vÀªÀÄä ¥Àj¸ÀgÀzÀ PÀvÉUÁgÀgÉÆA¢UÉ ¸ÀAªÁzÀ ªÀÄvÀÄÛ ¸ÀAzÀ±Àð£ÀUÀ¼À£ÀÄß K¥Àðr¸ÀÄªÀÅzÀÄ.
- PÀxÉUÀ¼À°ègÀÄªÀ aAvÀ£ÁvÄPÀ CA±ÀUÀ¼À£ÀÄß ZÀað¸ÀÄªÀÅzÀÄ.
- ¸Á»vÀå ¤AiÀÄvÀPÁ°PÀUÀ¼À°è ¥ÀæPÀlªÁUÀÄªÀ EwÛÃa£À PÀxÉUÀ¼À ªÀiÁzÀjUÀ¼À£ÀÄß ¸ÀAUÀæ»¸ÀÄªÀÅzÀÄ.
- PÀxÁgÀZÀ£À PÀªÀÄälUÀ¼À£ÀÄß K¥Àðr¸ÀÄªÀÅzÀÄ.
- ¸ÀtÚPÀvÉUÀ¼À£ÁßzsÀj¹zÀ ¹¤ªÀiÁUÀ¼À ¥ÀæzÀ±Àð£ÀªÀ£ÀÄß K¥Àðr¸ÀÄªÀÅzÀÄ.

¥ÀgÁªÀÄ±Àð£À UÀæAxÀUÀ¼ÀÄ

1. ±ÀvÀªÀiÁ£ÀzÀ ¸ÀtÚPÀvÉUÀ¼ÀÄ : PÀ£ÁðlPÀ ¸Á»vÀå CPÁqÉ«Ä
2. °ÉÆ¸ÀUÀ£ÀßqÀzÀ CgÀÄuÉÆÃzÀAiÀÄ : ²æÃ¤ªÁ¸À °ÁªÀ£ÀÆgÀ
3. °ÉÆ¸ÀUÀ£ÀßqÀ ¸Á»vÀå ZÀjvÉæ : J¯ï. J¸ï. ±ÉÃµÀVjgÁªï

4. AiÀÄÄUÀzsÀªÀÄð ªÀÄvÀÄÛ PÀ£ÀßqÀ ¸Á»vÀå : QÃwð£ÁxÀ PÀÄvÀÄðPÉÆÃn
5. PÀxÀ£À ¸Á»vÀå : f. J¸ï. CªÀÄÆgÀ
6. PÀ£ÀØqÀzÀ ¸ÀtÚPÀvÉUÀ¼ÀÄ : f. JZï, £ÁAiÀÄPÀ
7. fÃªÀ£À ¦æÃw : ¸ÀA. PÁ¼ÉÃUËqÀ £ÁUÀªÁgÀ
8. ¸ÁévÀAvÉÆæÃvÀÛgÀ PÁ®zÀ PÀ£ÀßqÀ ¸Á»vÀå : GzÀAiÀÄ¨sÁ£ÀÄ PÀ¯Á¸ÀAWÀ
9. PÀ£ÀßqÀ PÀxÀ£À ¸Á»vÀåzÀ°è ¸ÁA¸ÀÌøwPÀ ¸ÀAWÀµÀð : J£ï. PÉ. PÉÆÃzÀAqÀ gÁªÀÄ
10. ªÀiÁ¹ÛAiÀÄgÀ PÀxÉUÀ¼ÀÄ : J.J£À. ªÀÄÆwðgÁªï

¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉ, ¥ÀjÃPÉë ªÀÄvÀÄÛ ªÀiË®åªÀiÁ¥À£À ¥ÀæQæAiÉÄ

PÀ¯Á, ªÁtÂdå ªÀÄvÀÄÛ «eÁÕ£À ¤PÁAiÀÄUÀ½UÉ C£ÀéAiÀÄªÁUÀÄªÀAvÉ DAiÉÄÌ DzsÁjvÀ UÀÄuÁAPÀ ¥ÀzÀÞw (¹©¹J¸ï) PÀ£ÀßqÀ ¨sÁµÉ ªÀÄvÀÄÛ LaÒPÀ ¥ÀwæPÉUÀ¼À ¥ÀoÀåPÀæªÀÄPÉÌ ¸ÀA§A¢ü¹zÀAvÉ PÀ£ÀßqÀ «¨sÁUÀzÀ ªÀÄÄRå¸ÀÜgÀÄ ªÀÄvÀÄÛ CzsÁå¥ÀPÀjUÉ ¸ÀÆZÀ£ÉUÀ¼ÀÄ.

- ¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉUÀ¼À£ÀÄß PÀqÁØAiÀÄªÁV £ÀqÉ¸ÀÄªÀÅzÀÄ
- ¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉUÀ¼À zÁR¯ÉUÀ¼À£ÀÄß CzsÁå¥ÀPÀgÀÄ «zÁåyðUÀ½AzÀ ¸ÀAUÀæ»¹ ¸ÀAgÀQë¸ÀÄªÀÅzÀÄ.
- ¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉUÀ¼À°è ¨sÁUÀªÀ»¸ÀÄªÀ «zÁåyð «ªÀgÀUÀ¼À£ÀÄß (ZÀlÄªÀnPÉUÀ¼À ¸ÀégÀÆ¥À, «zÁåyð ºÉ¸ÀgÀÄ, vÀgÀUÀw, ¢£ÁAPÀ) n¥ÀàtÂ ¥ÀÄ¸ÀÛPÀzÀ°è zÁR°¸ÀÄªÀÅzÀÄ.
- ¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉUÀ½UÉ ¸À°ÁAiÀÄPÀªÁUÀÄªÀAvÉ «¨sÁUÀzÀ UÀæAxÁ®AiÀÄªÀ£ÀÄß gÀÆ¦¹PÉÆ¼Àî¨ÉÃPÀÄ
- ¹-1 : 15 CAPÀUÀ¼ÀÄ ZÀvÀÄªÀiÁð¸À (¸É«Ä¸ÀÖgï) DgÀA¨sÀªÁzÀ 8 ªÁgÀUÀ¼À M¼ÀUÉ ¥Àæw WÀlPÀzÀ®Æè ±ÉÃ. 50gÀµÀÄÖ ¥ÀoÀå¨ÉÆÃzsÀ£É ªÀiÁrgÀ¨ÉÃPÀÄ. ¨ÉÆÃ¢ü¹gÀÄªÀ ¥ÀoÀå «µÀAiÀÄUÀ¼À ªÉÄÃ¯É ¹-1 ªÀiË®å ªÀiÁ¥À£À ¥ÀæQæAiÉÄAiÀÄ£ÀÄß ¤AiÉÆÃfvÀ PÁAiÀÄð CxÀªÁ «ZÁgÀ ªÀÄAqÀ£É ªÀÄÆ®PÀ £ÀqÉ¸ÀÄªÀÅzÀÄ.
- ¹ -2 : CAPÀUÀ¼ÀÄ, ZÀvÀÄªÀiÁð¸À (¸É«Ä¸ÀÖgï) DgÀA¨sÀªÁzÀ 15 ªÁgÀUÀ¼À M¼ÀUÉ ¥ÀæwWÀlPÀzÀ®Æè ±ÉÃ. 100gÀµÀÄÖ ¥ÀoÀå ¨ÉÆÃzsÀ£É

ªÀiÁrgÀ¨ÉÃPÀÄ. ¨ÉÆÃ¢ü¹gÀÄª ¥ÀoÀå«µÀAiÀÄUÀ¼À ªÉÄÃ¯É ¹-2 ªÀiË®åªÀiÁ¥À£À ¥ÀæQæAiÉÄAiÀÄ£ÀÄß QgÀÄ ¥ÀjÃPÉë ªÀÄÆ®PÀ £ÀqÉ¸ÀÄªÀÅzÀÄ.

- «±Àé«zÁå®AiÀÄzÀ ¤AiÀÄªÀÄUÀ¼À£ÀéAiÀÄ ¹-1 ªÀÄvÀÄÛ ¹-2 ªÀiË®åªÀiÁ¥À£À ¥ÀæQæAiÉÄAiÀÄ zÁR¯ÉUÀ¼À£ÀÄß ¸ÀAgÀQë¹qÀÄªÀÅzÀÄ.
- ¹-3 : 70 CAPÀUÀ¼ÀÄ ªÀÄÄRå ¥ÀjÃPÉë: ªÀÄÆgÀÄ UÀAmÉUÀ¼À CªÀ¢ü: ¥ÀjÃPÉëAiÀÄÄ PÁ¯ÉÃdÄ ªÀÄlÖzÀ°è £ÀqÉAiÀÄÄvÀÛzÉ.
- ¹-1, ¹-2, ¹-3 : EªÀÅUÀ¼À §UÉÎ ºÉaÑ£À ªÀiÁ»wUÉ PÀ£ÀßqÀ «¨sÁUÀªÀ£ÀÄß ¸ÀA¥ÀQð¸ÀÄªÀÅzÀÄ.

DgÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À
LaÒPÀ PÀ£ÀßqÀ
r.J¸ï.E - ¥ÀwæPÉ -6.5(DSE)
Course code : ELF25823/ELF25826
PÀ£ÀßqÀ ¨sÁµÉ ªÀÄvÀÄÛ ¸ÀªÀÄÆºÀ ªÀiÁzsÀåªÀÄ

WÀlPÀ - 1 :

¨sÁµÉ ªÀÄvÀÄÛ ¸ÀªÀÄÆºÀ ªÀiÁzsÀåªÀÄ : CAvÀgï ¸ÀA§AzsÀ

C) ¸ÀªÀÄÆºÀ ªÀÄzsÀåªÀÄzÀ ¸ÀégÀÆ¥À ªÀÄvÀÄÛ ®PÀëtUÀ¼ÀÄ
D) ªÀiÁzsÀåªÀÄUÀ¼À ¨É¼ÀªÀtÂUÉAiÀÄ EwºÁ¸À ªÀÄvÀÄÛ ªÀÄºÀvÀé
E) ««zsÀ ¥ÀæPÁgÀzÀ ¸ÀªÀÄÆºÀ ªÀiÁzsÀåªÀÄUÀ¼ÀÄ

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WÀlPÀ - 2

PÀ£ÀßqÀ ¥ÀwæPÁ ªÀiÁzsÀåªÀÄ : ¸ÀégÀÆ¥À - ®PÀëtUÀ¼ÀÄ

C. ¥ÀwæPÁ ¨sÁµÉ ªÀÄvÀÄÛ §gÀºÀUÀ¼À ªÉÊ²µÀÖöå: ªÀgÀ¢, ¸ÀÄ¢Ý ¯ÉÃR£À, £ÀÄravÀæ, ²Ã¶ðPÉ §gÀºÀ, CAPÀt §gÀºÀ

ªÀåAUÀå avÀæ, gÉÃSÁavÀæ, NzÀÄUÀgÀ ¥ÀvÀæUÀ¼ÀÄ

D. ¸Á»vÀå ¥ÀÄgÀªÀtÂUÀ¼À ¸ÀégÀÆ¥À ªÀÄvÀÄÛ ªÀÄºÀvÀé, ¸ÀÈd£À²Ã® §gÀºÀUÀ¼ÀÄ, ¥ÀÄ¸ÀÛPÀ CªÀ¯ÉÆÃPÀ£À,

¸ÀAzÀ±Àð£À, ªÀåQÛavÀæ

E. ¸Á»vÀå ¥ÀwæPÉUÀ¼À ¸ÀégÀÆ¥À ªÀÄvÀÄÛ ¥ÀæPÁgÀUÀ¼ÀÄ : ºÀªÁå¹ ¥ÀvÀæPÀvÀðgÀÄ, ¥ÀÄ¸ÀÛPÀ ¥ÀæPÁ±À£À

WÀlPÀ : 3

PÀ£ÀßqÀ ¨sÁµÉ : ±ÀæªÀå ªÀÄvÀÄÛ zÀÈ±Àå ªÀiÁzsÀåªÀÄ

C) ¨Á£ÀÄ°, (DPÁ±ÀªÁtÂ) ¨sÁµÉAiÀÄ ¸ÀégÀÆ¥À : ¸ÀA¨sÁµÀuÉ, ¤gÀÆ¥ÀuÉ, GzÉÆÏÃµÀuÉAiÀÄ°è GZÁÒgÀuÉ

ªÀÄvÀÄÛ zsÀé¤«£Áå¸ÀzÀ ªÀÄºÀvÀé

D) ¨Á£ÀÄ° §gÀºÀzÀ ¸ÀégÀÆ¥À : ªÁvÁðªÁZÀ£À, £ÁlPÀ, aAvÀ£É, PÀxÁªÁZÀ£À, UÀªÀÄPÀ ªÁåSÁå£À

E) zÀÆgÀzÀ±Àð£ÀzÀ°è ¨sÁµÉ ªÀÄvÀÄÛ §gÀºÀ : ªÁvÉð, ¸ÀAzÀ±Àð£À, ¤gÀÆ¥ÀuÉAiÀÄ°è GZÁÒgÀuÉAiÀÄ

¸ÀégÀÆ¥À, ²Ã¶ðPÉ, eÁ»gÁvÀÄ, ZÀ°¸ÀÄªÀ §gÀºÀ (¸ÉÆÌçÃ°AUï) ¸ÀA¥ÁzÀ£Á ¸Á»vÀåzÀ°è

§gÀºÀzÀ ¸ÁÜ£À ªÀÄvÀÄÛ ªÀÄºÀvÀé

WÀlPÀ : 4

¥ÀÆgÀPÀ ¥ÀoÀå : ªÀiÁzsÀåªÀÄ ¸ÀAUÁw

PÀ£ÀßqÀ ¨sÁµÉ ªÀÄvÀÄÛ £ÀªÀªÀiÁzsÀåªÀÄ : ªÀiÁzÀj CzsÀåAiÀÄ£À DAiÀÄÝ ¨sÁUÀUÀ¼ÀÄ

C) CAvÀeÁð®zÀ°è PÀ£ÀßqÀ §¼ÀPÉAiÀÄ ¸ÀégÀÆ¥À

D) ¨sÁµÉ ªÀÄvÀÄÛ ¨sÁµÁAvÀgÀ vÀAvÁæA±ÀUÀ¼ÀÄ £ÀÄr, §gÀºÀ, PÀÄªÉA¥ÀÄ, d¸ïÖ PÀ£ÀßqÀ, AiÀÄÄ¤PÉÆÃqï, «Q¦rAiÀiÁ

WÀlPÀ : 5

PÀ£ÀßqÀ ¸ÀªÀÄÆºÀ ªÀiÁzsÀåªÀÄ : ªÀiÁzÀj CzsÀåAiÀÄ£À (DAiÀÄÝ ¨sÁUÀUÀ¼ÀÄ)

C) ¥ÀwæPÉAiÀÄ ZÀvÀÄgÀAUÀ : r.«.f

D) DPÁ±ÀªÁtÂ : ªÀ¸ÀAvÀPÀÄªÀiÁgï ¥É®ð

E) zÀÆgÀzÀ±Àð£À : r.©. £ÁAiÀÄPÀ

F) ªÀiÁzsÀåªÀÄ – ªÀvÀðªÀiÁ£ÀzÀ ©PÀÌlÄÖUÀ¼ÀÄ : ¥ÀzÀägÁd zÀAqÁªÀw

WÀlPÀ – 6 ªÀÄvÀÄÛ WÀlPÀ 7 : ¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPÉUÀ¼ÀÄ (lÄåmÉÆÃjAiÀÄ¯ï)

- PÀ£ÀßqÀ ¥ÀwæPÉUÀ¼À£ÀÄß N¢¸ÀÄªÀÅzÀÄ
- PÀ£ÀßqÀ ¥ÀwæPÉUÀ¼À£ÀÄß ¸ÀAUÀæ»¸ÀÄªÀAvÉ ¸À®ºÉ ¤ÃqÀÄªÀÅzÀÄ
- PÀ£ÀßqÀ ¥ÀwæPÉUÀ½UÉ ¥ÁæAiÉÆÃVPÀªÁV ¯ÉÃR£À §gÉ¸ÀÄªÀÅzÀÄ
- ¥ÁæAiÉÆÃVPÀ ¥ÀwæPÉUÀ¼À£ÀÄß gÀÆ¦¸À®Ä ªÀiÁUÀðzÀ±Àð£À ¤ÃqÀÄªÀÅzÀÄ.
- PÀ£ÀßqÀzÀ ¸Á»vÀå ªÀÄvÀÄÛ ¥ÀwæPÉUÀ¼À «ZÁgÀ¸ÀAQgÀtªÀ£ÀÄß K¥Àðr¸ÀÄªÀÅzÀÄ
- ¥ÀwæPÉUÀ¼À ¯ÉÃR£ÀUÀ½UÉ ¸ÀA§AzsÀ¥ÀlÖAvÉ C©ü¥ÁæAiÀÄ ªÀÄAqÀ£ÉUÉ CªÀPÁ±À PÀ°à¸ÀÄªÀÅzÀÄ.

¥ÀgÁªÀÄ±Àð£À UÀæAxÀUÀ¼ÀÄ

1. ªÀÈvÀÛ ¥ÀwæPÉ : r.«,f
2. ¨sÁgÀwÃAiÀÄ ¥ÀwæPÉÆÃzÀåªÀÄzÀ EwºÁ¸À : £ÁrUÀ PÀÈµÀÚªÀÄÆwð
3. EzÀÆ ¥ÀwæPÉÆÃzÀåªÀÄ : £ÀgÉÃAzÀæ gÉÊ zÉÃ®ð
4. ¨Á£ÀÄ° §gÀºÀ : r. PÉ. gÀ«
5. ¸ÀªÀÄÆºÀ ¸ÀA¥ÀPÀð ªÀiÁzsÀåªÀÄUÀ¼ÀÄ : ©.J¸ï. ZÀAzÀæ±ÉÃRgï
6. eÁ»ÃgÁvÀÄ : PÉ. «. £ÁUÀgÁdÄ
7. ªÁZÀPÀgÀ ªÁtÂ : ¸Á»vÁå£ÀAzÀ
8. ¥ÀwæPÉÆÃzÀåªÀÄ PÉÊ¦r . «. D£ÀAzÀ ªÀÄÆwð
9. DPÁ±ÀªÁtÂ ¸Á»vÀå : J£ï. J¸ï. «dAiÀÄ ºÀgÀ£ï
10. §gÀªÀtÂUÉ MAzÀÄ PÀ¯É : ¤gÀAd£À ªÁ£À½î
11. ªÀiÁzsÀåªÀÄ aAvÀ£À : ¯ÉÆÃ»vï. eÉ
12. ¥ÀwæPÉÆÃzÀåªÀÄzÀ ¥ÀjZÀAiÀÄ : PÉ. eÉ. eÉÆÃ¸É¥sï
13. ¸ÀÈd£À²Ã®vÉ ªÀÄvÀÄÛ ¸ÀªÀÄÆºÀ ªÀiÁzsÀåªÀÄUÀ¼ÀÄ : qÁ. J£ï. JA. VjeÁ¥Àw

¥Àæ±Éß ¥ÀwæPÉ ªÀiÁzÀj

ªÉÆzÀ®£ÉAiÀÄ, JgÀqÀ£ÉAiÀÄ, ªÀÄÆgÀ£ÉAiÀÄ ªÀÄvÀÄÛ £Á®Ì£ÉAiÀÄ

ZÀvÀÄªÀiÁð¸ÀUÀ¼À (¸É«Ä¸ÀÖgï) - ¹©¹J¸ï

¥ÀoÀåPÀæªÀÄzÀ PÀ£ÀßqÀ LZÀÒPÀ ¥ÀwæPÉUÀ¼À ¥Àæ±Éß ¥ÀwæPÉ ªÀiÁzÀj

r.J¸ï.¹ ªÀÄvÀÄÛ r.J¸ï.E ¥ÀwæPÉUÀ½UÉ C£ÀéAiÀÄªÁUÀÄªÀAvÉ

¸ÀªÀÄAiÀÄ: 3 UÀAmÉUÀ¼ÀÄ

UÀjµÀÖ CAPÀUÀ¼ÀÄ: 70

MAzÀÄ JgÀqÀÄ ªÀÄÆgÀÄ WÀlPÀUÀ½UÉ
CAPÀUÀ¼ÀÄ: 40

1. MAzÀÄ ¥Àæ±ÉßUÉ GvÀÛj¹ (JgÀqÀÄ ¥Àæ±ÉßUÀ¼À£ÀÄß PÉÃ¼ÀÄªÀÅzÀÄ)
   1 **X** 10 = 10
2. MAzÀÄ ¥Àæ±ÉßUÉ GvÀÛj¹ (JgÀqÀÄ ¥Àæ±ÉßUÀ¼À£ÀÄß PÉÃ¼ÀÄªÀÅzÀÄ)
   1 **X** 10 = 10
3. MAzÀÄ ¥Àæ±ÉßUÉ GvÀÛj¹ (JgÀqÀÄ ¥Àæ±ÉßUÀ¼À£ÀÄß PÉÃ¼ÀÄªÀÅzÀÄ)
   1 **X** 10 = 10
4. JgÀqÀÄ ¥Àæ±ÉßUÀ½UÉ GvÀÛj¹ (£Á®ÄÌ ¥Àæ±ÉßUÀ¼À£ÀÄß PÉÃ¼ÀÄªÀÅzÀÄ) 2 **X** 5 = 10

¥ÀÆgÀPÀ ¥ÀoÀå

CAPÀUÀ¼ÀÄ: 30

5. C) MAzÀÄ ¥ÀzÀå/UÀzÀå ¨sÁUÀzÀ «±ÉÃµÀvÉUÀ¼À£ÀÄß UÀÄgÀÄw¹.
   1 **X** 5 = 5

(DAiÀÄÝ JgÀqÀÄ ¨sÁUÀUÀ¼À£ÀÄß PÉÃ¼ÀÄªÀÅzÀÄ)

D) MAzÀÄ ªÁPÀåzÀ°è GvÀÛj¹ (LzÀÄ ¥Àæ±ÉßUÀ¼À£ÀÄß PÉÃ¼ÀÄªÀÅzÀÄ)

5 **X** 1 = 5

6. MAzÀÄ ¥Àæ±ÉßUÉ GvÀÛj¹ (JgÀqÀÄ ¥Àæ±ÉßUÀ¼À£ÀÄß PÉÃ¼ÀÄªÀÅzÀÄ)

1 **X** 10 = 10

7. JgÀqÀÄ ¥Àæ±ÉßUÉ GvÀÛj¹ (£Á®ÄÌ ¥Àæ±ÉßUÀ¼À£ÀÄß PÉÃ¼ÀÄªÀÅzÀÄ)

2 **X** 5 = 10

LzÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À

PÀ£ÀßqÀ ¸Á»vÀå ¥ÀjZÀAiÀÄ(GE)

Course Code :BA- ELE26021/ELE26022/ELE26023/ELE26024/ELE26025/ELE26026

¥ÀwæPÉ – 1 PÀ£ÀßqÀ ¸Á»vÀå ¥ÀjZÀAiÀÄ

WÀlPÀ – 1 ¥ÁæaÃ£À PÀ£ÀßqÀ ¸Á»vÀå ¥ÀjZÀAiÀÄ

C) PÀ£ÀßqÀ ¸Á»vÀåzÀ ¥ÁæaÃ£ÀvÉ; PÀ«gÁdªÀiÁUÀð, ªÀqÁØgÁzsÀ£É, ZÀA¥ÀÆ ¸Á»vÀå

C) zÁ¹ªÀÄAiÀÄå, C®èªÀÄ¥Àæ¨sÀÄ, §¸ÀªÀtÚ, CPÀÌªÀÄ°ÁzÉÃ«, °Àj°ÀgÀ, gÁWÀªÁAPÀ, ZÁªÀÄgÀ¸À,

gÀvÁßPÀgÀªÀtÂð, ¸ÀªÀðdÕ

¨sÁUÀªÀvÀ ªÀÄvÀÄÛ zÁ¸À¸Á»vÀå; PÀÄªÀiÁgÀªÁå¸À, ®Qëöä±À, ¥ÀÄgÀAzÀgÀzÁ¸À, PÀ£ÀPÀzÁ¸À

WÀlPÀ 2 – DzsÀÄ¤PÀ PÀ£ÀßqÀ ¸Á»vÀå ¥ÀjZÀAiÀÄ

C) ºÉÆ¸ÀUÀ£ÀßqÀ CgÀÄuÉÆÃzÀAiÀÄ: PÉA¥ÀÄ£ÁgÁAiÀÄt, ªÀÄÄzÀÝt

ºÉÆ¸ÀUÀ£ÀßqÀ ¸Á»vÀåzÀ ªÀÄÄRåWÀlÖUÀ¼ÀÄ: £ÀªÉÇÃzÀAiÀÄ, ¥ÀæUÀw²Ã®, £ÀªÀå ªÀÄvÀÄÛ

zÀ°vÀ §AqÁAiÀÄ ¥ÀAxÀUÀ¼À ¸ÀAQë¥ÀÛ ¥ÀjZÀAiÀÄ

D)©,JA,²æÃ., zÀ,gÁ, ¨ÉÃAzÉæ, PÀÄªÉA¥ÀÄ, ²ªÀgÁªÀÄ PÁgÀAvÀ, UÉÆÃ¥Á®PÀÈµÀÚ CrUÀ,

wgÀÄªÀÄ¯ ÁA§, wæªÉÃtÂ, ¸ÁgÁ C§Æ§Ìgï, EªÀgÀ ¸ÀAQë¥ÀÛ ¥ÀjZÀAiÀÄ

¥ÀgÁªÀÄ±Àð£À UÀæAxÀUÀ¼ÀÄ

1. PÀ£ÀßqÀ ¸Á»vÀå ZÀjvÉæ : gÀA. ²æÃ. ªÀÄÄUÀ½
2. PÀ£ÀßqÀ ¸Á»vÀå ZÀjvÉæ : vÀ.¸ÀÄ. ±ÁªÀÄgÁAiÀÄ
3. ºÉÆ¸ÀUÀ£ÀßqÀ ¸Á»vÀå ZÀjvÉæ : J¯ï. J¸ï. ±ÉÃµÀVjgÁªï,
4. ¸Á®Ä¢Ã¥ÀUÀ¼ÀÄ : PÀ£ÁðlPÀ ¸Á»vÀå CPÁqÉ«Ä
5. PÀ£ÀßqÀ ¸Á»vÀå PÉÆÃ±À : gÁd¥Àà zÀ¼ÀªÁ¬Ä

DgÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð¸À
PÀ£ÀßqÀ ¸Á»vÀå ¥ÀjZÀAiÀÄ(GE)
Course Code :BA- ELF25821/ELF25822/ELF25823/ELF25824/ELF25825/ELF25826

¥ÀwæPÉ – 1 PÀ£ÀßqÀ PÀ°PÉ – UÀ½PÉ
WÀlPÀ – 1 PÀ£ÀßqÀ ¸Á»vÀå PÀ°PÉ

C) PÀvÉUÀ¼À ¥ÀjZÀAiÀÄ : gÀAUÀ£À ªÀÄzÀÄªÉ - ²æÃ¤ªÁ¸À, ±ÀªÀzÀªÀÄ£É – ZÀzÀÄgÀAUÀ

C) PÀ«vÉUÀ¼À ¥ÀjZÀAiÀÄ: PÁtÂPÉ - ©,JA.²æÃ, £Á£ÀÄ §qÀ« - ¨ÉÃAzÉæ,

PÀ£ÀßqÀ ¥ÀzÀUÉÆ¼ï – f.¦. gÁdgÀvÀßA, ¤vÉÆåÃvÀìªÀ – PÉ.J¸ï. ¤¸Ágï CºÀªÀÄzï

D) £ÁlPÀUÀ¼À ¥ÀjZÀAiÀÄ : d®UÁgÀ – PÀÄªÉA¥ÀÄ, ¸ÀAPÁæAw - ¦. ®APÉÃ±ï (DAiÀÄÝ ¨sÁUÀUÀ¼ÀÄ)

WÀlPÀ 2 – PÀ£ÀßqÀ eÁÕ£À UÀ½PÉ

C) ¥ÀzÀeÁÕ£À – ªÀÄÆ® ¥ÀzÀUÀ¼ÀÄ, vÀvÀìªÀÄ – vÀzÀãªÀ, UÁzÉ, MUÀlÄ, £ÀÄrUÀlÄÖUÀ¼ÀÄ

C) ªÁåPÀgÀteÁÕ£À : £ÁªÀÄ. °AUÀ, ªÀZÀ£À. «¨sÀQÛ, ¸ÀA¢ü, ¸ÀªÀiÁ¸À

E) ªÁPÀåeÁÕ£À : ªÁPÀå ªÀÄvÀÄÛ ªÁPÀåzÀ «zsÀUÀ¼ÀÄ,. ¥Àæ§AzsÀ gÀZÀ£É, ¸ÀAPÉëÃ¥À ¯ÉÃR£À

¯ÉÃR£À aºÉßUÀ¼ÀÄ, ¨sÁµÁAvÀgÀ PË±À®

¥Àæ±Éß ¥ÀwæPÉ ªÀiÁzÀj

ªÀÄÄPÀÛ LaÒPÀ ¥ÀwæPÉ

f.E - **Generic Elective**

¸ÀªÀÄAiÀÄ: 2 UÀAmÉUÀ¼ÀÄ

UÀjµÀÖ CAPÀUÀ¼ÀÄ: 35

WÀlPÀ -1 **(CAPÀUÀ¼ÀÄ: 20)**

1. MAzÀÄ ¥Àæ±ÉßUÉ GvÀÛj¹ (JgÀqÀÄ ¥Àæ±ÉßUÀ¼À£ÀÄß PÉÃ¼ÀÄªÀÅzÀÄ) 1 **X**10 = 10
2. JgÀqÀÄ ¥Àæ±ÉßUÀ½UÉ GvÀÛj¹ (£Á®ÄÌ ¥Àæ±ÉßUÀ¼À£ÀÄß PÉÃ¼ÀÄªÀÅzÀÄ) 2 **X** 5 = 10

WÀlPÀ – 2 **(CAPÀUÀ¼ÀÄ: 15)**

3. JgÀqÀÄ ¥Àæ±ÉßUÀ½UÉ GvÀÛj¹ (£Á®ÄÌ ¥Àæ±ÉßUÀ¼À£ÀÄß PÉÃ¼ÀÄªÀÅzÀÄ) 2 **X** 5 = 10
4. MAzÉÆAzÀÄ ªÁPÀåzÀ°è GvÀÛj¹ (LzÀÄ ¥Àæ±ÉßUÀ¼À£ÀÄß PÉÃ¼ÀÄªÀÅzÀÄ) 5 **X** 1 = 5