

JSS Mahavidyapeetha
JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE
 OOTY ROAD, MYSURU – 570 025

POSTGRADUATE DEPARTMENT OF CHEMISTRY

Details of courses offered by the institution that focus on employability/ skill development during 2018-19

Name of the Course	Course Code	Employability/ Skill development	Highlighted Syllabus
Analytical Chemistry Practicals	CHA050 & CHB050	Skill development	<ol style="list-style-type: none"> 1. Determination of total acidity of vinegar and wines. 2. Determination of purity of a commercial boric acid sample, and Na₂CO₃ content of washing soda. 3. Determination of the pH of hair shampoos. 4. Analysis of water/ waste water for acidity by visual, pH metric and conductometric titrations. 5. Determination of ammonia in house-hold cleaners by visual and conductometric titration. 6. Spectrophotometric determination of creatinine and phosphorus in urine. 7. Flame emission spectrometric determination of sodium, potassium and calcium in river/ lake water. 8. Mercurimetric determination of chloride in blood or urine. 9. Determination of total hardness, calcium and magnesium hardness and carbonate and bicarbonate hardness of water. 10. Determination of calcium in calcium gluconate/ calcium carbonate tablets/ injections and of calcium in milk powder.
Inorganic Chemistry Practicals	CHA060 & CHB060	Skill development	<ol style="list-style-type: none"> 1. Determination of iron in haematite ore. 2. Estimation of calcium and magnesium carbonates in dolomite ore. 3. Determination of manganese dioxide in pyrolusite ore. 4. analysis of copper-nickel in alloy/mixture. 5. Gravimetric analysis of molybdenum with 8-hydroxyquinoline. 6. Spectrophotometric determinations of complexes. 7. Semimicro qualitative analysis of inorganic mixtures.
Organic Chemistry Practicals	CHA070 & CHB070	Skill development	<ol style="list-style-type: none"> 1. Preparation <i>p</i>-bromoaniline from acetanilide. 2. Preparation of <i>n</i>-butyl bromide from <i>n</i>-butyl alcohol. 3. Oxidation of cyclohexanol to adipic acid. 4. Esterification: Preparation of benzocaine from

			<p><i>p</i>-nitrotoluene.</p> <ol style="list-style-type: none"> Diazotization (Sandmeyer's reaction). Preparation benzilic acid from benzoin. Preparation of <i>o</i>-hydroxy benzophenone from phenyl benzoate <i>via</i> Fries rearrangement. Preparation of benzanilide from benzophenone oxime <i>via</i> Beckmann rearrangement. Preparation of benzoic acid from benzaldehyde (Cannizzaro Reaction). Preparation of chalcone. Separation of binary mixtures, identification of functional groups and preparation of suitable solid derivatives.
Physical Chemistry Practicals	CHA080 & CHB080	Skill development	<ol style="list-style-type: none"> Study of kinetics of hydrolysis of methyl acetate in presence of two different concentrations of HCl/H₂SO₄ and report the relative catalytic strength. Determination of partial molar volume of salt-water system. Determination of heat of solution of organic acid (benzoic acid/salicylic acid) by variable temperature method. Analysis of a binary mixture (Glycerol & Water) by measurement of refractive index. Determination of the molecular weight of a polymer material by viscosity measurements. Conductometric titration of a mixture of HCl and CH₃COOH against NaOH. Potentiometric titration of KI vs KMnO₄ solution.
Analytical Chemistry Practicals	CHC210 & CHD210	Skill development	<ol style="list-style-type: none"> Determination of calcium in limestone. Determination of vitamin C in orange juice. Determination of saccharin in tablets. Determination of iron in mustard seeds and phosphorus in peas by spectrophotometry. Determination of ethanol in wine. Analyses of waste waters for DO and COD by titrimetry. Analysis of a ground water sample for sulphate by titrimetry (EDTA) and turbidimetry. Determination of aspirin, phenacetin and caffeine in mixture and APC tablets. Ascorbic acid determination in natural orange juice by coulometry. Determination of fluoride in drinking water/ground water by spectrophotometry. Analysis of a soil Urine, Blood samples.
Inorganic Chemistry Practicals	CHC220 & CHD220	Skill development	<ol style="list-style-type: none"> Determination of bismuth, cadmium and lead in a mixture. Spectrophotometric determination of chromium and manganese in a steel solution.

			<ol style="list-style-type: none"> 3. Flame photometric determination of the metal ions. 4. Determination of iron as the 8-hydroxyquinolate by solvent extraction method. 5. Preparation and characterization of metal complexes. 6. Determination of the composition of iron-phenanthroline complexes.
Organic Chemistry Practicals	CHC230 & CHD230	Skill development	<ol style="list-style-type: none"> 1. Fractional crystallization: separation of mixture of naphthalene and biphenyl. 2. Thin layer chromatography: Separation of plant pigments. 3. Column chromatography: Separation of <i>o</i>- and <i>p</i>-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. 10. Estimation of ketones by haloform reaction. 11. Estimation of sugars by Bertrand's method. 12. Estimation of nitro groups, Estimation of amino group. 13. Determination of enol content by Meyer's method. 14. Determination of iodine value of an oil or fat. 15. Determination of saponification value of oil. 16. Determination of equivalent weight of carboxylic acid by silver salt method.
Physical Chemistry Practicals	CHC240 & CHD240	Skill development	<ol style="list-style-type: none"> 1. Study of kinetics of autocatalytic reaction. 2. Kinetics of saponification of ethyl acetate. 3. Spectrophotometric kinetics of oxidation. 4. Study the phase diagram of three component system. 5. Conductometric titrations. 6. Potentiometric titrations. 7. Spectrophotometric analysis
Inorganic Chemistry-I	CHA100	Employability	<p>Molecular symmetry and group theory The Point Groups Used with Molecules Representation of groups Applications of group theory Symmetry in Chemical bonding</p>
Spectroscopy	CHC 020	Employability	<p>NMR Spectroscopy Multiple resonance spectroscopy Electron Spin Resonance Spectroscopy NQR Spectroscopy Mössbauer spectroscopy Photoelectron Spectroscopy IR spectroscopy Mass Spectrometry</p>

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

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	2
4.	SWB HC-10	Social Work Practicum - III	0:1:2	3
5.	SWB SC-1	Communication and Counselling /	3:1:0	4
6.	SWB SC-2	Personal and Professional Growth/ Population and Environment/Social Science Perspectives for Social Work Practice	2:1:0	3
			Total	18

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/Employee Relations and Legislation	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	Gerontological Social Work / Social Work Practice with Children/Society and Social Work	4:0:0	4
			Total	19

IV Semester

Sl. No.	Course Code	Course Title	L:T:P	Credits
1	SWD HC-13	Organizational Behaviour and Organizational Development	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.

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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15. PRIA b Training of Trainers: A Manual for Participatory Training Methodology in Development, New Delhi: Society for Participatory Research in Asia.
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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 collecting 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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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.

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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.

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| 14. Rudrabasavaraj, M. N. 1986 | Cases in Human Resource Management,
Bombay: Himalaya Publishing House. |
| 15. Subba Rao, P. 1996 | Essentials of Human Resource Management
and Industrial Relations, Himalaya
Publishing House. |

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 industrialization 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. Provisions) 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.

Himalaya Publishing House.

16. Sanajaoba, Naorem 1985 Industrial Tribunal - Working, Procedure and Judicial Trends, New Delhi, Deep and Deep Publications.
17. Sharma, A. M. 1989 Industrial Relations - Conceptual and Legal Frame Work, Bombay, Himalaya Publishing House.
18. Saiyed I A, 2009 Labour Law, Mumbai, Himalaya Publishing House Pvt., Ltd.
19. Singh BD, 2005 Industrial Relations: Emerging Paradigms, New Delhi, Excell Books.
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22. Srivastava S C, 2009 Industrial Relations and Labour Law. New Delhi, Vikas Publishing House Pvt Ltd.
23. Subramanian, H. N. 1967 Labour Management Relations in India, Bombay, Asia Publishing House.
24. Tripathi, P. C. 1989 Personnel Management and Industrial Relations, New Delhi, S. Chand and Sons,.
25. Tyagi, B. P. 1976 Labour Economics and Social Welfare, Meerut, Jai Prakash Nath & Co.
26. Vaid, K. N. 1970 Labour Welfare in India, New Delhi, Sri Ram Centre for Industrial Relations.
27. Yoder, D. 1972 Personnel Management an Industrial Relations, New York, Prentice-Hall India.

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:

1. Bajpai, P. K. (Ed.) 1998 Social Work Perspectives on Health, Jaipur, Rawat Publications.
2. Brody, Elaine M. and Contributors. 1974 A Social Work Guide for Long-Term Care Facilities, U. S. Dept. of Health, Education and Welfare, Public Health Service, Maryland: National Institute of Mental Health.
3. Butrym, Zofia and Horder, John. 1983 Health, Doctors and Social Workers, London: Routledge and Kegan Paul.
4. Clark, D. W. and MacMahon, B. (Ed.) 1981 Preventive and Community Medicine, Boston. Little, Brown and Company,
5. Friedlander, W. A. 1967 Introduction to Social Welfare (Chapter 12: Social Work in Medical and Psychiatric Settings), New Delhi: Prentice-Hall of India.
6. Hilleboe, H. E. and Larimore, G.W.1966 Preventive Medicine, Philadelphia, W. B. Saunders Company.
7. Humble, Stephen and Unell Judith (Ed.) 1989 Self Help in Health and Social Welfare, London: Routledge.
8. Jordan, William. 1972 The Social Worker in Family Situations, London: Routledge and Kegan Paul.
9. Lathem, W. and Newbery, A. 1970 Community Medicine - Teaching, Research and Health Care, London, Butterworths.
10. Mathur, J. S. 1971 Introduction to Social and Preventive

- Medicine, New Delhi, Oxford and LB.H. Publishing Company,
11. Mechanic, David 1968
Medical Sociology- A Selective View, New York, Free Press.
 12. Mishne, Judith (Ed.) 1980
Psychotherapy and Training in Clinical Social Work, New York: Gardner Press.
 13. Nichols, P. J. R. (Ed.) 1980
Rehabilitation Medicine, London: Butterworths.
 14. Park, K. 2002
Park's Textbook of Preventive and Social Medicine, Jabalpur, Banarsidas Bhanot.
 15. Pathak, S. H. 1968
Medical Social Work, Chapter.25, In Wadia, A R (Ed.) : History and Philosophy of Social Work in India, Bombay: Allied Publishers.
 16. Ramachandrudu, G. 1997
Health Planning in India,' New Delhi, A. P. H. Publishing Corporation.
 17. Rusk, Howard A. 1977
Rehabilitation Medicine, Saint Louis: Mosby Company.
 18. UNICEF
Health and Basic Services, New Delhi, UNICEF South Central Asia Regional Office.

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.

REFERENCES

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A Short Textbook of Psychiatry, Third Edition, New Delhi, Jaypee Brothers.

2. Anderson, David. 1982
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London, Macmillan Press Ltd.

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In.
Wadia, A. R. (Ed.): History and
Philosophy of Social Work in India,
Bombay: Allied Publishers.

4. Brody, Elaine M. and
care
Contributors 1974
A Social Work Guide for Long-term
Facilities, U. S. Department of Health,
Education and Welfare, Public Health
Service, Maryland: National Institute
of Mental Health.

5. Coleman, J. C. 1976
Life,
Abnormal Psychology and Modern
Bombay, D. B. Taraporevala and Sons.

6. Dickerson, Martha Ufford. 1981
Social Work Practice with the Mentally
Retarded, New York: Free Press.
7. Freedman, A. M. and
Kaplan, H. I. (Eds.) 1967
Comprehensive Textbook of
Psychiatry,
Baltimore, Williams and Wilkins
Company.

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Psychiatric Social Work, New York;
The Commonwealth Fund.

9. Friedlander, W. A. 1967
Introduction to Social Welfare,
(Chapter 12: Social Work in Medical
and Psychiatric Settings), New Delhi:
Prentice-Hall of India.

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Understanding Psychology, 4th
Edition, Tata McGraw-Hill Publishing
Company Limited, New Delhi

11. Golan, Naomi. 1978
Treatment in Crisis Situations, New
York: Free Press.

12. Henderson, Sir David
and Batchelor, I. R. C. 1962
Textbook of Psychiatry, New York
Oxford University Press.

13. Hudson, Barbara L. 1982
Social Work with Psychiatric Patients,
London: Macmillan.

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Self Help in Health and Social Welfare, London: Routledge.
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A History of the Mental Health Services, London: Routledge and Kegan Paul.
16. Jordan, William. 1972
The Social Worker in Family Situations, London: Routledge and Kegan Paul.
17. Maller, Joshua-o. 1971
The Therapeutic Community with Chronic Mental Patients, S. Karger.
18. Mishne, Judith (Ed.) 1980
Psychotherapy and Training in Clinical Social Work, New York: Gardner Press.
19. Page, J. D. 1983
Abnormal Psychology, New York, McGraw-Hill.
20. Robbins, Arthur J. 1957
Mental Hospitals in India and Social Work Service, Delhi School of Social Work.
21. Strean, Herbert S. 1979
Psychoanalytic Theory and Social Work Practice, New York: Free Press.
22. Stroup, H. H. 1960
Social Work - An Introduction to the Field, (Chapter 9: Psychiatric Social Work), New Delhi: Eurasia Publishing House.
23. Todd,F.Joan.1967
Social Work with the Mentally Subnormal, New York: Routledge and Kegan Paul.
24. Towle, Charlotte. 1941
Social Case Records from Psychiatric Clinics with Discuss Notes, Chicago; Illinois: University of Chicago Press.
25. Yelloly, Margaret. 1980
Social Work Theory and Psychoanalysis, New York: Van Nostrand Reinhold Company.

26. National Mental Health Programme for India

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 familiar 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

1. Bhattacharyya, Dipak Kumar.1999 Managing People, New Delhi, Excel Books.
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 Principles 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.

**CHOICE BASED CREDIT SYSTEM AND
CONTINUOUS ASSESSMENT AND GRADING PATTERN**

SYLLABUS FOR

**MASTER'S DEGREE PROGRAM
IN
BIOTECHNOLOGY
2018-19**



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

II SEMESTER

COURSE CODE: BTB040

COURSE TITLE: GENE TECHNOLOGY (HARD CORE)

TOTAL DURATION:

48Hrs

Course Outcome:

After studying this course, the students are able to:

CO1- Learn different molecular tools used in recombinant DNA technology

CO2- Understand applications like gene sequencing, variants of PCR, gene therapy, human genome project, molecular markers, microarray

CO3- Know the development of GMOs and bioethics.

UNIT No.	CONTENT	Duration in Hrs
I	Cloning and Expression vectors: Plasmids, lambda vectors, M13 Phage, Cosmids, Phagemids, BACs, PACs, plant and animal viruses as vectors, Transposons, YAC and MAC vectors, Expression vectors: Promoters, expression cassettes, Baculovirus, Virus expression vectors for mammalian cells, binary and shuttle vectors.	8
II	Recombinant DNA and Molecular probes: Restriction enzymes for cloning, Technique of restriction mapping, construction of chimeric DNA: cloning in plasmid, Phage and cosmid vectors, hosts for cloning vectors.	4
	Molecular probes: preparation, labelling, amplification, techniques of molecular probing, applications, and Molecular markers.	2
	Gene analysis techniques: Nucleic acid hybridization, Southern and Northern blotting, mapping genes to chromosomes, <i>in situ</i> hybridization, Polymerase chain reaction- Types, RAPD, AFLP, RT-PCR, realtime PCR, microsatellites, applications.	4
	Gene libraries: Construction and screening of genomic and cDNA libraries, chromosome walking, Chromosome Jumping, BAC libraries and assembly of BACs into contigs.	2
III	Isolation, Sequencing and synthesis of genes: Isolation of genes for: specific proteins, proteins having tissue specific expressions, isolation of genes using DNA or RNA probes. Sequencing by Maxam and Gilberts methods, Sangers dideoxy method, automatic DNA sequencers, by PCR, DNA sequencing through transcription, sequencing using DNA chips, sequencing by DE-MALDI-TOFMS. Gene synthesis machines, gene synthesis using PCR, mRNA.	8
	Gene Therapy: Human diseases targeted for gene therapy, Vectors and other delivery systems for gene therapy, <i>Ex vivo</i> and <i>In vivo</i> gene therapy, tissue of choice for gene therapy, In-vitro gene therapy, gene therapy of genetic diseases: eg. Neurological, metabolic disorders and cystic fibrosis, gene therapy for acquired diseases infections, cardiovascular, cancer. Nanotechnology for drug targeting and gene therapy, Future of gene therapy	6

IV	Genomics & Proteomics: Concept of a genome – information content in genome sequences, Whole genome analysis – construction of cosmid libraries, BAC libraries, shotgun cloning and sequencing, automated sequencing, sequence assembly Understanding genome sequence – sequence annotation – searching for ORF's and expressed sequences, homology analysis, sequence similarity and structural similarity, comparative genomics Functional genomics – DNA microarray, microarray fabrication, gene expression using microarrays, transcriptome Proteome analysis – two dimensional separation of total cellular proteins, isolation and sequence analysis of individual protein spots by mass spectroscopy; protein microarrays Human genome project	8 6
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Reference Books

1. A Text Book of Bio-technology. H. D. Kumar.
2. Genetic Engineering: Primose, S. B.
3. Principles of gene manipulation and genomics. Primose, S. B. and Twyman, R. M.
4. Gene cloning and DNA analysis an Introduction. Brown, T. A. Blackwell Science Company.
5. Molecular Biology and Biotechnology. Walker, J. M. and Rapley, R. Panima Publishing Corporation.
6. Molecular Biotechnology – Principles and application of Recombinant DNA. GLicks, R. Bernard and Pasternak, J. Jack. Panima Publishing Corporation.
7. Genes (VIII edition). Benjamin Lewin. Pearson Education International.
8. Molecular Biology of the gene (V edition). Watson, J. D. *et al.*, Pearson Education Publication.
9. Enzymology Primer for Recombinant DNA technology. Hyone-Myong Eun. Academic Press.
10. From Genes to clones. Winnacker. Panima Publishing Corporation.
11. Genomes. Brown, T. A. Jhon Wiley and sons Publication. 1999.
12. Bacterial Plasmids. Breda, P.
13. Genetic Engineering - Principles and Practice. Sandhya Mitra. MacMillan India Ltd.



JSS COLLEGE OF ARTS COMMERCE AND SCIENCE
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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
<p>*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.</p> <p>**Any two soft core papers shall be studied.</p>				

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 16				Credits:
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

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	

Q I.

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 algal 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, programmed 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 megasporogenesis, 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 Systematic Bacteriology; C. R. Woese- Three domain classification of Bacteria; Archaeobacteria 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 Microorganisms, 13th edn. Benjamin Cummings.
- 2) Willey, J, Sherwood, L. and Woolverton, C.J. 2013. Prescott's Microbiology 9th edn. Mc Graw- Hill Education.
- 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. Virology. Prentice Hall, Englewood Cliffs, New Jersey.
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- 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.
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- 13) Flint, S.J. Enquist, L.W., Rancicillo, 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 Pteridophytes).

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:

- 1) Bower, F.O. 1935. Primitive land plants, Macmillan, London.
- 2) Campbell, D. H. 1972. Evolution of land plants (Embryophytes), Central Book Department Allahabad.

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- 9) Chapman and Chapman. 1973. The Algae. Macmillan Co., New York.
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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, Botanicum-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, Nymphaeaceae, 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 analysis-rooted and unrooted trees; Data analysis- alignment, substitution, model building; Phylogenetic 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:

1. Cronquist, A. 1981. An Integrated system of classification of flowering plants. Columbia University Press, New York.
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.
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11. Nei, M. and Kumar, S. 2000. *Molecular Evolution and Phylogenetics*. Oxford Univ. Press, New York
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:

- 1) Alexopoulos, C. J., Mims, C. W. and Blakwell, M. 2007. Introductory Mycology 4th edn. Wiley India, New Delhi.
- 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.
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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.

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- 1) Bold, H. C. and Wynne, M. J. 1978. Introduction to the algae. Structure and reproduction. Prentice Hall, New York.
- 2) Chapman and Chapman, V.J. 1973. The Algae. Macmillan Co., New York.
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- 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.
- 6) Odum, E. P. Fundamentals of Ecology. 3rd edn. Toppan Co., Ltd., Japan.
- 7) Round, F. E. 1973. Biology of the algae. Edward Arnold Ltd., London.
- 8) Southcott, G. R. and Whittick, A. 1987. Introduction to Phycology. Blackwell Scientific Publication, UK.
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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. *JeJSME* 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 foliicolous 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, Ascosporeogenesis; 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; Phosphate 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.
- 3) Awasthi D. D. 2013). A hand book of lichens , Publisher: M/s Bishen Singh Mahendra Pal Singh, Dehra Dun.
- 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.

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; Potato 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.

- 4) Johnston, A and Both, C. 1983. Plant Pathologists Pocket-book. 2nd edn. Commonwealth Mycological Institute, Oxford and IBH Pub. Co. Calcutta.
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- 8) Schumann, G. L. and D'Arcy, C. J. 2012. Hungry Planet: Stories of Plant Diseases, APS Press, USA.
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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 embryo sac; 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, ruminant 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, pluripotency, 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 meristeme 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*, *Grevillia 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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- 4) Eames, 1961. Morphology of Angiosperms. McGraw Hill book Co., Inc., New York.
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- 8) Turing, A. M. 1952. The chemical basis of morphogenesis. Phil. Trans. R. Soc. Lond. B. 237: 37- 72.
- 9) Sinnot, E. W. 1960. Plant Morphogenesis. Mc Graw- Hill Book Co. Inc. New York, USA.
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- 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.
- 14) Smith, H. 1975. Phytochrome and Photomorphogenesis- an introduction to the photocontrol of plant development. Mc Graw- Hill Book Co. (UK), Ltd.
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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; **Concept 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.

- 3) Hartl. D. 1991. Basic Genetics. 2edn., Jones and Barlett Publishers Inc. Boston.
- 4) Fairbanks, D.J. and Anderson, W.R. 1999. Genetics the continuity of Life. Brooks's/Cole publishing Company, California.
- 5) Brooker. R.J. 1999. Genetics –analysis and principles. Addison Wesley Longman Inc. California.
- 6) Snustad, D.P., Simmons, M.J. and Jenkins, J.R. 1997. Principles of Genetics. Hohn Wiley & son's inc. New York.
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- 9) Strickberger, Monroe W. 2000. Evolution. 3rd Edn. Jones & Bartlett Publishers, Inc. 40 Tall Pine Drive Sudbury, MA 01776, USA.
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- 14) Buchanan, B.B. W.Gruissem and Jones, R.L. (2000). Biochemistry and Molecular Biology of Plants. ed. ASPP Press. USA.

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-** gene 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.

References

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- 4) Fairbanks, D.J. and W.R. Anderson. 1999. Genetics the continuity of life. Brooks's/Cole publishing company. California.
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- 12) Chopra, V.L. 2000. Plant Breeding- theory and practices. Oxford and IBH Publishing Co. Pvt. Ltd., Oxford.
- 13) Chahal, G.S. and Gosal, S.S. 2002. Principles and procedures of Plant Breeding. Narosa Publishing House, New Delhi.

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 anomalous 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:

- 1) Abraham, F. 1982. Plant Anatomy. 3rd edn. Pergamon Press. Oxford.
- 2) Cariquist, S. 1967. Comparative Plant Anatomy- Holt Reinert and Winston, New York.
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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.

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- 4) Jain, S.K. 1990. Contributions of Indian ethno-botany. Scientific Publishers, Jodhpur.

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- 7) Rajiv K. Sinha – Ethno-botany The Renaissance of Traditional Herbal Medicine – INA – SHREE Publishers, Jaipur-1996
- 8) Faulks, P.J. 1958. An introduction to Ethno-botany, Moredale pub. Ltd. London

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.
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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.
- 3) Agrobios, India.
- 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:

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- 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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- 16) Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones. Springer Verlag, New York, USA.
- 17) Singhal *et al.* 1999. Concepts in Photobiology, Photosynthesis and Phytomorphogenesis, Narosa Pub. House, New Delhi.

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 ferritin and transferrin 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 T_m value of DNA.
- 9-12) Photo graphs/ charts related to molecular biology/Molecular Biologists.

References:

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- 10) T.A. Brown, 2000. Essential of Molecular Biology, Vol-I & 2 Oxford University Press.
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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, androgenesis 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, Lambda 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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- 2) Plant Biotechnology. 2000. J.H. Hammond, P. Mcgarvey, and V. Yusibov (eds). Springer Verlag, Heidelberg.
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- 4) Plant Biotechnology -The Genetic Manipulation of Plants, Adrian Slater, Nigel Scott and Mark Flower, Oxford University Press, (2000).
- 5) Plant Genetic Transformation and Gene Expression by (eds) J.Draper *et.al*. Blackwell Scientific Publications, Oxford (1988).
- 6) Reinert, J. 1982. Plant Cell and Tissue Culture: A Laboratory Manual. Narosa Publishing House, New Delhi.
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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:

- 1) Buchmann, B.B., Gruissem, W., and Jones, R.L. 2000. Biochemistry and Molecular Biology of Plants. ASPP Press, USA.
- 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.
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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 pathogenicity 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 Transduction-** 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 on 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 lipoxygenase 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.
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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- types 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: Phytochemistry: 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 2ndedn. New Age International Pvt Ltd. New Delhi.
- 5) Harborne, J.B. 1984. Phytochemical Methods, 2ndedn. 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
- 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) 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 quadrat method.
- 2) Water analysis for pollution studies.(Bio-monitoring: TDS, Hardness, Chlorides, CO₂ COD, DO, BOD)
- 3) Rapid detection of bacteriological quality of water with special reference to faecal 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, Taylor 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. 2nd 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 COLLEGE OF ARTS, COMMERCE & SCIENCE
(AUTONOMOUS)
OOTY ROAD, MYSORE-570 025

Postgraduate Department of Commerce

2018-19

MCB050 ENTREPRENEURIAL DEVELOPMENT

Course Objective:

CO1: Write down in detail with examples skills of an young entrepreneurs
CO2: Write down in detail with examples techniques of project planning, implementation and execution
CO3: Identify in detail with examples institutional support to entrepreneurs
CO4: Learn the characteristics of MIS in project

Module – 1: Entrepreneurship: Need, Scope, Entrepreneurial Competencies and Traits, 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, Relationship between Small and Large Units; Indian MSME Sector - Nature, Contribution to Economy, Problems and Government Schemes; and MSMEs Act, 2006.

Module – 2: Entrepreneurial Development Programs and Small Business: Relevance and Achievements of EDPs, Role of Government in Organizing such Programs, Women and Rural Entrepreneurs - Present Status in India. Small Business: Concept and Definition, Role of Small Business in Modern Indian Economy, Small Entrepreneur in International Business, 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, Scope and Importance, Role of Project Manager. Project Appraisal - Preparation of a Real Time Project, Feasibility Report containing 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, Factory Design and Layout, and Feasibility Report Preparation.

Module – 4: Project Planning: Functions, Project Objectives and Policies, Identifying Strategic Project Variables; Statement of Work; Mile Stone Schedules Tools for Planning Hierarchy of Plans. 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

MCC210 Indirect Tax Law and Practice

Course Objective:

CO1: To comprehend the principles of taxations, objectives of taxes and its impact, shifting and incidence process of indirect taxes in market orientated economy
CO2: To understand the implications of indirect taxes on the taxable capacity consumers, dealers and of the society at large and its changes
CO3: To make them to be a tax consultant in preparing the tax planning, tax management. Payment of tax and filling of tax returns
CO4: To understand the impact of tax on Domestic, National and International Trade and educating the students as a tax audit, consultant and managers

Modul-1: Excise Duty: Nature of Excise Duty-Definitions-Basis of Duty Payable-Basis of Assessable Value-Transaction Value as Assessable Value-Inclusions in and Exclusions from Transaction Value-Valuation Rules to Determine Assessable Value-Sale to a Related Person. Excise Duty on Small Scale Industries.

Module-2: Value Added Tax: Concept of value added. Cascading Effect of Taxes CENVAT, Cascading Effect of Taxes: CENVAT on Inputs-CENVAT on Capital Goods- Dealers' Invoice for CENVAT. Exemptions from Excise Duty- Payment of Duty>Returns-Assessment-Recovery and Refunds Administrative Set Up of Central Excise,

Modul-3: Customs Duty: Customs Act, 1962 and the related Rules, Circulars and Notifications; Customs Tariff Act, 1975 and the related Rules. Principles governing levy of customs duty, types of duty including protective duty, safeguard duty, countervailing duty and anti-dumping duty and exemption from customs duties. Basic principles of classification of goods and valuation of goods. Customs authorities, appointment of customs ports, warehousing stations. Provisions governing conveyance, importation and exportation of goods, special provisions regarding baggage, goods imported or exported by post, and stores.

Modul-4: Service Tax :Scope of Service Tax-Taxable Service- Administration of the Act- Exemptions from Service Tax-Rate of Service Tax- Computation of Service Tax in Case of Advertising Agency Services: Banking and Financial Services-General Insurance Services-Telephone and Pager Services-Tour Operating Services.

MCC250 Marginal costing and Decision making

Course Objective:

CO1: Identify the detail of wide range of managerial decisions
CO2: Deliberate the detail of techniques of controlling cost through standard costing
CO3: Understand the detail of managerial cost control decisions
CO4: Learn the detail of direct costing

Module 1: Introduction: Meaning- terminology- Scope & Concepts- Cost Behavior Analysis- Break Even Analysis- Approaches of Break Even Analysis in relation to cost & revenue. Factors- Multi-product Break Even Analysis- Assumptions Underlying Break Even Analysis- Limitations of Break Even Analysis- Case Studies.

Module 2: Contribution Concepts & Sort term Profitability Analysis: Profitability Analysis Under Constrained Conditions- Profit- Volume Ratio & its Uses- Profit Volume Graphs – Case Studies.

Module 3: Marginal Costing & Managerial Decisions: Profit Planning- Pricing Decision – Production Decision – Make and Buy Decision Joint & By-product Decision – Distribution Cost Analysis- Case Studies.

Module 4: Direct Costing: Meaning- Importance & Preparation of income statements- Comparison with Absorption Costing- Arguments in Favour of Direct Costing- Criticisms of Direct Costing. Value Analysis & Value Engineering: Basic Concept of Value- Constitution of a Value Analysis Team- Procedures Underlying Value Analysis Study- Benefits From & Resistance to Value Analysis Study- Reporting to Management- Objectives of Reporting- Reporting Needs of Different Management Levels- Types of Reports- General Principles of Reporting- Modes of Reporting- Reports to the Board of Directors- Reports to Top Management- Reporting to top Divisional Management- Reports to Junior Management Level- Preparation of Reports- use of Reports by Management- Case Studies.

MCC030 - Management of Non-profit organization

Course Objective:

CO1: Understand the Non-profit Sectors
CO2: Specify the Characteristics of Financial Reporting
CO3: Learn in depth training and development
CO4: Write down the details Governance and professionalism

Module 1: The world of non-profit enterprises – third sector, nonprofits sector, social enterprises; Economic, Sociological and Structural theories of nonprofits; Contemporary role of nonprofits; Nonprofits vis-à-vis State and Business

Module 2: Accounting & Finance – Financial reporting in nonprofits; Distinct needs of nonprofit accounting; Sources of funds and their implications; Basic tenets of fund management in nonprofits

Module 3: Human Resource Management – Volunteers & Staff, Critical issues of compensation, quality and retention, Training and development, Incentives and Motivation

Module 4: Governance and Professionalism – Governance process and Board role; Credibility and legitimacy issues; Professionalism, Productivity and measurement of quality

MCB 260: RETAIL MANAGEMENT

Module 1: Retailing Introduction to Retail: What is Retail?- Functions of a retailer-The Marketing-Retail equation The Rise of the Retailer – Proximity to customer – Rise of consumerism-Global retail market Challenges and opportunities-Empowered consumer-Technology enabled effectiveness Evolution of Retail in India-Drivers of Retail change in India-Emergence of young earning India Size of Retail in India: Clothing ,Textiles and Fashion accessories-Food And Food services Books & Music, Communication accessories –Emerging Sectors-FDI in retail-Retail Realities : Beyond Urban Boundaries –Challenges to Retail Development in India – Threat of new entrants –Substitutes, Bargaining Power of suppliers and buyers, Intensity of rivalry

Module 2: Retail Models And Theories Of Retail Development The Evolution of Retail formats – Theories of retail development-Environmental, Cyclical and Conflict Theory-The Concept of life cycle in Retail-Innovation, accelerative growth- Maturity Decline-Phase of growth in retail markets-Business models in retail-Classification based on ownership /Merchandise offered/Franchising /Non Store Retailing/Direct selling/Direct response marketing/Telemarketing/Fairs and Road Shows/Event Management/Automated Vending/kiosks/ The Cash & Carry/credit Marketing/Brand Management.

Module 3: Customer Relationship Management (Crm) CRM : What is CRM-Common Misconceptions-Definition-Components off CRM-Defining CRM Concepts – Customer Life Cycle- B to B CRM- Understanding Goal of CRM-Using Customer touch points – Deciding who should lead the CRM Functions : Marketing/Sales/Customer Services/ Product Support-Channel and other partners-CRM Planning – Developing Strategy- Building CRM Component-Analyzing and Segmenting Customers Taking it to Customers – Get Ready : Avoiding Common Barriers, GETSET: Organising for success and go: Developing your CRM strategy-CRM Building : Infrastructure, Information, Process, Technology, People – Managing quality information, Quality systems, Customer privacy.

Module 4: Services Management: Distinctive characteristics service operations-Service Benchmarking-Service strategy - Designing the service enterprise – Service quality-Service facility location-Managing service operations-Service-Supply relationships vehicle routing.

MCD250 Tools and Techniques of control

Course Objective

CO1: Deliberate the detail of cost control and management tools
CO2: Learn in detail with examples costing system for job and process oriented manufacturing environments
CO3: Identify the classification and characteristics of uniform costing and inter-firm comparison
CO4: Learn in depth objectives and criticism of management audit

Module 1: Budgetary Control: Objectives of Budgetary Control-Preparation of the Budget-Functional Budgets-Sales Budgets-Production Budget-Cost Budget-Plant Utilization Budget Capital Expenditure Budget-Selling & Distribution Cost Budget-Purchasing Budget & Cost Budget-The Master Budget-Operation of Budgetary Control-Flexible Budgetary Control-Zero-Base Budgeting-Case Studies.

Module 2: Standard Costing: Objectives-Principles-Determination of Standards for Material-Labor-Direct Expenses & Overhead Costs-Variable and Fixed Costs-Case Studies.

Module 3: Variance analyses: Material, Labor, and Overhead Variances-sales & Profit Variances-Disposition of Variances-Assessing the Significance of Standard Cost Variance-Standard Cost Accounting-Case Studies.

Module 4: Uniform costing & Interfirm Comparisons: Objectives and Purposes Underlying Uniform Costing-Development of Uniform Costing-Cost Audit-Meaning & Definition-Inclusion of Clause B to Sec.208 to Sub Sec. (d) to Sec. 209-Indian Companies Act 1956-Appointment of Cost-Cost Audit Programme-Records Relating to Materials-Labor Overhead-Depreciation-Stores & Spare Parts-Work-in-progress and Incomplete Contracts-Cost Auditor's Report-Application of Cost Audit Report Rules, 1963-Sachar Committee's Report. Management Audit: Meaning & Definition-objectives & Criticisms-Types of Audits-Arguments for & Against Management Audit-Social Audit-Steps Underlying Social Audit Programme-Social Audit Report-Limitations of Social Audits-Case Studies.



J S S COLLEGE OF ARTS, COMMERCE & SCIENCE

(AUTONOMOUS)

OOTY ROAD, MYSORE-570 025

(Autonomous under University of Mysore :: Re-accredited by NAAC with 'A' Grade)

Choice Based Credit System

MASTERS DEGREE

in

COMPUTER SCIENCE

Syllabus

2018-19

JAVA Programming

Course Code : CSA 210

UNIT 1: -

History and evolution of Java, An overview of Java, Data types, variables and arrays, Operators, Control statements.

UNIT 2 : -

Introducing classes, A closer look at methods and classes, Inheritance, Packages and interfaces.

UNIT 3 : -

Exception handling, Multithreaded Programming, Enumeration, Autoboxing, I/O, Applets.

UNIT 4 : -

String handling, Collection framework, Introduction to J2EE, Java servlet, Java server pages (JSP) and HTML, JDBC objects.

TEXT BOOKS:

1. The complete reference Java – 7th Edition – Herbert Schildt – Tata Mcgraw hill Edition.
2. The complete reference J2EE – Jem Keogh – Tata Mcgraw hill Edition.

REFERENCE BOOKS:

1. Programming with Java A primer – 4th Edition – E Balagurusamy – Tata Mcgraw Hill.
2. Head First Java – 2nd Edition

**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, Malpighian 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 lumbricoides* 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) Rhinoceros 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) Cypraea 6) Octopus
7) Sanguinolaria 8) Chicoreus 9) Ficus 10) Lambis 11) Mytilus 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) Protozoa 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., Stumft, 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) Longevity 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 Chromosomal 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 <i>Drosophila melanogaster</i>	1x4=04hrs
2) Preparation of culture media. Culture of <i>Drosophila</i> - Methods of maintenance.	1x4=04hrs
3) Study of morphology of <i>Drosophila melanogaster</i>	1x4=04hrs
4) Mounting of Sex comb of <i>Drosophila melanogaster</i>	1x4=04hrs
5) Mounting of Wing of <i>Drosophila melanogaster</i>	1x4=04hrs
6) Study of mutants of <i>D. melanogaster</i>	1x4=04hrs
7) Preparation of genital plate of <i>D. melanogaster</i>	2x4=08hrs
8) Chi square Analysis of F1, F2 and Test cross progeny in <i>Drosophila melanogaster</i> 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 <i>Allium cepa</i>	2x4=08hrs
10) Temporary squash preparation of Meiotic chromosomes from testis of <i>Poicelocerus pictus</i>	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.

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 Immunoelectrophoresis

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

**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. Chandrashekar, 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, Baren 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

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 atherosclerosis.
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. Immunohistochemistry techniques for localization of proteins in endocrine cells (Pituitary cell types or islet of Langerhans)

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 atherosclerosis
- D. Neuropathology of alcoholism and methanol poisoning.

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, Philadelphia.
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.

**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: Comparison of three Protochordates, Subphyla in terms of General comparison, 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) *Periophthalmus* 9) *Triacanthus*

10) *Notopterus* 11) *Exocoetus* 12) *Diodon hystrix* 13) *Echeneis 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. Cambridge University Press, London.
2. Barrington, E.J.W. 1965. The Biology of Hemichordata and Protochordata, Oliver and Boyd, Edinburgh.
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 glucuronic 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.
Hypothalamo - 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) Neuroendocrinology of Reproduction, Physiology and Behaviour. Austin, C. R and R. V. Short (eds) (1972) Reproduction in mammals. (1) Germ cells and Fertilization (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) *Sitotrua* (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 morphogenesis : 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 <i>Drosophila</i> (Live Observation of embryo) and dechoriation and observation of embryos | 2X2=04hrs |
| 4. Study of Imaginal discs – the precursors of adult structures in <i>Drosophila</i> | 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.
5. Wolpert, Beddington, Brockes, Jessell, Lawrence, Meyerowitz, (3rd Ed., 2006) Principles of Development, , Oxford University Press, New Delhi, INDIA.
6. Wolpert, L, Beddington, R, Jessell, T, Lawrence P, Meyerowitz, E, Smith J., 2001, Principles of Deveopment Oxford University Press Oxford.
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

**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.
3. Futuyama D.J (1986) Evolutionary Biology, Sinuauer Associates Inc. USA
4. Hartl D.L (2000) A primer of population genetics, Sinuauer Associates Inc. USA
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 synthetase, 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.

Identification 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
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

**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) Neuroendocrinology of Reproduction, Physiology and Behaviour.
2. Austin, C. R and R. V. Short (eds) (1972) Reproduction in mammals. (1) Germ cells and Fertilization (2) Embryonic and Foetal development (3) Hormones in Reproduction (4) Reproduction pattern (5) Artificial control of reproduction, Cambridge University press, London.
3. Barrington, E. J. W (1976) An introduction to general and comparative endocrinology, Oxford University press, London
4. Raghavendra Puri (2003) Mammalian endocrinology Vol. I & II, Dominant Publishers and Distributors, New Delhi.
5. Muneeth Kainth (2005) Chordate Embryology, Dominant Publishers and Distributors, New Delhi.
6. Moudgal, N. R. Yoshinaga K Rao, A. J. and P. R. Adiga (1991) Perspectives in primate reproductive biology. Wiley Eastern Ltd., New Delhi, Bangalore
7. Paul Wassar man and Jimmy D. Neill (2005) Knogbil and neill's physiology of reproductive volume 1st and 2nd and 3rd edition
8. Jones, R. E (1991) Human Reproductive Biology press N.Y
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 DGMT.
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

1. Begon, Harper and Townsend, 1995. Ecology: Individuals, populations and community. II edition. Blackwell Series, U.S.A.
2. Bhatia, H.S. 1998: A Text book on Environmental Pollution and Control, Galgotia, New Delhi.
3. Clarke, G.L. 1963. Elements of Ecology, . Wiley Eastern Limited. New Delhi.
4. Emmel, T.C. 1976. Population Biology, Harper and Row publishers, N.Y.
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7. Odum, E.P. 1983. Basic Ecology, Holt Saunders, Japan.
8. Sharma, P.D. 1996: Ecology and Environment Rastogi, Publications, Meerut.
9. APHA, 1992: Standard methods for examination of water and waste water, 18th edition
10. Negi, S.S and Bahuguna, V.K. 1983. An Introduction to wildlife management. Bishen Singh Mahendra Pal Singh. Dehara Dun, India.
11. NBA. 2004. The Biological Diversity Act (2002) and Biological Diversity rules (2004). National Biodiversity Authority, India.
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 behaviour in Animals. J.V. Publishing House Jodhpur India.
- 3) Vandenberg. J.E.(Ed) (1983). Pheromones and Reproduction in mammals. Academic Press. NewYork.
- 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, SO_x, 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.

Unit III: **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, Biotoxification 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.
4. Bio-pesticides in Insect Pest Management 1999. S. Ignacimuthu and Alok Sen, Phoenix Publishing House Pvt., Ltd., New Delhi.
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

7. Hosetti, B.B. 2001. A Text Book of Applied Aquatic Biology, Daya Publishing House, Delhi.
8. Hassall, K.A. 1990. The Biochemistry and uses Pesticides structure, metabolism and Mode of action and uses in crop protection, John Wiley & Sons. Inc.
9. Pandey, K. and J.P. Shukla, 1990. Elements of Toxicology. Radha publ. New Delhi.

**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 Ltd., London
3. Ltd., London

4. Hyman L. H. 1940. The invertebrates Vol.1 Protozoa through Ctenophora, McGraw hill co., N. Y.
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.
8. Russel – Hunter, W.D 1969. A. biology of higher invertebrates, Mac millon Co., Ltd.,
9. London.
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11. Clark, W. E 1963. History of the Primates IV Edn., Univ. of Chicago Press, Chicago.
12. Malcom Jollie, 1962. Chordata morphology – East-West Press Pvt. Ltd., New Delhi.
13. Romer, A. S. 1966. Vertebrate Paleontolgy, 3rd Ed., Univ. of Chicago Press, Chicago.
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16. Young J Z 1957 Life of mammals, Oxford University Press, London.

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:

1. The Human Genome 2001, Nature Vol. 409.
2. The *Drosophila* Genome. 2000, Science Vol. 267.
3. The *Caenorhabditis elegans* genome 1998. Science Vol. 282.
4. Introduction to Genetic Analysis. Griffiths, Anthony J.F.; Miller, Jeffrey H.; Suzuki, David T.; Lewontin, Richard C.; Gelbart, William M. New York: W.H. Freeman & Co.; 1999
5. Fundamental Neuroscience. Larry R. Squire, Darwin Berg, Floyd Bloom, and Sascha du Lac. Third Edition, Academic Press; 3 edition (2008)
6. Principles of Neural Science. Eric R. Kandel, James H. Schwartz, and Thomas M. Jessell. McGraw-Hill Medical; 4 edition(2000)
7. Neurogenetics: Scientific and Clinical Advances (Neurological Disease and Therapy) David R. Lynch, Informa HealthCare; 1 edition (2005)
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

9. Bioinformatics for Dummies, Claverie J. M., Notredame C., (2nd Ed., 2007), Wiley Publishing, Inc., New York, USA
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. Economic 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

1. Ashok Kumar (2009) Textbook of Animal Diseases
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)

SEMESTER I

Course code: EMA2104

ESC 14: Computer Science I

Problem Solving Using Computer

Credits: Theory – 04, Practical – 04

Elective: 00 Institute

COURSE OBJECTIVE:

After successful completion of the course, the student is able to:

- LO1: Understands the basic Computer Fundamentals.
- LO2: Understands in detail with feature Computer Organization.
- LO3: Learn the basics of Problem Solving Techniques.
- LO4: Understands the characteristics of Programming Language.
- LO5: Understands in detail with examples - Python Programming Language.
- LO6: Apply to design I/Os, From C++ and C++ language to Python.

Unit - 1

(10 Lectures)

Computer Fundamentals: Introduction to Computers; Characteristics of Computers; Uses of computers; Types and generation of Computers.

Basic Computer Organization: Units of a computer, CPU, ALU, memory hierarchy, registers, I/O devices.

Techniques of Problem Solving: Concept of problem solving, Problem definition, Program design, Debugging, Types of errors in programming, Documentation/flowcharting, Decision table, algorithms, structured programming concepts, Programming methodology (i). Top-down and bottom-up programming.

Unit - 2

(10 Lectures)

Overview of Programming: Structure of a Python Program, Elements of Python.

Introduction to Python: Python Interpreter, Using Python as interactive, Python shell, Introduction, Access, Identifiers and keywords, Literals, Strings, Operator (Arithmetic operators, Relational operators, Logical or Boolean operators, Assignment, Operator, Ternary operator, Bit wise operators, Increment or

Environment operators, Input and Output Statements, Control statements (Looping: while, for, for Else, for Loop, Loop Control)

Unit - 3

(18 Lectures)

Creating Python Programs: Conditional Statement (if, else, Difference between break, continue and pass)

Structural: Numbers, Strings, Lists, Tuples, Dictionary, Class & Class, Modules, Defining Functions, Exit function, default arguments.

Unit - 4

(18 Lectures)

Introduction to Advanced Python: Objects and Classes, Inheritance, Regular Expressions, Event-Driven Programming, GUI Programming.

References:

1. R. S. Yasthal-PyTutorials, "Tutorial Fundamentals", EPB Publications, 2007
2. Dr. Anita-Gard-Computer Fundamentals, Prentice Education, 2010
3. T. Hunt, Learning Python, Third, 1st Ed, 2012
4. Python Tutorial (The introduction were given in 2010)
5. Allen Downey, Jeffrey Elmer, Chris Meyer, How to think like a computer scientist: learning with Python, freely available online 2012

Problem Solving Using ComputerLab

Software's Lab using Python

Section A (Single program)

1. Write a menu-driven program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon user's choice.
2. Write a calculator total marks, percentage and grade of a student. Marks obtained in each of the three subjects are to be input by the user. Average grade according to the following criteria
 - Grade A: Percentage >=80
 - Grade B: Percentage >=70 and <=80
 - Grade C: Percentage >=60 and <=70
 - Grade D: Percentage >=50 and <=60
 - Grade E: Percentage <50

46 Computer Science - OBC Solution

1. Write a non-recursive program, using user-defined functions to find the area of triangle, square, circle and triangle by accepting suitable typed parameters from user.
2. Write a program to display the first n terms of Fibonacci series.
3. Write a program to find factorial of the given number.
4. Write a program to find sum of the following series for a given n : $1 + 2(2)^1 + 3(2)^2 + \dots + n(2)^{n-1}$.
5. Write a program to calculate the sum and product of two compatible numbers.

Section B (Visual Python)

47. The program should be written using user-defined functions, wherever possible.

1. Write a non-recursive program to draw mathematical (2D) objects:
 - (a) Circle
 - (b) Square
 - (c) Circle
 - (d) Arc
 - (e) Ellipse
 - (f) Polygon
2. Write a program to read a temperature and display that as a histogram.
3. Write a program to read, insert, polynomial and exponential series.
4. Write a program to plot a graph of people with polar axis p vs. height h . The values of p and h are to be entered by the user.
5. Write a program to calculate the mass rate in a chemical reaction. The mass rate for given substances according to the formula $\frac{dM}{dt} = kM$, 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:
$$P(t) = 1000 \exp(0.2t)$$
where the time t is measured in hours. Write a program to illustrate the growth 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 including equations of motion:
 - (i) Velocity vs. time $(v = u + at)$
 - (ii) Distance vs. time $(s = ut + \frac{1}{2}at^2)$
 - (iii) Distance vs. velocity $(v^2 = u^2 + 2as)$

SEMESTER V

Course code: CSE333

BS Computer Science - V Database Management Systems

Credits: Theory - 04, Practical - 02

Theory 60 Lectures

Course Outcome:

After successful completion of the course, the student is able to:

- CO1: Understand the characteristics of DBMS with examples.
- CO2: Differentiate the details of types of database languages with examples.
- CO3: Learn the details of ER Diagrams and Relationship.
- CO4: Understand in depth basic concepts of Relational Model.
- CO5: Learn in depth with examples RYNDJ Commands.
- CO6: Learn in detail with examples in PL/SQL.

Unit - 1

(15 Lectures)

Introduction to Database Management Systems: Definition of Data, Information, DBMS, Data base system application, Purpose of database systems, Characteristics of DB – Self describing system, Interaction between programs, data and data Abstraction (Data Independence), support of multiple views of the data, sharing of data and multiple transaction processing, Storage management, Database language – DDL, DML, DCL.

File processing system vs 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 Lectures)

Entity Relationship and Enhanced ER Modeling: Entity types, Entity Sets, Attributes, and Keys, Relationships, Relationship Types, Roles, and Structural Constraints, Weak Entity Types, ER Diagrams, Naming Conventions, SQL Schema Definition, constraints, and object modeling.

Unit - 3

(15 Lectures)

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 in relational modeling, functional dependencies, normal forms-first normal form, second normal form, third normal form, BCNF

Unit - 4

(18 Lectures)

SQL: DDL, DML, SQL, SQL, SQL, * PLUS SQL, COMMANDS, SQL, DATA, TYPES, OPERATORS AND EXPRESSIONS, INTRODUCTION TO SQL, * PLUS, MANAGING TABLES AND DATA

- CREATING AND ALTERING TABLES (INCLUDING CONSTRAINTS)
- DATA MANIPULATION COMMANDS LIKE INSERT, UPDATE, DELETE
- SELECT STATEMENT WITH WHERE, GROUP BY AND HAVING, ORDER BY, DISTINCT, SPECIAL OPERATOR LIKE IN, ANY, ALL BETWEEN, EXISTS, LIKE
- JOIN, NULL IN FUNCTIONS, OTHER DATABASE OBJECTS
- VIEW - SYNONYMS, INDEX, TRANSACTION CONTROL STATEMENTS
- COMMIT, ROLLBACK, SAVEDPOINT INTRODUCTION TO PL/SQL
- SQL VS PL/SQL, * PLUS, BLOCK STRUCTURE
- LANGUAGE CONSTRAINT ON PL/SQL (VARIABLES, BASIC AND COMPOSITE DATA, TYPE, CONDITIONS, LOOPING ETC.)
- % TYPE AND % ROWTYPE
- USING CURSOR (IMPLICIT, EXPLICIT)

References:

1. R. Elmasri, S.J. Navati, Fundamentals of Database Systems 4th Edition, Pearson Education, 2004.
2. H. Elmasri, S.J. Navati, Database Management Systems 3rd Edition, McGraw-Hill, 2002.
3. A. Abraham, S.P. Karthi, S. Sathishan, Database System Concepts 4th Edition, McGraw-Hill, 2010.
4. R. Elmasri, S.J. Navati, Database Systems: Models, Languages, Design and Applications Programming, 4th Edition, Pearson Education, 2002.

Database Management System Lab

Software Lab based on Database Management System

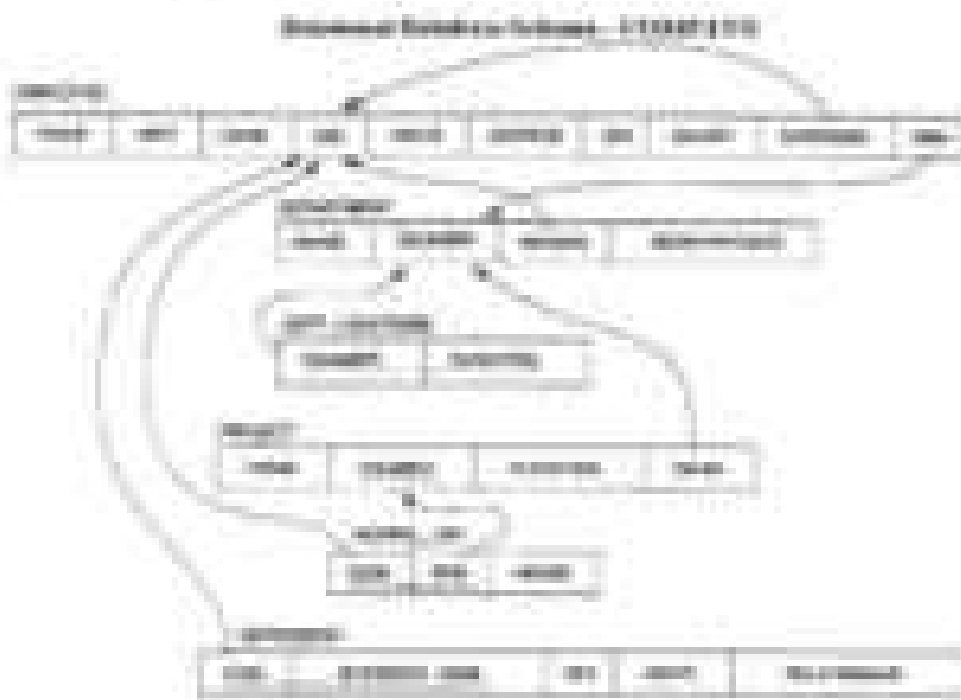
The following concepts need to be introduced to the students. System like database MySQL may be used.

DDL Commands

- Create table, alter table, drop table

DML Commands

- Select, update, insert, delete statements
- Conditions specification using logical and comparison operators (and, or, not, <, >, <=, >=)
- Arithmetic operators and aggregate functions (sum, max, avg, Min, Max)
- Multiple table queries (join or different and same tables) + Nested select statements
- Set operations using (+) to combine all set or set minus, set minus, union, set union, union, intersect, minus, etc.
- Grouping using group by _____ having
- Ordering 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. Employees, names, phone, address of employees who work in department no 1.

4. Retrieve the location and address of the employees whose name is 'Stanley T. Wong'.
5. Retrieve the name and salary of every employee.
6. Retrieve all distinct values taken.
7. Retrieve all employee names whose address is in 'Boston'.
8. Retrieve all employees who were hired during the 1980s.
9. Retrieve all employees in department 5 whose salary is between 50,000 and 60,000 inclusive.
10. Retrieve the names of all employees who do not have supervisors.
11. Retrieve SSN and department name for all employees.
12. Retrieve the name and address of all employees who work for the 'Research' department.
 - 12.1. For every project located in 'Boston', list the project number, the controlling department number, and the department manager's last name, address, and birthday.
 - 12.2. For each employee, retrieve the employee's name, and the name of his or her immediate supervisor.
13. Retrieve all combinations of Employee Name and Department Name.
14. Make a list of all project numbers for projects that involve an employee whose last name is 'Tracy' as a worker or as a manager of the department that controls the project.
 - 14.1. Increase the salary of all employees working on the 'Boston' project by 15%.
 - 14.2. Retrieve employee name and increased salary of those employees.
15. Retrieve a list of employees and the project name each works on, ordered by the employee's department, and within each department ordered alphabetically by employee last name.
16. Select the number of employees whose salary does not match with salary of any employee in department.
17. Retrieve the name of each employee who has a dependent with the name that same and same sex as the employee.
18. Retrieve the employee numbers of all employees who work on project located in Boston, Houston, or Dallas.
19. Find the sum of the salaries of all employees, the maximum salary, the minimum salary, and the average salary. Display with project headings.
20. 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.
21. Select the names of employees whose salary is greater than the average salary of all employees in department 10.
22. For each department, retrieve the department number, the number of employees in the department, and their average salary.
23. For each project, retrieve the project number, the project name, and the number of employees who work on that project.
24. Change the location and controlling department number for all projects having more than 5 employees to 'Boston' and 6 respectively.
 - 24.1. For each department having

102 Computer Science – DB2 Schema

more than 10 employees, reduce the department no. to 1 of employees drawing more than 40,000 in salary.

28. Insert a record in Project table which violates referential integrity constraint with respect to Department number. Now remove this violation by making necessary correction in the Department table.
29. Delete all dependents of employee whose emp no is 101456789.
30. Delete an employee from Employee table with emp no = 101456789 make sure that this employee has some dependents, is working on some projects, is a manager of some department and is supervising some employees. Check and display the remaining effect on Dependents and Works on table. In Department table DEPTNO should be set to default value and, in Employee table EMPNO should be set to NULL. Perform a query using star command to display field and a constraint in Employee table.

SEMESTER V

Course code: CMA3202

Elective Computer Science - V Computer Networks

Credits: Theory – 08, Practical – 02

Theory: 08 Lectures

Course Objectives:

After successful completion of the course, the student is able to:

- CO1: Understand the Elements of Data Communications and network Systems
- CO2: Learn in depth Transmission Media
- CO3: Understand in details with examples Network Models
- CO4: Understanding the various classifications and characteristics of Protocols
- CO5: Learn in depth Error Detection and Correction Algorithms
- CO6: Learn in detail of Network Security

Unit - 1

(05 Lectures)

Basic concepts: Components of data communication, standards and organizations, Network Classifications, Network Topologies ; network protocol, layered network architecture, overview of OSI reference model, overview of TCP/IP protocol suite.

Unit - 2

(08 Lectures)

Physical Layer: Cabling, Network Interface Card, Transmission Media Devices- Repeater, Hub, Bridge, Switch, Router, Gateway

Data Link Layer: Framing techniques, Error Control, Flow Control Protocols, Shared media protocols - CSMA/CD and CSMA/CA.

Unit - 3

(05 Lectures)

Network Layer: Virtual Circuits and Datagram approach, IP addressing methods – Subnetting, Routing Algorithms (adaptive and non-adaptive)

Transport Layer: Transport services, Transport Layer protocol of TCP and UDP

Unit - 4

(15 Lectures)

Application Layer: Application layer protocols and services: – Domain name system, HTTP, WWW, telnet, FTP, SMTP

Network Security: Common Terms, Firewall, Virtual Private Networks:

References:

1. R.S. Prasad: Data Communication and Networking, 4th Edition, Tata McGraw Hill, 2007
2. D.L. Cason: Internetworking with TCP/IP, Vol. 1, Prentice Hall of India, 1998.
3. W. Stallng, Data & Computer Communications, 4th edition, Prentice Hall of India, 2006.
4. H. Bhanuain, R. Datta: Data Networks, 3rd edition, Prentice Hall of India, 1992.

Computer Networks Lab

Software Lab based on Computer Networks

Implement the concepts of Computer Networks with an

1. Simulate Checksum Algorithm
2. Simulate CRC Algorithm
3. Simulate Stop & Wait, With Protocol
4. Simulate Go-Back-N Protocol
5. Simulate Selective Repeat Protocol with

SEMESTER VI

Course code: CME21902

DSE&A: Elective: Computer Science - VI Internet Technologies

Credits: Theory – 04, Practical – 01

Theory: 60 lectures

Course Outcome:

After successful completion of the course, the student is able to:

- CO1: Learn the details of HTML, CSS
- CO2: Understand the details of Basic PHP and implement
- CO3: Understand the details of Basic Concepts of Java Script
- CO4: Learn the Core Java Programming
- CO5: Write down in details with application and Usage of PHP
- CO6: Learn the detail of JSP Environment

Unit - 1

(18 Lectures)

Introduction to Web Design; Introduction to hypertext markup language (HTML) document type definitions, creating web pages, graphical elements, lists, hyperlinks, tables, web forms, inserting images, frames

Customized Features: Creating style sheets, (css) the text formatting and other manipulations.

JavaScript: Data types, operators, keywords, control structures

Unit - 2

(18 Lectures)

Java Script events and event handling

Java: Use of Objects, Array and Array List class, Designing classes, Inheritance, InnerClass, Exception Handling.

Unit - 3

(18 Lectures)

JDBC: JDBC Fundamentals, Establishing Connectivity and working with interactive interface, Working with statements, Creating and Executing SQL Statements, Working with Result Set Objects.

JSP: Introduction to Servlets, Pages, HTTP and Servlet Basics, The Profile with Servlets, The Anatomy of a JSP Page, JSP Processing, JSP Application Design with MVC.

Unit - 4

(15 Lectures)

Setting Up the JSP Environment, Implicit JSP Objects, Conditional Processing, Displaying Values, Using an expression to Set an Attribute, Declaring Variables and Methods, Error Handling and Debugging, Storing Data Between JSP Page Requests, and User, Database Access.

Reference Books

1. Web Enabled Commercial Application Development Using HTML, HTML, JavaScript, and CGI by Tom Archer, WPH Publications, 2009.
2. JSP Java Cap Hornsman, Wiley Publications, 3rd Edition, 2009.
3. Java 7 :The Complete Reference, Herbert Schildt, 9th Edition, 2009.
4. The Complete Reference JSP, TMH, Jia Singh, 2002.
5. Java Server Pages, Data Access, Third Edition, O'Reilly Media December 2002.

Internet Technologies Lab

Software Lab based on Internet Technologies

[JAVA Script]

1. Create a student registration form. Create functions to perform the following checks:
 - a. Roll number is a 7 digit numeric value
 - b. Name should be an alphabetical value (String)
 - c. Non-empty fields like DOB.
2. Implement a static password protection.
3. Write a java script
 - a. To change the colour of text using `setTextColor()`
 - b. To move an image across screen using `setInterval()`

[JAVA Programs]

1. WAP to find the largest of a natural numbers.
2. WAP to find whether a given number is prime or not.

3. Write a program to print the sum and product of digits of an integer and reverse the integer.
4. Write a program to create an array of 10 integers. Assign 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.
5. Write Java program for the following matrix operations:
 - a. Addition of two matrices
 - b. Subtraction of two matrices
 - c. Transpose of a matrixInput the elements of matrices from user
6. Write a Java program that computes the area of a circle, rectangle and a Cylinder using function overloading.

ETBC

1. Create a table 'Student' and 'Teacher' in 'College' database and insert two rows in this newly created table using JDBC API and do the following:
 - a. Update an already created table 'Teacher' in 'College' database by updating a teacher's name, with 'Sir' appended before the name, whose name is 'Rita'.
 - b. Repeat the same thing for all the teachers using PreparedStatement.
 - c. Delete the student with ID=3 from 'Student' database.
 - d. Insert two students in the ResultSet returned by the query which selects all students with FirstName="Ajay". The database must also get updated along with ResultSet.
2. Create a procedure in MySQL, to count the number of rows in table 'Student'. Use Callable Statement to call this method from Java code.

JP Practical list

1. Display the pattern

```
1
```

```
1 2
```

```
1 2 3
```

Take 'n' as a number from user. Display this pattern using

*-loopless

*-with-while-loop

2. Make two files as follows:

- a. main.html shows 2 text boxes and 3 radio buttons with values "addition", "subtraction" and "multiplication"
- b. operate.js, depending on what the user selects perform the corresponding function. (Give two implementations: using request.getParameter() and using expression language)
3. Validate User input entered in a form. The input must include Name, DOB, Email ID, lucky Number, Favorite food etc. (Refer Chapter 6)
4. Display Good Morning message, Good Afternoon message or Good Evening message based on the current time of the day
5. Create your pattern library which contains two tags: <hello>, <show>. Usage of the tags
 - <hello name="Ajay">: Output should be Hello Ajay. It contains a mandatory attribute 'name' which can accept dynamic value.
 - <show message="Darey">: Output should be Darey, HiDarey.
 - <show message="Crunchy">: Output should be Crunch, HiCrunch.That means the mandatory attribute must accept a value, and based on the attribute's value, it should give output. You must use a Java Description for this pattern.

V SEMESTER**SEC 5.1: - Electronic Computer Application (Practical)****Credit (L : T : P : R : B : I) 10 Hours****SEC 5.1.1: - Electronic Office Automation****Practical List for SEC5.1:**

1. Create a telephone directory.
 - The heading should be Microsoft Word 2010 or later
 - The rest of the document should use Microsoft Word 2010
 - Other headings should use Microsoft Word 2010
 - The footer should show the page number as well as the date and system.
2. Design a letter table form for your college.
 - The first line should mention the name of the college in Microsoft Word 2010 and should be bold.
 - The second line should give the postal master teacher's name and the department in Microsoft Word.
 - Leave a gap of Microsoft.
 - The rest of the document should use Microsoft Word 2010.
 - The footer should contain your specifications as the designer and date of creation.
3. Create the following document: A spreadsheet with a header and 3 columns in general dimensions, including at least one image recommended by you.

Practical List for SEC5.2:

1. Create a master worksheet containing cell numbers, names and total marks. Open a document in Word and insert the word worksheet using:
 - (i) Copy/Paste
 - (ii) Inserting
 - (iii) Linking
2. The new word marks for APN class of 20 students are given in 3 columns (first column total, second and third). Create a 4th worksheet that contains student names and their total and average marks for the entire year. Give proper headings using borders. Make the column headings bold and italic. The 4th worksheet should contain college name at the first line. Make it bold, italic and center it.
3. Consider the following employee worksheet:

Roll (First)	Name (Last)	Grade (1-5)	Score (Mark)	BLA	TP	Home	Yes	(BLA) Variable Allocation

BLA is calculated as follows:

Grade BLA Total (Mark)

1 80%

2 70%

3 60%

Level - Basic - MBA - B.A.

Unit - Quant. III

PT in 20% for all students

7.5 to 20.00, 20.00 and 20.00 for Grades 1, 2 and 3.

- Final year, total and average salary of employees in respective grade.
- Final year of people above 500000.
- Final year most frequently occurring grade.
- Final month when employees were rated with 'A' for MBA students.
- Final Grade into record of all employees with address of net salary and other paid costs. For national companies.
- Final records when Grade is 1 or 2 and salary is between 10000 and 20000 for all industries.

8. In a meeting of a marketing department of an organization it has been decided that profit of selling an item is fixed at 20%. It was resolved to increase the cost of each of many items and getting the profit of 20% (20% less than cost of that item) how many items can we sell to get at least 100000 per profit figure.

9. Consider the following constraint for ABC, f^2 programming:

Sl.No.	Item	PH	CH	HT	HT	CB	Unit Metric	No.	Grade
1									
2									

Grade is calculated as follows:-

87% >= 70% - Grade A

87% >= 70% - 70% - Grade B

87% >= 70% - 60% - Grade C

87% >= 70% - 50% - Grade D

Otherwise students will be declared fail

- Calculate Grade using if function
- Sort the data according to total marks
- Apply filter to display the marks of the students having more than 87% marks.
- Draw a pie chart showing % marks scored in each subject by the topper of the class.
- Draw the frequency chart of the data set in (b).
- Draw the S.No. of a student and find out the Grade of the student using VLOOKUP. Highlight all records where:-
 - Begin with 'A'
 - Contains 'B'
 - Ends with 'A'

Practical List for Power Point

- Create five Power-point slides. Each slide should appear different format. In first slide, explain about an application of IT. Make sure duration less or 10 seconds.
- Create five Power Point slides to give advantages/disadvantages of computer; application of computers and logical structure of computer.
- Create five Power Point slides showing the process of internal conversion. It should be a self-running form.

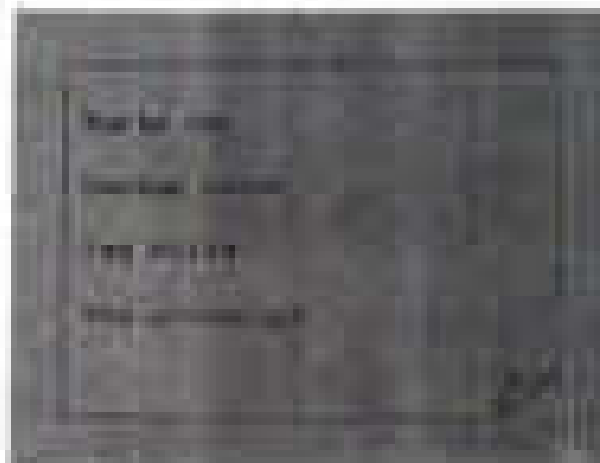
MIE 311: Exercise: XML Programming

Software Lab Based on XML:

Exercise 01 - Document Structure

In this exercise, student will practice identifying the structure of an information object. For the sample document provided below:

1. Label the information structure you see, including identifying structure.
2. Draw a tree representation of the structure.



Exercise 02 - Documenting an XML Document

In this exercise, student will practice identifying the explicit structure within an XML document. In a sense, this is the reverse of what you did in Exercise 01. For the sample XML markup below, create a document-like representation (or a simple drawing) for the content contained within the XML tags:

```
<book>
```

```
  <booktitle>
```

```
    The XML Handbook
```

```
  <author>Chapter 1: Introduction</author>
```

```
  <author>Paul Fresson</author>
```

```
  <author>Bernard Bellier</author>
```

```
  <description>The definitive XML authors, applications, products, and technologies. Current and expanded - over 600 new pages.</description>
```

```
</booktitle>
```

```
</author>
```

```
</book>
```

Exercise 03 - Drawing XML Markup

In this exercise, student create XML markup based on the tree representation from Exercise 01 above, and the content from the original sample document.

Exercise 04 - Self-Inspection

This exercise checks your understanding of the exercises for each description. Are the following document instances well formed? Explain any XML errors.

```
<booktitle>The XML Handbook</booktitle>
```

```
</author>Chapter 1: Introduction</author>
```

```
<author>Paul Fresson</author> <author>Bernard Bellier</author>
```

```
<description>The definitive XML authors, applications, products, and technologies. Current and expanded - over 600 new pages.</description>
```


BACHELOR**1 SEMESTER****BAC 1A) Computer Fundamentals & MS****Credit (L: T: P=4: 0: 2)****Course Outcomes**

After successful completion of the course, the student is able to

- CO1: Understand the details of computer system.
- CO2: Learn the classification and characteristics of computer system.
- CO3: Understand in detail with examples software.
- CO4: Identify the characteristics of devices.
- CO5: Learn the classification and characteristics of software.
- CO6: Understand the classification and characteristics of Memory units.
- CO7: Learn the classification and characteristics of CPU.
- CO8: Identify the characteristics of Computer Components.
- CO9: Understand the classification and characteristics of Computer Technologies.
- CO10: Learn the details of Computer Applications in Education and research.
- CO11: Identify in detail with examples MS.
- CO12: Apply in report MS.

Unit - 1**15 Hours**

Introduction: Introduction to computer system, uses, types.

Human Computer Interface: Types of software, Operating system as user interface, utility programs.

Devices: Input and output devices (with connections and practical demo), keyboard, mouse, joystick, scanner, OCR, OMR, bar code reader, web camera, camera, printer, plotter.

Unit - 2**15 Hours**

Memory: Primary, secondary, auxiliary memory, RAM, ROM, cache memory, hard disks, optical disks.

Computer Organization and Architecture: CPU, registers, system bus, main memory unit, cache memory, Inside a computer, SMPs, Motherboard, Ports and Interfaces, expansion cards, ribbon cables, memory chips, processors.

Unit - 3**11 Hours**

Overview of Emerging Technologies: Hadoop, cloud computing, big data, data mining, mobile computing and embedded systems.

Use of Computers in Education and Research: Data analysis, Histograms, graphs, tables, Graph Solver, Certain specific packages such as SPSS, Mathematical etc.

18 Hours

Unit - 4

MANAGEMENT INFORMATION SYSTEMS: Introduction to data and information, Types of Information, Types of Information Systems, Input of MIS, Role and Importance, Managers and Activities in IS, Types of Computers Used by Organizations in Setting up MIS, Hardware support for MIS.

Reference Books:

1. A. Gal, Computer Fundamentals, Pearson Education, 2010.
2. P. Nandy, S. Datta, Introduction to Information Technology, Cengage Learning, 2009.
3. P. K. Naha, P. Saha, Fundamentals of Computers, WPH Publishers, 2011.

Computer Fundamentals & MIS Lab

LIST OF EXPERIMENTS

1. Study and Identification of standard desktop personal computer.
2. Understanding of Motherboard and its interfacing components.
3. Install and configure computer drivers and system components.
4. Disk formatting, partitioning and Disk operating system environments.
5. Install, upgrade and configure Windows operating systems.
6. Remote backup, compression and file sharing.
7. Identify, install and manage network connections. Configuring IP address and DNS on any system.
8. Install, upgrade and configure Linux operating systems.
9. Installation, Activation and configure the antivirus.
10. Installation of proxy and scanner software.
11. Documentation and Inventory of hardware.
12. Troubleshooting and Managing Systems.

File No.:**EXAMINER****ITSC 534 (Object Oriented Programming in C++)****Credits: L: T: P= 4: 0: 2****Course Objectives:**

After successful completion of the course, the student is able to:

- CO1: Understand the classification and characteristics of Basic of Problem Solving Techniques
- CO2: Understand the concept of Basic of Problem Solving Techniques
- CO3: Understand the basic concepts of OOPS and C++ Programming Language
- CO4: Understand the concept of Program Development using OOPS Concepts
- CO5: Apply the concepts with applications and use of Abstraction, Encaps
- CO6: Apply the concept of implementation of inheritance using C++

Unit-1**15 Marks**

Problem solving aspects: Introduction, Problem definition, Problem analysis, Design of problem solution, Algorithm, Pseudocode, Coding, Debugging, Type of error in programming, Program Development and Program Execution.

Techniques of Problem Solving: Identifying, deriving, using, testing, algorithms, structured programming concepts, Programming methodologies, OOP-classes and basic object programming.

Introduction to C++: Concepts of Object-oriented programming, benefits of C++ , features of C++ program & Applications of C++.

Fundamentals: Variables, Keywords, Identifiers and constants, Basic Data Types, Fundamental data types, Derived data Types, Storing constants, Declaration of variables.

Operators in C++: Basic arithmetic operators, Memory management operators, Manipulators, Type cast operators, Expressions and their types.

Unit-2**15 Marks**

Control structures & Functions: The main function, Function prototyping, Call to Secondary function by Arguments, Inline functions, Function overloading, Friend and Virtual functions.

Object Oriented Concepts: Abstraction, encapsulation, objects, classes, methods, constructors, inheritance, polymorphism, static and dynamic binding, overloading.

Classes and Objects: Specifying a Class, Defining member functions, Making an Object, Function calls, Calling of member functions, Private member functions, Access within a Class, Static data members, Static member functions, Access of Objects.

Unit - 3

15 Hours

Program Development: Object oriented analysis, design, unit testing & debugging, system using & integration, maintenance.

Constructors and Destructors: Constructors, Parameterized constructors, copy constructors, Dynamic constructor and Destructors.

Unit - 4

15 Hours

Operator overloading and Type Conversion: Defining operator overloading, Overloading unary operators, Overloading Binary operators, Rules for overloading operators, Type conversion.

Inheritance: introduction, defining derived classes, single inheritance, making a private member inheritance, multilevel inheritance, hierarchical inheritance and hybrid inheritance.

Polymorphism – introduction, pointers, pointers to objects, this pointer pointer to derived classes, virtual functions, pure virtual functions.

Reference Books

1. R. E. Nagamachi, "C++ Fundamentals", NPH Publications, 2002.
2. Dr. Arun Laksh, "Computer Fundamentals", Pearson Education, 2019.
3. Object Oriented Programming with C++ - M. T. Nawrothkate, IT S. Class, N.A.
4. Programming, C++, Introduction, PHI Learning, New Delhi, 2002.
5. Object Oriented Programming with C++ by S. Rajaganesan.
6. Richard Adams, An Introduction to Object-Oriented Application Development, Thomson Learning, 2000.
7. B. Stroustrup, the C++ Programming Language, Addison Wesley, 2000.

Object Oriented Programming in C++ Lab

PART-A

1. PROGRAM TO FIND THE ROOTS OF A QUADRATIC EQUATION
2. PROGRAM TO FIND WHETHER GIVEN NUMBER IS EVEN OR NOT
3. PROGRAM TO FIND LARGEST OF 3 NUMBERS GIVEN BY
4. PROGRAM TO DISPLAY A NUMBER COLLEGE USING SWITCH STATEMENT
5. PROGRAM TO CALCULATE SIMPLE & COMPOUND INTEREST
6. PROGRAM TO FIND AREA OF SQUARE IN 2 DIMENSIONAL ARRAY
7. PROGRAM TO GENERATE FIBONACCI SERIES OF A GIVEN NO
8. PROGRAM TO FIND FACTORIAL OF A GIVEN NO
9. PROGRAM TO SEARCH AN ELEMENT IN 1 DIMENSIONAL ARRAY
10. PROGRAM TO DISPLAY 10 NATURAL NUMBERS & THEIR SUM

PART-B

1. PROGRAM TO MAKE TWO NUMBERS CALL BY REFERENCE
2. PROGRAM TO ILLUSTRATE INLINE FUNCTION
3. PROGRAM TO ILLUSTRATE FRIEND FUNCTION
4. PROGRAM TO ILLUSTRATE OPERATOR OVERLOADING
5. PROGRAM TO ILLUSTRATE INLINE FUNCTION
6. PROGRAM TO ILLUSTRATE MULTIPLE INHERITANCE
7. PROGRAM TO CREATE A CLASS CALLED EMPLOYEE. ACCEPT PROGRAM TO ILLUSTRATE INLINE FUNCTION USING ARRAY OF OBJECTS
8. PROGRAM TO CREATE A CLASS CALLED STUDENT & TO ACCEPT & DISPLAY NECESSARY DETAILS OF A STUDENT USING NESTED CLASS
9. PROGRAM TO CREATE A CLASS CALLED BANK & ACCEPT CUSTOMER DATA
10. PROGRAM TO ILLUSTRATE FUNCTION OVERLOADING

ICHS2018**II SEMESTER****BSC (H) Data Structures and File Processing**

Credit (L: T: P= 4: 0: 2)

Course Outcomes

After successful completion of the course, the student is able to:

- CO1. Explain the classification, characteristics and understanding of Data structures.
- CO2. Analyze the details of Searching Techniques
- CO3. Explain in detail with examples: New Concepts of Memory Management Techniques
- CO4. Understand the details of System Operations
- CO5. Explain the characteristics of File Organization Methods
- CO6. Explain in detail with examples of Storage Devices

Unit - 1**15 Hours**

Basic Data Structures: Introduction, Abstract data structures: stacks, queues, linked lists and binary trees. Sets, Dictionary Implementations, use of priority queues, hashing, binary trees, balanced trees, sets with range-find operations.

Unit - 2**15 Hours**

Searching: Linear and external searching, use of hashing and binary techniques.

Memory Management: Garbage collection algorithms for spatial and block storage allocation for objects with virtual size, buddy systems.

Unit - 3**15 Hours**

Physical Devices: Characteristics of storage devices such as disks and tape I/O buffering.

Basic File System Operations: Create, open, close, extend, delete, read/write/delete, permission restrictions.

Unit - 4**15 Hours**

File Organization: Sequential, indexed sequential, direct, inverted, multi-indexed systems, indexing using B-trees, B+ trees and their variants, buffer pool concept, cellwise hashing methods, extensible hashing.

Reference Books:

1. M.T. Goodrich, R. Tamassia, and D. Mount, Data Structures and Algorithms in C++), John Wiley and Sons, Inc., 2004.
2. T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, Introduction to Algorithms, 3rd Ed., Prentice Hall of India, 2009.
3. Robert S. Kruse and A.A. Ryle, Data Structures and Program Design in C++, Prentice Hall, Inc., NJ, 1998.
4. B. Stroustrup, The C++ Programming Language, Addison Wesley, 2000.
5. H.S. Guchi, Fundamental Algorithms (Vol. 1), Addison Wesley, 1997.

Data Structures and File Processing Lab**Part - A**

1. Program to find lower triangular and upper triangular matrices for the given matrix.
2. Write an interactive program to insert an element at the given position and delete an element at the specified position in the given array.
3. Program to search an element identifies the number of occurrences with locations in linear array.
4. Program to sort the given $M \times N$ matrix row-wise and column-wise using bubble sorting technique.
5. Write an interactive program to search an element in the given linear array using linear and binary searching techniques.
6. Write a program to merge two sorted arrays.

Part - B

7. Write an interactive program to implement the following operations on stack using arrays:
 - a. PUSH
 - b. POP
8. Program to implement Tower of Hanoi problem.
9. Write an interactive program to perform insertion and deletion operations in Linear Queue using arrays.
10. Write an interactive program to perform insertion and deletion operations in Circular Queue using arrays.
11. Write an interactive program to insert a node in a linked list at the front, delete a node from the rear and display.
12. Write an interactive program to implement pre order, post order and in order traversal of a binary tree using linked list.

Note: Lecturer May Change the Programs without deviating Theory Paper

DEGREE**B SC SEMESTER****(CSC 10) Operating Systems with Linux****Credits (L: T: P= 4: 0: 2)****Course Objectives**

After successful completion of the course, the student is able to:

- CO1: Learn in details with examples system software
- CO2: Learn the details of forming system organization
- CO3: Understand the classification and characteristics of Process Management in scheduling mechanism
- CO4: Understand in depth memory management and allocation strategies
- CO5: Learn in details with examples basic concepts of shell scripting
- CO6: Understand in depth basic Linux environment

Unit - 1**15 Hours**

Introduction: System Software, Resource Allocation, OS strategies, Types of operating systems - Multiprogramming, Batch, Time Sharing, Single user and Multitasking, Process Control & Real-Time Systems.

Operating System Organization: Factors in operating system design, basic OS functions, implementation considerations; process models, methods of requesting system services - system calls and system programs.

Unit - 2**15 Hours**

Process Management: System view of the process and resources, initiating in OS, process address space, process abstraction, process characteristics, process hierarchy, Thread model

Unit - 3**15 Hours**

Scheduling: Scheduling Mechanisms, Priority selection, non-pre-emptive and pre-emptive strategies.

Memory Management: Mapping address space to memory space.

Unit - 4**15 Hours**

Memory allocation strategies: Fixed partition, variable partition, paging, virtual memory

Shell Introduction and Shell Scripting: What is shell and various type of shell. Various utilities present in Linux. Different modes of operation in vi editor

What is shell script, Writing and executing the shell scripts, Shell variable (user defined and system variables), System calls, Using system calls, Pipes and Filters, Decision making in Shell Scripts (if else, switch), Loops in shell, Functions, Utility programs (cat, paste, join, @ , unique utilities), Pattern matching utility (grep)

Reference Books:

1. A. Silberschatz, P.B. Galvin, H. Gagne, Operating Systems Concepts, 6th Edition, John Wiley Publications (2005)
2. A.S. Tanenbaum, Modern Operating Systems, 3rd Edition, Pearson Education (2007)
3. G. Vittal, Operating Systems - A Modern Perspective, 2nd Edition, Pearson Education (2007)
4. W. Stallings, Operating Systems, Internals & Design Principles, 3rd Edition, Prentice Hall of India, 2004.
5. M. Silberschatz, Operating Systems: Concepts and Design, Tata McGraw Hill (1992).

Operating Systems with Linux Lab

Reference Lab based on Operating Systems

Note: Following exercises can be performed using Linux or UNIX

1. Usage of following commands: ls, pwd, ty, cat, who, who am I, mv, mkdir, rmdir, touch, cd.
2. Usage of following commands: cp, cat (appends), cat (concatenates), mv, cp, rm, dir.
3. Usage of following commands: chmod, grep, find (locate), highlight, ls.
4. Write a shell script to check if the number entered in the command line is prime or not.
5. Write a shell script to modify "cat" command to display calculation of its specified number.
6. Write a shell script to modify "cat" command to display calculation of its specified range of number.
7. Write a shell script to accept a login name. If not a valid login name display message - "Entered login name is invalid".
8. Write a shell script to display date in the readability format.
9. Write a shell script to display on the screen sorted output of "who" command along with the total number of users.
10. Write a shell script to display the multiplication table any number.
11. Write a shell script to compare two files and if found equal then the user is delete the duplicate file.
12. Write a shell script to find the sum of digits of a given number.
13. Write a shell script to merge the contents of three files, sort the contents and then display them page by page.
14. Write a shell script to find the LCM (least common divisor) of two numbers.
15. Write a shell script to perform the tasks of basic calculator.
16. Write a shell script to find the power of a given number.
17. Write a shell script to find the factorial of a given number.
18. Write a shell script to check whether the number is Armstrong or not.
19. Write a shell script to check whether the file have all the permissions or not.
20. Program to show the presence of special character ""

BCBC1000

II SEMESTER**BSC-III: Programming in JAVA****Credit (L: T: P = 4: 0: 0)****Course Outcomes:**

After successful completion of the course, the student is able to

- CO1: Understands the basic java programming fundamental
- CO2: Ability to identify real examples like java applet, Applet
- CO3: Understands the basic java interfaces and packages
- CO4: Understands the details of Exception handling in java
- CO5: Identify the classification and categorization of File handling in java
- CO6: Learn the details of File handling in java
- CO7: Learn the classification of Applet Programming

Unit - 1**15 Hours**

Introduction to Java: History of Java, IDE Environment, Object Oriented Programming Concept Overview of Programming, Package, Class, Abstraction, Encapsulation, Inheritance, Polymorphism, Difference between C++ and JAVA

Java Programming Fundamentals: Structure of java program, Data types, Variables, Operators, Keywords, Naming Conventions, Decision Making (if, switch), Looping (for, while), Type Casting

Unit - 2**15 Hours**

Classes and Objects: Creating Classes and objects, Memory allocation for objects, Constructors, Implementation of Inheritance, Implementation of Polymorphism, Method Overloading, Method Overriding, Nested and Inner classes

Arrays and Strings: Arrays, Creating an array, Types of Arrays, String class Methods, String Builder methods.

Unit - 3**15 Hours**

Abstract Class, Interface and Packages: Modifiers and Access Control, Abstract classes and methods, Interface, Package Concept, Creating user defined packages

Exception Handling: Exception types, Using try, catch and multiple try, finally, throws clause and finally, Creating User defined Exceptions.

Unit - 4

20 Marks

File Handling: Byte Stream, Character Stream, File IO Hierarchy, File Open, Creating file, Reading file, Writing File.

Applet Programming: Introduction, Types Applet, Applet Life cycle, Class Applet, Applet tag.

Reference Books:

1. Ivan Soper, Web Enabled Commercial Application Development in HTML, Dreamweaver, Perl CGI, IBM Publications, 2005.
2. Cay Horstmann, J2E Java, Wiley Publications, 3rd Edition, 2004.
3. Herbert Schildt, Java T, The Complete Reference, , 9th Edition, 2005.
4. E. Balagurusamy, Programming with JAVA, TMH, 2007.

Programming in Java & Lab

Software Lab based on Java

1. Write a method to find the largest of 3 natural numbers.
2. Write a method to check whether a given number is prime or not.
3. Write a menu-driven program for following:
 - a. Display a Fibonacci series
 - b. Compute factorial of a number
 - c. Write a method to check whether a given number is odd or even.
 - d. Write a method to check whether a given string is palindromic or not.
4. Write a program to print the sum and product of digits of an integer and reverse the integer.
5. Write a program to create an array of 10 integers. Assign values from the user to 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 that number passed.
6. Write a program that will prompt the user for a list of 5 prices. Compute the average of the prices and find out all the prices that are higher than the calculated average.
7. Write a program to take an input 10 numbers in an array and print out the remaining numbers from the array.
8. Write java program for the following matrix operations:
 - a. Addition of two matrices
 - b. Subtraction of two matrices
 - c. Transpose of a matrix
 - d. Check for detection of whether two equal.
9. Write a java program that computes the area of a triangle, rectangle and a Cylinder using function overloading.
10. Write a Java for the parametrization of multiple inheritance using interfaces to calculate the area of a rectangle and triangle.
11. Write a Java program to create a three windows in an Applet. Display your name, address and profession in the three windows.
12. Write a java program to draw a line between two coordinates in a window.
13. Write a java program to display the following graphics in an applet window.
 - a. Rectangle
 - b. Circle
 - c. Ellipse
 - d. Arc
 - e. Polygon
14. Write a program that reads two integer numbers for the variables a and b. If any value (either a or b) is equal to zero, then the sum is output by standard output device. Also the output message {} prints the information about the other summing system.
15. Write a program for the following using operations:
 - a. Compare two strings
 - b. Concatenate two strings
 - c. Compare length of a string
16. Create a class called Fraction that can be used to represent the ratio of two integers. Include appropriate constructors and methods. If the denominator becomes zero, then and handle an exception.

BCC12003

III SEMESTER

BCC 203 Database Management Systems

Credit (L: T: P = 4: 0: 2)

Course Outcome

- After successful completion of the course, the student is able to
- CO1. Understand the characteristics of DBMS with examples
 - CO2. Differentiate the levels of types of database languages with examples
 - CO3. Explain the levels of ER- Diagrams and Relationship
 - CO4. Understand to apply the concepts of Relational Model
 - CO5. Learn to deals with examples MYMS, Commands
 - CO6. Learn to deals with examples in PL/SQL.

Unit - 1

15 Hour

Introduction to Database Management Systems: Definition of Data Information, DBMS, Data base system applications, Purpose of data systems, Characteristics of DB – Self describing nature, Isolation from programs, data and data Abstraction (data independence), support of multiple views of the data, sharing of data and multiple transaction processing, Data management, Database language – DDL, DML, DCL, File processing system in DBMS, Data models, Levels of Abstraction in a DBMS, Three Schema architecture, Characteristics of database approach, data models, DB architecture and data independence.

Unit - 2

15 Hour

Entity Relationship and Enhanced ER Modelling: Entity types, Set Sets, Attributes, and Keys, Relationships, Relationship Types, Role of Cardinal, Constraints, Weak Entity Types, ER Diagrams, Name Conventions, SQL ER Schema Definition, constraints, and object modeling

Unit - 3

15 Hour

Relational Data Model: Basic concepts, Relational Constraints and Relational Database Schema, Update Operations and Dealing with Constraint Violation Basic Relational Algebra Operations.

Database design: ER and EER to relational mapping, functional dependencies normal forms-First normal form, second normal form, Third normal form 4NF.

Unit - 4

18 Hours

SYNOPSIS: INCLUDE: SQL: SQL VS. SQL * PLUS: SQL COMMANDS: ASSOCIATED TYPES, OPERATORS AND EXPRESSIONS, INTRODUCTION TO SQL * PLUS.

Managing Tables and Data:

- CREATING AND ALTERING TABLES (INCLUDING CONSTRAINTS)
- DATA MANIPULATION COMMANDS LIKE INSERT, UPDATE, DELETE
- SELECT STATEMENT WITH WHERE, GROUP BY AND HAVING, ORDER BY, DISTINCT, SPECIAL OPERATOR LIKE IN, ANY, ALL, BETWEEN, EXISTS, LIKE
- JOIN, BUILT IN FUNCTIONS OTHER DATABASE OBJECTS
- VIEW + SYNONYMS, INDEX, TRANSACTION CONTROL STATEMENTS
- COMMIT, ROLLBACK, SAVEPOINT INTRODUCTION TO PL/SQL
- SQL VS PL/SQL + PL/SQL BLOCK STRUCTURE
- LANGUAGE CONSTRUCT OF PL/SQL (VARIABLES, BASIC AND COMPOSITE DATA TYPE, CONDITIONS, LOOPING ETC.)
- % TYPE AND % ROWTYPE
- USING CURSOR (IMPLICIT, EXPLICIT)

Reference Books:

1. R. Elmasri, S.B. Navathe, Fundamentals of Database Systems 6th Edition, Pearson Education, 2016.
2. R. Ramakrishnan, J. Ullrich, Database Management Systems 3rd Edition, McGraw Hill, 2011.
3. A. Silberschatz, H.F. Korth, E. Abrahamson, Database System Concepts 6th Edition, McGraw Hill, 2014.
4. R. Elmasri, S.B. Navathe Database Systems: Models, Languages, Design and Application Programming, 6th Edition, Pearson Education, 2011.

Database Management Systems Lab

Software Lab based on Database Management Systems

The following concepts must be introduced to the students. Notes, MS Access, MySQL may be used.

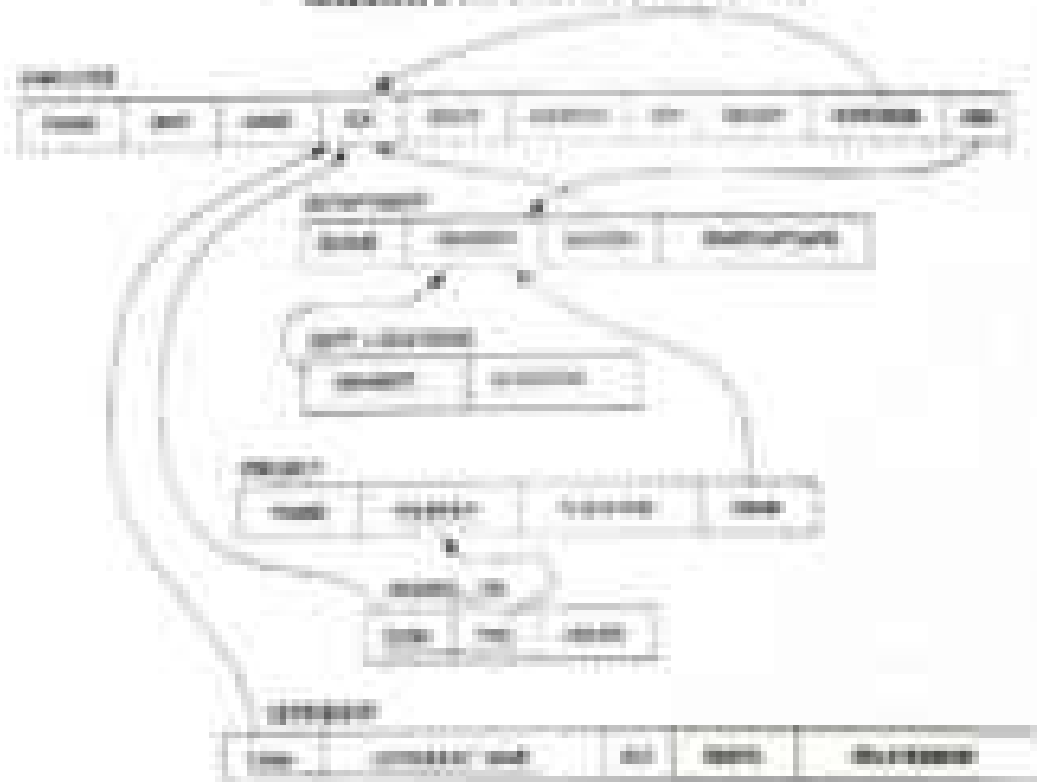
DDL Commands

- Create table, alter table, drop table

DML Commands

- Select, update, delete and insert statements
- Constraint specification using primary and composite operations (and, or, not, between, in)
- Arithmetic operators and aggregate functions (sum, count, avg, Min, Max)
- Multiple table queries (join on different and same tables) + Nested query statements
- Set manipulation using (any, in, contains, all, not in, not contains, exists, not exists, union, intersect, minus, etc.)
- Grouping using group by
- Sorting using order by

Relational Database Theory (2021-22)



- ii. Create tables with relevant foreign key constraints

2. Retrieve the tables with data.
3. Retrieve the following queries on the database:
 - a. Display all the details of all employees working in the company.
 - b. Display emp, empno, empname, address of employees who work in department no. 2.
 - c. Retrieve the position and address of the employee whose name is 'Francis E. 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 'Bellevue'.
7. Retrieve all employees who were born during the 1950s.
8. Retrieve all employees in department 2 whose salary is between 30,000 and 40,000 inclusive.
9. Retrieve the names of all employees who do not have superiors.
10. Retrieve SSN and department name for all employees.
11. Retrieve the name and address of all employees who work for the 'Research' department (2). 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.
12. For each employee, retrieve the employee's name, and the name of his or her immediate superior.
13. Retrieve all combinations of Employee Name and Department Name.
14. Make a list of all project numbers for projects that involve an employee whose last name is 'Thompson' either as a worker or as a manager of the department that controls the project. 15. Increase the salary of all employees working on the 'Production' project by 10%. Retrieve employee name and increased salary of those employees.
15. Retrieve a list of employees and the project name each works on, ordered by the employee's department, and within each department ordered alphabetically by employee first name.
16. Select the names of employees whose salary does not match with salary of any employee in department 10.
17. Retrieve the name of each employee who has a dependent with the same first name and same sex as the employee.
18. Retrieve the employee numbers of all employees who work on project located in Bellevue, Houston, or Stafford.
19. Find the sum of the salaries of all employees, the maximum salary, the minimum salary, and the average salary. Display with proper headings.

12. Find the sum of the salaries and number of employees of all employees in the 'Marketing' department, as well as the maximum salary, the minimum salary, and the average salary in this department.
13. Select the names of employees whose salary is greater than the average salary of all employees in department 40.
14. For each department, retrieve the department number, the number of employees in the department, and their average salary.
15. For each project, retrieve the project number, the project name, and the number of employees who work on that project.
16. Change the location and controlling department number for all projects having more than 5 employees to 'Bellevue' and 8 respectively.
17. For each department having more than 10 employees, retrieve the department no, no. of employees drawing more than 40,000 as salary.
18. Write a query to Project table which violates referential integrity constraint with respect to Department number. Now remove the violate by making necessary insertion in the Department table.
19. Delete all dependents of employee whose emp_id is '117456789'.
20. Delete an employee from Employee table with emp_id = '12345' (make sure that this employee has some dependents, is working on some project, is manager of some department and is supervising some employees). Check and display the cascading effects on Dependents and Works_on table. In Department table MGRIDFN should be set to default value and in Employee table SUPERMGRN should be set to NULL.
21. Perform a query using the command to drop old field and a comment in Employee table.

ENCLURE**III SEMESTER****ENCL 301: Web Technologies****Credit (L: T: P = 4: 0: 2)****Course Objectives:**

After successful completion of the course, the student is able to:

- CO 1. Know the details of HTML tags
- CO 2. Understand the details of Basic CSS and implement
- CO 3. Understand the details of Basic Concepts of Java Script
- CO 4. Write down in details web applications and design of Java script
- CO 5. Understand in details web application Document Object Model
- CO 6. Understand in depth Basics of XML

Unit - 1**15 Hours**

Introduction to Web Design: Introduction to HyperTextMarkupLanguage (HTML), Header, Footer, Formatting tags, graphical elements, inserting images, lists, hyperlinks, tables. **Frames** - introduction, frames, Frames- attributes of frames. Creating web pages

Unit - 2**15 Hours**

Cascading Style Sheets: Introduction, Understanding the Basic CSS syntax, Types of style sheets, multiple sheets, Background properties, Text properties, Font properties, Border properties, Margin properties, Padding list & table properties, DIV, SPAN

Unit - 3**15 Hours**

JavaScript: Introduction, Java script in HTML, Java script statements, comments, Expressions, Data types, operators, Conditional statements, Loop statements, Functions, Program Issues. **Array & Boolean Objects** Math & Date Objects, String & Number Objects, events and event handling & form document object.

Unit - 4**15 Hours**

DOM and XML: Basics of DOM, DOM methods, Functions, Forms collection, table collections from HTML.

XML: Introduction; Syntax; Document structure; Document Type definitions; Namespaces; XML schemas; Displaying raw XML documents; Displaying XML documents with CSS; XML style sheets.

Reference Books:

1. St. Thomas P.J. Deitel, & H. Deitel: *Java and JSP: Web Site Development in Progress*, 2nd Edition, Pearson Education, 2005, 2006.
2. Steve Nouri: *Web Programming: Building Internet Applications*, 3rd Edition, Wiley, 2006.
3. E. Neuhoff et al.: *The Java Source Code to Web Programming*, Thomson, 2005.

Web Technologies Lab

1. Program for inserting tags.
2. Creating a Webpage having Hyperlink.
3. Creating Types of Lists (Ordered, UnOrdered, Definition).
4. Creating a nested List.
5. Creating a User Table.
6. Creating a HTML document having vertical tables.
7. Creating nested Application Forms.
8. Program to insert audio & video files.
9. Creating Internal & External Style Sheets.
10. Program to Margins & Padding.
11. Program to create & Display table.
12. Program to Image Transparency.
13. Program to generate Fibonacci series in Javascript.
14. Program to display Random 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 number.
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. Program to generate random numbers.
24. Program to find the sum of individual numbers.
25. Program to display Book information in XML.

DCDS1003

IV SEMESTER**DCS-103: Numerical Analysis and Statistics****Credit (L: T: P = 4: 0: 2)****Course Objective:**

After successful completion of the course, the student is able to

- CO1: Understand the basics of Computer Numerical and statistics
- CO2: Understand the classification and characteristics of Numerical Methods in numerical analysis
- CO3: Understand to solve with examples Matrix and linear system of Equations
- CO4: Apply to solve with examples Interpolation
- CO5: Understand in depth Numerical integration and differentiation
- CO6: Learn the aspects of Integration and Numerical 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**

Matrix and Linear System of Equations: LU decomposition method, Gauss elimination, Gauss-Jordan and Gauss-Jordan for solving system of equations

Interpolation: Polynomial interpolation, Newton-C Gregory Forward and backward interpolation, Newton's divided difference 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, Histograms, Frequency polygon, Frequency curve and O given Measures of central tendency: Mean, Median, Mode, Dispersion, Correlation, Regression.

Reference Books:

1. B.P. Anderson, W. Liu, *Essentials Numerical Analysis*, 1st Ed., Wiley, 2001
2. C. Davis, J.B. Borger, *Introduction to Parallel Algorithms*, Wiley-Interscience, 1999
3. N. Sidi, R.N. Vicharek, *An Introduction to Numerical Methods in MATLAB*, Approach for Ed. Computer and Math Ed., 2001
4. B. Burden, A Friendly Introduction to Numerical Analysis, Prepress Education, 1997
5. G.E. Otto and J.F. Timney, *An Introduction to Programming and Numerical Methods*, MATLAB, Springer, 2002
6. H.H. Jain, S.R.R. Chingappa & S. Jain, *Numerical Methods for Scientists and Engineering Application*, 7th Ed., New Age International Publications, 2001
7. *Computer oriented numerical methods* by V. Balaraman
8. *Numerical Theory and Practice* by M. S. Tomikita, Japanese
9. *Numerical analysis* by B.P. Flagan

Numerical Analysis and Statistics Lab**Software lab based on numerical techniques and statistics**

1. GAUSS-JORDAN METHOD
2. LU DECOMPOSITION
3. RUNGE-KUTTA METHOD
4. NEWTON-RAPHSON
5. SECANT
6. LU DECOMPOSITION
7. GAUSS-JORDAN
8. LU DECOMPOSITION
9. LU DECOMPOSITION
10. LU DECOMPOSITION
11. RUNGE-KUTTA METHOD
12. RUNGE-KUTTA METHOD
13. RUNGE-KUTTA METHOD
14. RUNGE-KUTTA METHOD
15. RUNGE-KUTTA METHOD
16. RUNGE-KUTTA METHOD
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 FORWARD AND BACKWARD INTERPOLATION
21. NEWTON DIVIDED DIFFERENCE

PRELIMINARY :

14 SEMESTER
THE 3RD YEAR
Credit (L: T: P= 4: 0: 2)

Course Objectives

After successful completion of the course, the student is able to

- CO-1: Learn the details of Basic elements of JSP
- CO-2: Understand the details of Concepts of Multi-Tier Architecture
- CO-3: Understand the development of Enterprise Application Strategy
- CO-4: Write down in-depth Basic Concepts of JSP
- CO-5: Ability to deal with examples implementation of JSP Elements Using JSPC elements
- CO-6: Learn in detail with examples Basic Concepts of Servlet
- CO-7: Learn in detail with examples Basic Concepts of JSP

Unit -1**15 Hours**

Introduction: The ABC of Programming Languages, taking programming languages as a noun, the highlighting of java, java keywords, the advantages of Java, JSP and J2EE.

J2EE Multi-Tier Architecture: Distribution systems, the Tier, J2EE Multi-Tier Architecture, Client Tier Implementation, Web Tier Implementation, Enterprise JavaBeans Tier Implementation, Enterprise Information Systems Tier Implementation, Challenges.

J2EE Best Practices: Enterprise Application Strategy, The enterprise applications, clients, Session Management, Web-Tier and Java Server pages, Enterprise Java Beans Tier, The Myth of using inheritance, Manipulating classes, Performance Enhancements, The power of interfaces, The power of threads, The power of Notifications.

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, Metadata.

Unit - 3**15 Hours**

DBMS and Embedded SQL: About Programs: Stored & Programs, Stored & Programs, Tables: Creating a Table, Dropping a Table, Indexing: Creating a Index, Dropping an Index, Inserting Data into tables: Inserting a Row, Inserting the system data into a column, Inserting the system Time into a column, Inserting a Timestamp into a column, Selecting Data from a Table: Selecting a data from a Table, Requesting one column, Requesting Multiple columns, Requesting rows, Requesting rows and columns, AND, OR, and NOT clause, Joining multiple compared 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**

Modifying: Number of columns in result set, Data type of a column, Name of a column, Column Size, updating Tables: Updating a row and columns, updating multiple rows, Deleting Data from a table: Deleting a Row from a table, Joining tables, Calculating Data, Grouping and ordering data, sub queries, views.

Java Servlets: Java servlet and container gateway interface programming, Benefits of using a Java servlet, A simple Java servlet, Anatomy of a java servlet Development Diagram, Reading Data from a client, Reading HTTP request Headers, Sending Data to a Client & writing the HTTP response Header, Working with cookies, Forwarding Sessions, Quick reference guide.

JAVA Server Pages: JSP compilation, JSP Tags: Variables & objects, Method, Control Statements, Loops, Transfer, Request string: Forward using alternative User sessions, cookies, Session objects, Quick reference guide.

Reference Books:

1. The complete reference JEE seventh edition - Java J Enterprise edition edition
2. JEE: The complete Reference - McGraw-Hill Education

J2EE Lab

SEE LAB CYCLE

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 demonstrate Basic Servlet.
5. Write a program to Display request header information.
6. Write a program to design web application.
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 Servlet Program to implement a dynamic HTML using Servlet class make and processed should be accepted using HTML and deployed using a Servlet.
11. Write a JAVA Servlet 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 Servlet Program to implement RequestDispatcher object (use include() and forward() methods).
13. Write a JAVA Servlet Program to implement and demonstrate get() and PostMethodUsing HTTP Servlet Class.
14. Write a JAVA Servlet Program to implement sendRedirect() methodUsing HTTP Servlet Class.
15. Write a JAVA Servlet Program to implement sessions (Using HTTP Session Interface).
16. Write a JAVA JSP Program to print 10 even and 10 odd number.
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 use a applet.
20. Write a JAVA JSP Program which implements nested tags and also uses Tag Support Class.

DEGREE**IV SEMESTER****ISC 3D: Software Engineering and Software Testing****Credit (L: T: P=4: 0: 2)****Course Outcomes**

After successful completion of the course, the student is able to

- CO 1: Understand in detail 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-depth sub-branches Software Testing
- CO 6: Specify in depth details in software engineering

Unit - 1**15 Hours**

Software Process Introduction, SW Engineering Paradigms, life cycle models (water fall, incremental, spiral, evolutionary, prototyping, object oriented), System engineering, computer based systems, 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, SW documents.

Unit - 2**15 Hours**

Software Analysis: Analysis and modeling, data, functional and behavioral models, structural analysis and data dictionary.

Design Concepts and Principles: Design process and concepts, module design, design heuristic, design model and diagrams, Architectural design, software architecture, data design, architectural design, transactions or transaction mapping, user interface design, user interface design principles, Real time systems, Real time software design, system design, real time systems, data acquisition systems, monitoring and control systems.

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, cost control, process, cost control, data and logic structure measures, estimation, flow measure, Estimation for Software Process, Empirical Estimation Models, Project Scheduling.

Unit - 4

(5 Hours)

Testing: Taxonomy of software testing, types, test activities, types of test tool, black box testing, testing boundary conditions, structural testing, test coverage criteria based on data flow, reachability, 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 – concepts – 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, 8th edition, 2009.
3. Richard Ikin- An Integrated Approach to Software Engineering, Springer-Verlag, 1997.
4. James F. Peters and Wood-Peterson, "Software Engineering – An Engineering Approach", John Wiley and Sons, New Delhi, 2009.
5. Al. Bachman and Frederick J. Heblum, "Software Engineering – Fundamentals", Oxford University Press, New Delhi, 1996.
6. Pfleger, "Software Engineering", Pearson Education India, New Delhi, 1998.
7. Carlo Ghezzi, Mehdi Jazayeri and Elzer Mancini, "Fundamentals of Software Engineering", Prentice Hall of India, New Delhi, 1991.

Software Engineering and Software Testing Lab

Lab based on Software Engineering

1. **Starting Title**
 - Feasible Statement
 - Process Model
2. **Requirement Analysis**
 - Creating a Data Flow
 - Data Dictionary
 - Use Cases
3. **Project Management**
 - Computing PP
 - Effort
 - Schedule, Risk, Gantt, Gantt chart
4. **Design Engineering**
 - Architectural Design
 - Data Design, Component Level Design
5. **Testing**
 - Basic Path Testing

Sample Projects list

- **DEC: Route Information:** Online information about the bus routes, their frequency and fares
- **Car Parking:** To maintain a web based internet application for an organization
- **Employees:** within an organization to avail the facility of work effectively
- **Patent Application and Prescription Management System**
- **Organized Road Mapping Management Software**
- **Parking Allocation System**
- **Website Management System**

HC 027001

BY SEMESTER

BSC 101: Electronic Entrepreneurship Development

Credit (L: T: P) = (3: 1: 0)

Course Outcome

After successful completion of the course, the student is able to:

- CO1: Specify the characteristics of Entrepreneurship
- CO2: Identify the kinds of Identification of opportunities
- CO3: Understand the steps Financing and Business management of the Project
- CO4: Write down the details of Project Report
- CO5: Explain the characteristics of PERT Technique
- CO6: Explain the kinds of Computer Aided applications

Unit - 1**10 Hours**

Need, scope and characteristics of entrepreneurship special schemes for industrial entrepreneur (SIIT)

Identification of opportunities: Exposure to Demand based, Resource base, Service based important industries and export promotion industries. Make strategy techniques.

Need, scope and approaches for the project formulation.

Criteria for the principles of products selection and development.

Unit - 2**15 Hours**

Structure of the project report, Choice of technology, plant and equipment.

Institutions financing procedure and financial incentives, financial ratios and their significance. Tools of economic, financial statements and funds flow analysis.

Resource management, man machine and material. The critical path method (CPM) and project evaluation, review technique (PERT).

Planning tools for marketing (SI)

a. CREATIVITY AND INNOVATION b. BALANCE SHEET

APPROACH

a. STRENGTH AND WEAKNESS OPPORTUNITY AND THREAT

(SWOT) analysis.

Unit - 3**15 Hours**

Feasible economic feasibility of the project, Plant layout and process planning for the product Quality control / quality assurance and testing of the product Costing and pricing.

Management of self and understanding human behavior. Factors in small scale industries and their essential resources.

Unit - 4

12 Hours

Copying and uncertainties, stress management, and positive reinforcement

- a. Licensing registration, b. Modified by laws and insurance coverage
- Important provisions of factory act, safety of goods and partnership act.
- a. **DELEGATION CONTROL,**
- b. **SOCIAL RESPONSIBILITY AND BUSINESS ETHICS**
- Income tax, labour law and strike rule.

Reference Books:

1. Entrepreneurship Development - Kothalia
2. Entrepreneurship Development - VasantDrao

CC333001

V SEMESTER

DS6: DA: Elective Data Communication and Computer Networks

Credit (L: T: P= 4: 0: 0)

Course Objective:

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 identification and characteristics of Signals
- CO4: Understand in depth with examples Network Models
- CO5: Learn in depth Data Encapsulation and Compression Algorithms
- CO6: Differentiate in detail with examples Switching Concepts
- CO7: Explain in detail identification 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 Networks LAN, MAN, WAN

History of Networks: Protocols and Standards; Protocols Classification (application)

Addressing: Physical, Logical, Port, Specific

Unit - 2

15 Hours

Transmission Media: Guided Media – Twisted pair cable, co-axial cable, optical fiber, 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 – Binary with bit length, bit rate, base band transmission, Digital vs Analog, Transmission Impairment, Bit rate limits (Noise and utilization channel)

Unit - 3

15 Hours

Network Models: Layered models, OSI model (user – user – user), Layered Architecture: Functions of Layers (OSI), TCP / IP Protocol suite

Multiplexing: FDM, TDM and MDM, packet, Application of FDM, WDM, TDM (Interleaving, time-sharing, bit-packing)

Switching Concept: Working principle of circuit switching and packet switching, Circuit switched networks, flow control efficiency, delay, Data plane network, routing table, delay efficiency, virtual.

Error Detection and Correction: Types of errors, Redundancy, Error detection using Error Correction

Error Detection: Parity check, Cyclic Redundancy Check (CRC), Check Sum, Error Correction – Hamming Code, 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 layer switches.

Routing Concepts: Types, Shortest path, flooding.

Wireless LAN's: Characteristics, Architecture, Basic LAN layers.

Network Layer: IPv4, IPv6 addresses.

Transport Layer: UDP – user Datagram, operations, Applications, TCP – Services, TCP segments, SCTP – Services, packet format.

Application Layer: SMTP, SNMP, HTTP, FTP.

Reference Books

1. Data Communication and Networking – Peterson
2. Computer Network – Tanenbaum – 3rd Edition.
3. Computer Network – Larry L. Peterson & Bruce S. Davie.

Data Communication and Computer Networks Lab

1. Program for Identifying web server 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 Programs)
6. Program for implementing HTTP.
7. Program for Downloading Image files.
8. Simulate Checksum Algorithm.
9. Simulate Long Jump, Stop, Wait, Protocol.
10. Simulate Go-Back-N, Protocol.
11. Simulate Selective Repeat Protocol.
12. Take an example subset of some Class structure from Set 11.
13. Network address with automatic subnet address generation.

Syllabus

V SEMESTER
DSC 10: Electrical Computer Graphics
Credit (L: T: P = 4: 0: 1)

Course Outcomes

After successful completion of the course, the student is able to

- CO1. Learn the classification and characteristics of Elements of Graphics Systems
- CO2. Learn 2-D and 3-D graphics Algorithms
- CO3. Determine the classification and characteristics of 2D Graphics
- CO4. Determine the characteristics of 3D Graphics
- CO5. Determine the details of Transformation and Viewing Techniques
- CO6. Learn the details of Illumination and Color Models

Unit - 1**15 Hours**

INTRODUCTION: history 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 functions, 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 conditions, reference frame, window-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 tubes- Plane equations - Polygon meshes; Curved Lines and surfaces, Quadratic surfaces, Bézier objects, Spline representations - Bézier 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 conditions, Projections, Clipping, Visible surface detection methods.

Unit -4

ILLUMINATION AND OTHER MODELS: Light sources – View classes, models – Hidden surfaces and shading techniques; Properties of light: Standard projection and chromaticity diagram; Additive colour concepts – RGB colour model – YIQ colour model – CMY colour model – HSV colour model, HLS colour model, Colour selection.

Reference Books:

1. Computer Graphics: C Version, by Donald Hearn & M. Pauline, Prentice Education, New Delhi, 1994.
2. Fundamentals Concepts for Computer Graphics by David F. Rogers, by McGraw Hill Book Company, New Delhi, 2003
3. Computer Graphics: Principles & Practice in C, by J. D. Foley, S. B. Van Dam, F. H. van Dam, Prentice Education, 2004
4. Computer Graphics using Open GL, by Francisco S. Hill Jr Prentice Education, 2004

Computer Graphics Lab

1. Implementation of Bresenham's Algorithm – Line, Circle, Ellipse.
2. Implementation of Line, Circle and ellipse Algorithms
3. Two Dimensional transformations – Translation, Rotation, Scaling, Reflection, Shear.
4. Composite 2D Transformations
5. Cohen-Sutherland 2D line clipping and Windowing
6. Sutherland - Hodgman 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

Syllabus**V SEMESTER****ISE 10: Electronic Multimedia Systems and Applications****Credit (L: T: P = 4: 0: 1)****Course Objectives:**

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 Video
- CO3. Learn to apply Animation Techniques
- CO4. Understand the details of Multimedia in Internet
- CO5. Understand the characteristics of Making Multimedia
- CO6. Introduction to apply Multimedia Making Tools

Unit - 1**15 Hours**

Multimedia: Introduction to multimedia, components, uses of multimedia, multimedia applications, virtual reality.

Text: Fonts & Layout, Using Text in Multimedia, Font Editing & Design Tools, Hypertexts & Hyperlink.

Images: Still Images – Storage, vector drawing, 3D drawing & rendering, natural light sources, computerized colors, color palette, Image On Screen.

Unit - 2**15 Hours**

Sound: Digital Audio, MP3 Audio, MIDI vs Digital Audio, Audio File Formats.

Video: From video works, analog video, digital video, video file formats, video shooting and editing.

Unit - 3**15 Hours**

Animation: Principles of animation, animation techniques, animation On Screen.

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: Steps of a multimedia project; Requirements to make good multimedia, Multimedia Hardware – Macintosh and Windows production.

Platforms, Hardware peripherals, Classifications, Memory and storage, Multimedia software and Authoring tools.

Reference Books:

1. Jay Nagler, "Multimedia: Making it work", IEEE, Eighth edition.
2. Bill Stallman and Christosourach, "Multimedia: Emerging, Commercialized Applications", Prentice.
3. Kavin, "Multimedia Technology", IEEE.
4. R. Adolph and S. Thakur, "Multimedia System Design", PEE.

Multimedia Systems and Applications Lab

Practical exercises based on concepts listed in theory using Presentation tools in either animation and / or MP / Member / Animator / Animation Tools / Image Editors / Video Editors.

Implement the following using Macromedia :

1. Create an animation using the tools panel and the properties panel to show the following :
 - Line, pt., oval, circle, rectangle, square, pentagon, hexagon, star, text box.
2. Create an animation using text tool to set the font, size, color etc.
3. Create an animation using Free transform tool that should use following:
 - Move Objects
 - Scale / Rotate
 - Stretch Objects
 - Rotate Objects
 - Stretch Objects while maintaining proportions
 - Rotate Objects after releasing the center dot
4. Create an animation using layers having following features: Layer Lock, Object Lock, guide lines, Mask layer.
5. Modify the document (changing background color etc.) using the following tools:
 - Eraser tool
 - Fill tool
 - Text tool
 - Stamp tool
 - Free Rotate tool
 - Free Rotate tool
6. Create an animation the two curves in which both starts from the same point and end near the end.
7. Create an animation in which two balls get connected from CircleType (using motion-path tooling).
8. Create an animation having the image having ball-in-hole effect.
9. Create an animation where the picture (using multiple layers) and motion tweening).
10. Create an animation to show the apple effect.
11. Create an animation (using shape tweening and shape tools) for illustrating the shape transformation.
12. Create an animation for stretching ball (you may use motion guide layer).

OR

Project :

Design a minimum 10 page brochure website using Dreamweaver or WordPress.

BCA22041**V SEMESTER****ISE 2A: Electrical ASP.NET****Credit (L: T: P = 4: 0: 1)****Course Outcomes:**

- CO-1: After successful completion of the course, the student is able to
 - CO-1.1: Learn the logical ASP.NET Framework.
 - CO-1.2: Learn the details of ASP.NET working Environment.
 - CO-1.3: Deploy the details with examples Standard Control of asp.NET.
 - CO-1.4: Understanding details of Developing Simple Websites Using ASP.NET Controls.
 - CO-1.5: Understands concepts Developing Simple Web Application Using ASP.NET Controls.
 - CO-1.6: Learn the details of Database Access Controls.
 - CO-1.7: Apply the details with examples Database Access Controls.

Unit - 1**15 Hrs**

Overview of the ASP.NET: Introduction of different Web Technology, Vs in Asp.Net, How Asp.Net Works, Use of visual studio, Different Language used in ASP.Net, Summary.

Framework: Common Language Runtime (CLR), .NET Framework Class Library, Summary.

Unit - 2**15 Hrs**

Setting up and Installing ASP.NET: Installing Internet Information Service, Installation of Asp.Net, virtual directory, Application Setting in IIS, Summary.

Unit - 3**15 Hrs**

Asp.Net Standard Controls: Displaying information, Label Controls, Link Controls, Bulleted List, Accepting User Input, Textbox controls, Radio Button and Radio Button List Controls, Checkboxes and Checkboxes List Controls, Hyper controls, Link Button Control, Gauge 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 & Site Management, Overview of events in page, Summary.

Unit - 4**15 Hrs**

Designing Websites with master pages, creating master pages, Creating detail content, using master page, registering master page in web configuration Summary.

ASP.Net Themes: ASP.NET Website Themes, Named Skin and Default Skin in ASP.NET Themes, Style Sheet Themes and Theme Attribution On A Page Template

Using the Rich Controls: Accepting File Uploads, Saving Data to the system, Calendar Control, Displaying advertisements, Displaying Different Page view, Displaying a Tailored Page View, Wizard Control, Summary.

Reference Books

1. Matthew Mac Donald, ASP .Net The Complete Reference, McGraw -Hill, 2002.

ASP .Net Lab

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 date.
6. Write a Program to perform validation operation.
7. Write a Program to perform Tree view operation.
8. Write a Program to display the presence of an author using database.
9. Write a Program to insert the data in to database using Insertion-Net Query.
10. Write a Program to find data using template in data list.
11. Write a Program to find data using Hypertext column in data grid.

Chapter 10

Accounting Systems

10-10 The Accounting System Program

Learning Objectives

LO 10-10-1 Explain the accounting system program and its components.

10-10-1

- 1. Explain the accounting system program and its components.
- 2. Explain the accounting system program and its components.
- 3. Explain the accounting system program and its components.
- 4. Explain the accounting system program and its components.
- 5. Explain the accounting system program and its components.
- 6. Explain the accounting system program and its components.
- 7. Explain the accounting system program and its components.
- 8. Explain the accounting system program and its components.

LO 10-10-2

LO 10-10-3

LO 10-10-2 Explain the accounting system program and its components.

LO 10-10-3 Explain the accounting system program and its components.

LO 10-10-4 Explain the accounting system program and its components.

LO 10-10-5

LO 10-10-6

LO 10-10-5 Explain the accounting system program and its components.

LO 10-10-6 Explain the accounting system program and its components.

Visual Programming Lab

1. Print a table of numbers from 5 to 11 and their squares and Cubes.
2. Print the largest of three numbers.
3. Find the factorial 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 bank account yielding 12% interest. Compute the amount in the account at the end of each year for 4 years.
6. Read n numbers. Count the number of negative numbers, positive ones, and zero in the list.
7. Read n numbers. Count the number of negative numbers, positive ones, and zero in the list. Use arrays.
8. Read a single dimension array. Find the sum and average of these ones.
9. Read a two dimension array. Find the sum of row ID Array.
10. Create a database Employee and Make a form to allow data entry to Employee Form with the following associated buttons:

BCU7001**V SEMESTER****BSE-SC: Elective: Artificial Intelligence and Expert Systems****Credit (L: T: P = 4: 0: 0)****Course Outcomes**

- After successful completion of the course, the student is able to:
- CO1: Understand 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 - I**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 Decoding, Solution- Hill Climbing- Depth first and Breadth first, Constraint satisfaction - Heuristic algorithms, Measure of performance and analysis of search algorithms.

REPRESENTATION OF KNOWLEDGE: Game playing - Knowledge representation, Knowledge representation using Predicate logic.

Unit - II**15 Hours**

Introduction to predicate calculus, Resolution, Use of predicate calculus, Knowledge representation using other logic-formalised representation of knowledge.

KNOWLEDGE INFERENCE: Knowledge representation -Production based system, Frame based system, Inference - Backward chaining, Forward chaining, Rule rule approach, Fact reasoning - Certainty factors, Bayesian Theory- Diagnostic Methods- Deepstar -Shell Theory.

Unit - III**15 Hours**

PLANNING AND MACHINE LEARNING: Basic plan generation systems - STRIPS -Advanced plan generation systems - KRYPTON -Strategic explanations - Why, Why not and how explanations, Learning: Machine learning, adaptive learning.

Unit - 4

15 H

EXPERT SYSTEMS: Expert systems - Architecture of expert systems. B of expert systems. Knowledge Acquisition - Meta knowledge. Heuristics. Typical expert systems - MYCIN, LISP, SCAM, Expert systems shells.

Reference Books:

1. Kevin Night, Elaine Rich, Neil R., "Artificial Intelligence (AI)", McGraw Hill-2008. (11th ed.) (2,4,7)
2. Dan W. Patterson, "Introduction to AI and CS", Pearson Education, 2007. (11th ed.)
3. Peter Jackson, "Introduction to Expert Systems", 3rd Edition, Pearson Education, 2007.
4. Stuart Russell, Peter Norvig "AI - A Modern Approach", 2nd Edition, Pearson Education, 2007.

Artificial Intelligence and Expert Systems Lab

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.

BCA20001**5 SEMESTER****BSE-1A: Cloud Computing****Credit: (T: 1, P = 4, (W: 1)****Course Outcomes**

- 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 Systems
 - CO3: Learn in depth Concept of Collaborating, with Cloud
 - CO4: Understand the details of Introduction to cloud
 - CO5: Learn the identification and characterization of Security challenges in Cloud Computing
 - CO6: Identify the Identification and Management of Security challenges in Cloud Computing
 - CO7: Understand the details of Security challenges in Cloud Computing
 - CO8: Understand the Features standard Cloud Computing
 - CO9: Understand in details with examples Various Applications 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 - Fault-tolerance - Security - Open Network, CloudFire.

Cloud Services and File Systems: 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 AWS, Microsoft Azure, Sales force.

Collaborating With Cloud: Collaborating on Calendar, Schedules and Task Management - Collaborating on Event Management, Contact Management, Project Management - Collaborating on Word Processing, Database - 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 – Virtualization – Types of Virtualization – System Vfs, Process VM, User Machine monitor – Virtual machine properties – Interpretation and User execution, VML, 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. Steve K. Rasmussen M., Hajar F., John Hester: "Cloud Computing" Wiley Inc, India, 2010.
2. John Humphreys, James Harrison: "Cloud Computing Implementation: Migration and Strategy" CRC Press, 2010.
3. Austin T. Loke: "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, New York: "Virtual Machines", Morgan Kaufmann Publishers, 2006.

Online Reading Supporting Material

1. Cloud Basics: "Cloud Computing: New Paradigm for Managing and Monitoring Platform for Distributed Computing – applications and User Content in the Cloud with AWS, Amazon by LinkedIn, July 2008.
2. <http://www.ibm.com/press/us/2011/CloudPaaS.shtml>
3. <http://www.ibm.com/press/us/2011/CloudPaaS.shtml>
4. <http://www.ibm.com/press/us/2011/CloudPaaS.shtml>
5. <http://www.ibm.com/press/us/2011/CloudPaaS.shtml>
6. <http://www.ibm.com/press/us/2011/CloudPaaS.shtml>

Cloud Computing Lab

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:
 - (i) Storage
 - (ii) Sharing of files
 - (iii) Manage your calendar, to-do lists,
 - (iv) A document editing tool
4. Exploring Open source cloud (Any two)

DECLARATION**V SEMESTER****ISEL 30: Enterprise Resource Planning****Credit (L: T: P) = 4: 0: 0****Course Objective:**

After successful completion of the course, the student is able to:

- CO1: Understand the details of ERP
- CO2: Learn in-depth details of ERP
- CO3: Work done to design Business Process Mapping for ERP
- CO4: Understand in details with applications of ERP and Related Technologies
- CO5: Understand the details of ERP Modules
- CO6: Apply in details with examples ERP

Unit - 1**15 Hours**

Introduction to ERP, Evolution of ERP, What is ERP? Reasons for the growth of ERP, Benefits and Justification of ERP in India, Evaluation of ERP, Various Modules of ERP, Advantages of ERP and Disadvantages of ERP.

Unit - 2**15 Hours**

An overview of Enterprise, Integrated Management Information, Business Modeling, ERP for Small Business, ERP for multi-entities 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, Hana Company, Oracle Corporation, People Soft, JD Edwards World Solution Company, Systems Software Association.

Reference Books

1. C.S. Y. Sharma Enterprise Resource Planning
2. R.G. Saha – Enterprise Resource Planning - ERP
3. Steven Lamm, John Publications: Enterprise Resource Planning
4. Ravi Aravamudan, Saha Chaper, Thomson Education – Managing Business Process Flow

- b. Archer, P.H. *Corporate Business Planning*
- c. Westbrook, J.R. *International Publishers, Corporate Business Planning*
- d. P. *International Business (1st and 2nd Editions)*; P.H. *Corporate Business Planning*
- e. *Introduction to MRP, an Overview of MRP, MRP, ERP, CRM: Models of MRP, an Comprehensive Corporate Business Planning*

Enterprise Business Planning Lab

Students should be Prepare ERP Solution Report for his/her Case Study under the supervision of Teacher/Lecturer

BCE2001**V SEMESTER****BCE 201: Elective: Data Mining and Data Warehousing****Credit (L: T: P = 4: 0: 1)****Course Outcomes:**

After successful completion of the course, the student is able to:

- CO1. Understand the fundamentals of Data Warehousing.
- CO2. Understand the aspects of Data Warehousing Architecture.
- CO3. Differences in depth Data Mining.
- CO4. Learn in details with examples Association Rule Mining.
- CO5. Specify the details of Classification and Predictive 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; features of past decision support systems. OLTP vs DW/ DWH-DWH requirements: needs 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 planning: Data transformation: Data reduction - Data mining primitives.

Unit - 3**15 Hours**

Association Rule Mining: Introduction - Mining single dimensional Frequent 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.

14014

15 Hours

Clustering & Learning Methods: Cluster analysis

Applications and Other Data Mining Methods: Distributed and parallel Data Mining Algorithms, Text mining, Web mining

Reference Books:

1. Ian H. Witten and Michael Karlen: "Data Mining: Concepts and Techniques", Morgan Kaufmann Publishers, USA, 2005
2. Hanman, Data Warehousing, Data Mining and OLAP", Tata McGraw Hill Ltd, New Delhi, 2004
3. Peng-Ning Fan, Michael Steinbach, Vijay Kumar, Introduction to Data Mining, Pearson Education.
4. Arun K. Potti, Data mining techniques", Oxford University Press, London, 2005
5. Dhanraj M.H, Data mining: Introductory and Advanced Topics", Pearson Education, New Delhi, 2003
6. Michael Karlen: "Data Mining: Concepts, Methods and Algorithms", John Wiley and Sons, USA, 2003
7. Sarita K. P. Dasakulapati, Raju K., Insights into Data mining: Theory and Practice, PHI 2006

Data Mining and Data Warehousing Lab

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 dataset data sets of weka and on 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. Preprocessing: Apply the following items –

- a. weka-class/supervised/stratified
AddDistribution, AddDistributions, Discretize, NominalToBinary
- b. weka-class/supervised/instance
StandardizeNominal, Resample
- c. weka-class/supervised/mathem
Add, AddExpression, AddNoise, Center, Discretize, MergeExpression, MergeTwoValues, NominalToBinary, NominalToInteger, Normalize, NumericToNominal, NumericTransform, PrincipalComponent, ReplaceSubset, Remove, RemoveType, ReplaceMissingValues, Standardize
- d. weka-class/supervised/instance
Normalize, Randomize, Standardize, RemoveIrrelevantValues, RemoveWithValues, Resample, SubsampleExpression

2. Explore the 'select attributes' as follows

weka-class/attributeSelection, FilterAttributeList, WrapperAttributeEval

3. Association mining

weka-class/associations, Apriori, FPMine

4. Classification**

weka-classifiers/bayes, NaiveBayes, weka-classifiers/lazy, IB1, IB2, weka-classifiers/trees, SimpleCart, RandomTree, C4.5

5. Clustering**

weka-classifiers, SimpleKMeans, Partitioned algorithm, CHC/CAN, HierarchicalCluster

BCA CPE 3

V SEMESTER**SEC 2A: Direction: Object Oriented Modelling & Design with UML****Credit (L: T: P = 3: 0: 1)****Course Outcomes**

- CO1: Demonstrate an ability with examples Object Oriented Development
- CO2: Write down the details of OO Modelling Concepts
- CO3: Learn the details of UML process Overview
- CO4: Identify the steps/Steps of System Using OO Model
- CO5: Identify the details of Steps for Implementation of OO Modelling
- CO6: Learn the details of Design a System Using UML Tool

Unit - 1**15 Hours**

INTRODUCTION: What is object orientation? What is OO development? OO terms, Evidence for usefulness of OO development, OO Modelling history, Introduction to UML, Importance of modeling, Principles of modeling, Object oriented modeling, Overview of UML, Conceptual model of the UML, Architecture, Software development life cycle.

MODELING CONCEPTS/Modeling as a design technique- Modeling, Abstraction, the three models: Class modeling -object and class concepts, link and association concepts, Generalization and inheritance, a sample model, navigation of class models, Advanced class modeling, advanced object and class concepts, association ends, many associations, aggregation, abstract classes, multiple inheritance, relations, replication, constraints, domain data packages.

Unit - 2**15 Hours**

State modeling: states, states, transitions and conditions, state diagrams, state diagram behavior, Interactive modeling: use case models, response models, activity models, Advanced Interactive Modeling: use case relationships, structural response models, special constructs for activity models

PROCESS OVERVIEW- development stages, development life cycle, Domain analysis: overview of analysis, domain class model, domain use model, domain interaction model, Iterating the analysis.

Unit - 3**15 Hours**

SYSTEM DESIGN overview of system design, estimating performance, making a reuse plan, breaking a system into subsystems, identifying

accessories, alignment of subprograms, management of data objects, handling global variables, choosing a software access strategy, handling resource contention.

CLASS DESIGN: Overview of class design, bridging the gap, reducing its costs, designing algorithms, harnessing inheritance, refactoring, Design Optimization: Reflection of Behavior, adjustment of inheritance, organizing a class design.

IMPLEMENTATION MODELING: Overview of implementation, the using classes Fine-tuning generalizations, Building associations using.

References Books:

1. Object-oriented modeling and design: Michael R. State and James R.umbaugh,
2. Object Technology: David A. Taylor.
3. Designing Flexible Object-Oriented systems with UML - Charles Stacher
4. Object-Oriented Analysis & Design, 2nd edition, Jackson, Fred Thomson
5. Object Oriented Modeling and Design - James Rumbaugh
6. Java Tutorial UML in Action - Joseph S. Scussone.

Object Oriented Modeling & Design with UML Lab

Term Work / Assignment

Each candidate will submit an approximately 10-page written report on a case study or real project. Students have to do UML analysis & design for the project, problem, and develop the case model, analysis model and design model for it using UML.

Practical assignment

Five assignments, one on each of the diagrams here in UML.

V SEMESTER

SEC-210 : Electives: Analysis and Design of Algorithms

(Credit L: T: P = 3: 0: 1)

Course Objectives:

- CO1: Upon successful completion of the course, the student is able to
- CO2: Learn the details of Types of various Algorithms
- CO3: Learn in details with examples Algorithm Design Techniques
- CO4: Understand in depth Sorting Techniques
- CO5: Understand in depth of Searching Techniques
- CO6: Identify in details with examples Analysis of Graph Algorithms
- CO7: Learn the details of Dynamic Programming Methods

Unit - I

15 Hours

Introduction: Notion of Algorithms, Basics of Asymptotic Notations, Mathematical Analysis of Non-Recursive and Recursive Algorithms, Comparison of Algorithms.

Algorithm Design Techniques: Iterative techniques Greedy and compare greedy algorithms.

Sorting Techniques: Selection sort, bubble sort, insertion sort, merge sorting techniques-quick sort, merge sort, Radix sort.

Unit - II

15 Hours

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 - PRIMAL 'S, KRUSKAL, Dijkstra's algorithm, Travelling Hamiltonian Circuit problem.

Unit - 3

15 Hours

DYNAMIC PROGRAMMING: The General Method, Marshall's Algorithm, Floyd's Algorithm for the All-Pairs Shortest Paths, Single-Source Shortest Paths, The Travelling Salesperson problem.

Reference Books:

1. Analysis & Design of Algorithms-Peter North
2. A.V. Levitin, Introduction to the Design and Analysis of Algorithms, Pearson Education, 2006.
3. J.Kleinberg and E. Tardos, Algorithmic Design, Pearson Education, 2006.

Analysis and Design of Algorithms Lab

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 Kruskal's Algorithm
12. Implement Traveling Salesperson problem
13. Implement Floyd's Algorithm
14. Implement Depth First Search
15. Implement Binary Search tree.

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V SEMESTER**BCC 2C: Electronic E-Commerce Technologies****Credit (L: T: P = 3: 0: 1)****Course Objectives**

- CO1: Understand the details of E-Commerce
- CO2: Learn the details of basic concepts of Internet and WWW
- CO3: Identify various Internet Security Methods
- CO4: Learn to decide with examples Concepts of Electronic Data Exchange and applications
- CO5: Learn to decide with examples Planning For E-Commerce
- CO6: Understand to apply Features of Internet Marketing

Unit -1**15 Hours**

An introduction to Electronic commerce: What is E-Commerce (Introduction and Definitions), Main activities E-Commerce, Goals of E-Commerce, Essential 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 (EC, EC2, EC3, B2C, B2B, B2A, P2P, B2A, C2A, H2B, 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 Applications, building over website, Cost, Time, Reach, Registering a Domain Name, Web promotion, Target email, Host, Exchange, Shopping Bots.

Unit -2**15 Hours**

Internet Security: Secure Transaction, Computer Monitoring, Privacy on Internet, Corporate Email privacy, Computer Crime Laws, Types of Criminal Threats, Attack on Computer System, Software Packages for privacy, Hacking, Computer Virus: How it spreads, Virus problems, Virus protection, Encryption and Decryption, Secret key Cryptography, DES, Public Key Encryption, RSA, Authentication and Authorization, Firewall, Digital Signature (How it Works)

Electronic Data Exchange: Introduction, Concepts of EDI and Limitations, Applications of EDI, Disadvantages of EDI, EDI model, Electronic Payment System: Introduction, Types of Electronic Payment Systems, Payment Types,

Value Exchange System, Credit Card System, Electronic Fund Transfer, Paperless Bill, Mobile Payment Cash, Electronic Cash.

Unit - 5

15 Hours

Planning for Electronic Commerce: Planning Electronic Commerce website, linking objectives to business strategies, measuring cost objectives, Comparing benefits to Costs, Strategies for developing electronic commerce web sites.

Internet Marketing: The PEST and SWOT of online shopping, The cost of online shopping, Identify an Internet business, Internet marketing techniques, The E-cycle of Internet marketing, Personalization e-commerce.

Reference Books:

1. Bill E. Stealy, E-Commerce Systems, Models, Strategies & Standard Publishing House, 2011.
2. Kenneth E. Bala and Debraj Ray, E-Commerce, 2005.
3. Peter P. Schwabert, Electronic commerce, International Business Journal, 2011.
4. ROBERT CRAN, RAYMOND GIBB, THARALDI DELLEON, ELIZABETH CHANG & COMPANY, FUNDAMENTALS AND APPLICATIONS, Wiley, Revised Edition, 2011.

E-Commerce Technologies Lab

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. Hyper Text Markup Language (HTML)
2. Cascading Style Sheets (CSS)
3. JavaScript
4. ASP
5. PHP
6. XML
7. Joomla

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V SEMESTER

HSE-4A: Elective: Operation Research

Credit (L: T: P = 4: 0: 1)

Course Objective

The successful completion of the course, the student is able to:

- (C1) Write down the details of Origin and Development of Operation Research
- (C2) Formulate the Mathematical of Linear Programming Problems and Methods
- (C3) Performer to solve Transportation Problems
- (C4) Performer to solve Assignment Problems
- (C5) Identify to details with examples Network Analysis
- (C6) Learn to depth Application of Operation Research

Unit - 1

15 Hours

Linear Programming Problems: Origin and development of operations research; Formulation of Linear Programming problems, 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 method 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 Problems.

Unit - 4

15 Hours

Network Analysis: Basic components of network, Rules for drawing Network diagram; Time calculation in Networks, Critical Path Method and PERT Evaluation and Review Techniques, Algorithm and flow chart for CPM and PERT.

Reference Books

1. Taha, "Operations Research", 7th edition, Pearson Education, 2007.
2. Elsayy E. Elwan, "Introduction to Operations Research", Helwan Publishing House, 1999.
3. Sureshchandra Taha "Operations Research", 2nd Edition, PHI, 1992.

Operative Research Lab**Lab based on Operative Research**

1. LP
2. Simplex
3. Dual Simplex
4. Big-M
5. Vogel's
6. Maxima and Minima
7. North West corner
8. Sequencing Problems
9. Mini Method
10. Hungarian Method
11. Assignment Problem

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VI SEMESTER**DSB 40: Operating System Software & Computer design**

Credit (L: T: P = 4: 0: 1)

Course Outcomes:

An successful completion of the course, the student is able to

- CO-1 Understand the architecture and characteristics of language Processors
- CO-2 Learn the details of Concepts Of Macro
- CO-3 Learn the details of Linkers and Loaders
- CO-4 Understand in details with examples of Compiler Concept
- CO-5 Understand the details of Parsing Methods
- CO-6 Write down the details of Code optimization

Unit - 1**18 Hours****ASSEMBLERS & MACROS:** Overview of Language processors – assemblers. Design of two pass assemblers – single pass assemblers**MACROS:** Macro definition, macro call – macro expansion- nested macro defined

Macro facilities- Design of Macroprocessor.

LINKERS & LOADERS: Relocation and linking concepts – Design of linker – and relocating programs – linking in MS-DOS – overlays**DYNAMIC LINKING:** Loaders – Absolute loaders- relocating loaders**Unit - 2****18 Hours****COMPILERS: GRAMMARS & AUTOMATA :** Languages – Chomsky – Types of grammar – Context free grammar – regular expressions – Recognizing of patterns – from automata (deterministic & non deterministic) Conversion of NFA to DFA – Conversion of regular expression of NFA – Thompson's construction- minimization of NFA – Derivation – parse tree – ambiguity – Lexical analysis: lexemes – token specification – design of lexical analyser (LEX) – Automatic generation of lexical analyser – input buffering – A language for specifying lexical analyser – implementation of lexical analyser**SYNTAX ANALYSIS – PARSING:** Definition – top of parser – top down parsing – bottom up parsing – Left recursion – left factoring – Handle pruning – Shift reduce parsing – operator precedence parsing – FIRST- FOLLOW- LEADING- TRAILING

Unit -3**15 Hours**

Predictive parsing – recursive descent parsing, LR parsing – LR (0) items – LR parsing – Canonical LR – LALR parsing – generation of LALR – Ambiguous grammar – shift reduce.

SYNTAX DIRECTED TRANSLATION & CODE OPTIMIZATION

Intermediate Language – postfix – postfix – Quadruple – triple – indirect triple – syntax tree Evaluation of expression – three address code- Symbolic address – labeled address – Conversion of Assignment statements- Boolean expressions – Backtracking – Declaration – CASE statements

Unit -4**15 Hours**

CODE OPTIMIZATION: Local optimization- Loop Optimization techniques – DAG – Dominators- Flow graphs – Storage allocation- Peephole optimization – Issues in Code Generation.

Reference Books:

1. Alfred V. Aho, Jeffrey D. Ullman, "Data Structures, Compilers, Principles techniques and tools", Pearson Education 2011.
2. Abraham D. D., "System Programming", Tata McGraw Hill Education Pvt. Ltd., 2011.
3. Kenneth Kell, "System Programming", Oxford University Press, 2011.
4. Raghavan V., "Principles of Compiler Design", Tata McGraw Hill Education Pvt. Ltd., 2011.
5. David Gillies, "Modern Compiler Design", Pearson Education, Revised 2011.
6. Donald Knuth, E., "Introduction to Grammar and Compiler Design", PHL, 2011.

System Software & Compiler design Lab

1. Implementation of a text editor
 2. Implementation of an Assembler
 3. Implementation of Macro processor
 4. Converting a regular expression to NFA
 5. Conversion of an NFA to DFA
 6. Computation of FIRST and FOLLOW sets
- LI-23-Engg-Tech-SEM-2023
7. Computation of Loading and Unloading Sets
 8. Construction of Prefective Parsing Table
 9. Implementation of LR(0) Reduced Parsing
 10. Computation of LR(0) items
 11. Construction of LR(0)
 12. Intermediate code generation

BCA30001**4th SEMESTER****DSO (C) Elective: Digital Image Processing****Credit (L: T: P = 4: 0: 1)****Course Outcomes**

After successful completion of the course, the student is able to:

- CO1: Learn in-depth with examples Elements of Digital Image Processing Systems
- CO2: Identify in-depth Image Enhancement Techniques
- CO3: Know about in-depth Image Restoration Methods
- CO4: Learn the details of Image Compression Algorithms
- CO5: Identify in-depth with examples Data Image Compression
- CO6: Learn in-depth Various Applications of Image Processing

Unit - 1**15 Hours**

DIGITAL IMAGE FUNDAMENTALS: Elements of digital image processing systems, Videocon and Digital Camera working principles, Elements of visual perception, brightness, contrast, tone, saturation, mask based effect, Color image fundamentals - RGB, CMY models, Image sampling, Quantization, filter, Two-dimensional mathematical performance, 2D transforms - DFT, DCT, SIFT, SVD.

IMAGE ENHANCEMENT: Histogram modification and specification techniques, Noise distributions, Spatial averaging.

Unit - 2**15 Hours**

Directional Smoothing, Median, Geometric mean, Harmonic mean, Contrast limited mean filter, Histogram equalization, Color image enhancement.

IMAGE RESTORATION: Image Restoration - degradation model, Unconstrained restoration - Lagrange multiplier and Constrained restoration, Inverse filtering/restoration of blur caused by uniform linear motion, Wiener filtering.

Unit - 3**15 Hours**

Geometric transformations-spatial repositioning.

IMAGE SEGMENTATION: Edge detection, Edge linking via Hough transform - Thresholding - Region based segmentation - Region growing - Region splitting and Merging - Segmentation by morphological watershed - Basic concepts - Line construction - Watershed segmentation algorithm.

18 Hours

IMAGE COMPRESSION: Tools for data compression, Huffman, Run Length coding, Loss codes, Arithmetic coding, Vector Quantization, Transform and DCT standard, MPEG.

Reference Books:

1. Robert C. Gonzalez, Richard E. Woods, – Digital Image Processing, Second, Second Edition, 2004.
2. Anil K. Jain, – Fundamentals of Digital Image Processing, Prentice Hall.

Digital Image Processing Lab

- Lab 01: Write a program for image enhancement.
- Lab 02: Write a program for image compression.
- Lab 03: Write a program for color image processing.
- Lab 04: Write a program for image segmentation.
- Lab 05: Write a program for image morphological.
- Lab 06: Image Resampling
- Lab 07: Edge detection
- Lab 08: Blurring & bit plane visual reconstruction

SECTION**SYNOPSIS****ISE 5: E-Commerce Dissertation / Project
Credit (L: T: P: W: R: S) 12 Hours/Week****Course Objectives:**

(After successful completion of the course, the student is able to)

- CO1. Identify the needs with respect to system identification
- CO2. Make plans to design system analysis
- CO3. Understand and Design DBS for selected system problems
- CO4. Understand and Develop System Design for selected system problems
- CO5. Understand details and Develop a Code and Test the System
- CO6. Understand the quality of Performance and Data of System Work

- This option is to be offered only in full 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 FWO (02) 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.

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VI SEMESTER

SEC 3A: PHP Programming

Credit (L: T: P: R: W: T)

Learning Objectives:

Successful completion of the course. The student is able to

- (a) Learn to depth Extension of PHP
- (b) Learn to depth Interaction Methods Between HTML and PHP
- (c) Understand to depth PHP functions
- (d) Understand to depth String Manipulation
- (e) Learn the characteristics of Regular Expression
- (f) Learn the details of Developing PHP Web Application

Unit - 1**15 Hours**

Introduction Basic PHP Development Control Structure: Introduction to www, mysql, Understanding client-server side: Apache, PHP, MySQL, XAMPP installation, PHP Basic syntax, PHP data Types, PHP Variables PHP Constants, PHP Expressions, PHP Operators, Control Structure & 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 Linking, Uploading Files via a 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

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 rows, Inserting, Deleting, Creating 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 Polmer (22 February 2014)
2. PHP and MySQL, Web Development by Lucas Thomas and Luke Welling
3. PHP Reference: Beginner to Intermediate PHP5 by Martin Lacey
4. PHP 4: A Beginner's Guide by William Stacey

PHP Programming Lab

Students should do Mini Project Using PHP under the supervision of Teacher/ Lecturer



V SEMESTER
SEC-301 – Elective: Computer Simulation
Credit (L: T: P = 3: 0: 1)

Course Objectives:

1. Understand the objectives of the course. The student is able to
 - (1) Differentiate the details of Concepts of Simulation and Methods.
 - (2) Understand the details of Random Numbers/variables.
 - (3) Learn the details of Design of Simulation Experiments.
 - (4) Understand the characteristics of Discrete System simulation language.
 - (5) Learn to handle with Case studies using Simulation Language.
 - (6) Identify the details of applications of simulation.

Unit - 1

15 Hours

INTRODUCTION: Concept of simulation – simulation as a decision making tool Monte Carlo simulation.

RANDOM NUMBERS/GENERATION: Pseudo random numbers – methods of getting random variables – random variables for uniform, normal, binomial, poisson, exponential distributions.

Unit - 2

15 Hours

BEGIN OF SIMULATION EXPERIMENTS: Problem formulation – data collection and reduction – logic developments – initial conditions – run length, error method of simulation – development of models using higher level language for systems like queuing, production, inventory and maintenance – report analysis and interpretation, validation.

Unit - 3

15 Hours

DISCRETE SYSTEM SIMULATION LANGUAGES: Need for simulation language – Comparison of simulation languages: SIMSCRIPT, GASP, SIMULA, GPSS, PROMODEL, etc.

CASE STUDIES USING SIMULATION LANGUAGES: Development of simulation models using the simulation language studies for systems for systems like queuing systems, production systems, inventory systems, maintenance and replacement systems, investment analysis and network.

Reference Books:

1. Jerry Banks and John S. Carson, Berni S. Nelson, David M. Tiedt, P. Ramasubramanian "Discrete event system simulation" Pearson, 2007.
2. Thomas E. Scholer, "Simulation using C++" John Wiley, 2002.
3. Law, A.M. and Nelson, W.D. "Simulation Modeling and Analysis, 3rd Edition" McGraw Hill, 2000.

Computer Simulation Lab

**Design Job Cycle based on Computer Simulation (Theory) Paper by
Concerned Teacher / Lecturer**

2013/2014

V SEMESTER

**SEC 301 – Elective: Information Security and Cyber Law
Credit (L: T: P = 3: 0: 1)**

Course Objectives:

Successful completion of the course, the student is able to

- (1) Learn in depth Computer Network Threats
- (2) Understand the details of Digital Crimes
- (3) Understand the details of Risk Analysis
- (4) Understand in detail with examples Concepts of Cryptography
- (5) Learn in detail with examples Applications of Cryptography
- (6) Learn in detail with examples ethics, laws and Cyber Law

Unit - 1

18 Hours

Introduction: Computer network as a threat, hardware vulnerability, software vulnerability, importance of data security.

Digital Crimes: Overview of digital crime, criminality of computer crime.

Intelligence Gathering Techniques: Tools of the attacker, reconnaissance and cyber warfare, scanning and spoofing, password cracking, malicious software, virus hijacking

Unit - 2

18 Hours

Risk Analysis and Threats: Risk analysis, process, key principles of operational computer security, security policies, authentication, data protection, access control, and internal vs. external threat, security assessment, passwords, authentication, and access control, computer forensics and incident response

Introduction to Cryptography and Applications: Important terms, Threat, Flaw, Vulnerability, Exploit, Attack, Ciphers, Codes, Substitution Cipher (Classical), Transposition Cipher (Rail-Fence), Public key cryptography (Diffie-Hellman only), Private key cryptography (Diffie-Hellman and Example), Cyber Forensics, Steganography

Safety Tools and Issues: Firewalls, logging and intrusion detection systems, Windows and windows XP / NT security, Unix/Linux security, ethics of hacking and cracking

Unit - 3**18 Hours****Cyber laws to be covered as per IT, 2008**

- Chapter 1: Definitions
- Chapter 2: Digital Signature And Electronic Signature
- [Section 43] Penalty and Compensation for damage to computer, computer system, etc.
- [Section 43A] Tampering with Computer Source Documents
- [Section 43B] Penalties for sending offensive messages through communication services, etc.
- [Section 43C] Penalties for dishonestly receiving stolen computer resource or communication device
- [Section 43D] Penalties for identity theft
- [Section 43E] Penalties for cheating by personation by using computer resource
- [Section 43F] Penalties for violation of privacy
- [Section 43G] Penalties for cyber terrorism
- [Section 43H] Penalties for publishing or transmitting obscene material in electronic form
- [Section 43IA] Penalties for publishing or transmitting of material containing sexually explicit act, etc. in electronic form [Section 43IB] Penalties for publishing or transmitting of material depicting children in sexually explicit act, etc. in electronic form
- [Section 72] Breach of confidentiality and privacy

Reference Books

1. M. Medsker, J. Breitinger, Information Security: Principles and Practices, Pearson Education
2. C.R.F. Snyder, J. Panko, Network Security, Cengage Learning, 2018
3. A. Bhatta, W. Hulan, Computer Security: Concepts, Issues and Implementation, Cengage Learning India, 2018
4. Anderson, Ross: Security engineering, John Wiley & Sons, 2018. (Freely available online)

Information Security and Cyber Laws Lab

Demonstrate the use of network tools ping, ipconfig, nslookup, traceroute, netstat, whois

Use of Password cracking tools like the Rappor, CyberChef. Verify the strength of passwords using these tools.

Perform encryption and decryption of Caesar cipher. Write a script for performing these operations.

Perform encryption and decryption of a Rail fence cipher. Write a script for performing these operations.

Use Wireshark / networkMiner to analyze a remote machine.

Use Burp proxy to capture and modify the message.

Demonstrate sending of a protected word document.

Demonstrate sending of a digitally signed document.

Demonstrate sending of a protected worksheet.

Demonstrate use of steganography tools.

Demonstrate use of gpg utility for signing and encrypting messages.

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE

(Autonomous)

B N ROAD, MYSURU- 570 025

DEPARTMENT OF ZOOLOGY

Syllabus

CHOICE BASED CREDIT SYSTEM

For B.Sc programmes

Chemistry, Botany, Zoology

Chemistry, Zoology, Biotechnology

2018-19

I SEMESTER ZOOLOGY

PRACTICAL –I
ANIMAL DIVERSITY

PRACTICAL

CREDITS 2

1. **PROTOZOA-** Culture preparation and observation of different protozoans.
Paramecium, Euglena, Amoeba and mounting of Foraminiferans
2. **PORIFERA-** Sycon, Hyalonema, , Gemmule, Monaxon spicules.
3. **COELETERATA-** Obelia, Physalia, Aurelia, Ephyra larva, Metridium
4. **HELMINTHES-** Taenia solium, Planaria, Fasciola, Ascaris male and female,
5. **ANNELIDA:** Pheretima, Nereis, Leech
Onychophora: Peripatus
6. **ARTHROPODA:** Palaemon, Palamnaeus, Scolopendra, Spirostreptus
study of mouth parts of cockroach/ honey bee/mosquito/house fly.
7. **MOLLUSCA:** Chiton, Unio, Aplysia, Sepia, Octopus.
8. **ECHINODERMATA:** Asteropecten, Ophiothrix, Sea urchin, Holothuria, Antedon,
Pedicellariae of Seaurchin.
9. **PROTOCHORDATA:** Balanoglossus, Herdmania, Amphioxus, Myxine, Petromyzon,
Ammocoetes larva.
10. **PISCES:** Pristis, Torpedo, Labeo, Exocoetus.
11. **AMPHIBIA:** Salamandra, Rana tigrina, Ichthyophis.
12. **REPTILES:** Chamaeleon, Draco, Vipera, Naja, Chelone.
Bungarus, Enhydrina.
13. **AVES:** Koel, Kite, Duck.
MAMMALS: Bat, Loris, Guinea pig.
14. Study of animal dissection through digi frog software.(digestive and reproductive system of Leech and Rat)
15. Preparation of animal album containing photographs, cut outs, with appropriate write up the above mentioned taxa. Different taxa/topics may be given to different sets of students.(**Invertebrates-05, Vertebrates-05**)

II SEMESTER ZOOLOGY

PRACTICAL –II

COMPARATIVE ANATOMY AND DEVELOPMENTAL BIOLOGY OF VERTEBRATES

PRACTICAL

(CREDITS 2)

1. Skeleton of [Pigeon] and [Rabbit].
2. Carapace and plastron of turtle /tortoise.
3. Mammalian skulls: Herbivorous (Rabbit/ Horse) and Carnivorous (Dog/Cat).
4. Skull of Frog, Pigeon.
5. Vertebrae of Frog (Atlas, Pro, Amphi and Acoelous), Pigeon (Heterocoelous Vertebra, Synsacrum) Rabbit (Atlas, Axis, Thoracic vertebrae).
6. Pectoral and Pelvic girdles of Frog, Pigeon and Rabbit.
7. Fore and hind limb skeletons of Frog, pigeon and Rabbit.
8. Study of development of hen's egg – Window technique.
9. Frog - cleavage stages.
10. Blastula, gastrula, neurula stage (whole mount) .
11. Chick embryo stages-18hrs, 24hrs, 36 hrs, 48hrs. (whole mount) .
12. Study of the different types of placenta- Sheep, Rat placenta.
13. Identification of various family planning devices .
14. Study of skeletal system through software.

PRACTICAL –III
PHYSIOLOGY AND BIOCHEMISTRY

PRACTICAL

(CREDITS 2)

1. Qualitative test for carbohydrate test-Molisch's test, Iodine test, Fehling's test and picric acid test.
2. Qualitative test for proteins- Biuret test, Ninhydrin test, Millon's test and Xanthoproteic test.
3. Qualitative test for lipids-Acrolein Test, Leiberman-Burchard test, Salkowasky test
4. Identification of vitamins presents in the food materials with their physiological role and their disorders.
5. Salivary amylase activity on starch.
6. Dehydrogenase activity in milk.
7. Preparation of hematin crystals.
8. Blood typing –ABO type and Rh factors.
9. Detection of nitrogenous wastes – Ammonia (Nessler's test), Urea (Urease test), Uric acid (Folin's U test).
10. Study of permanent histological sections of mammalian pituitary, thyroid, parathyroid.
11. Study of permanent histological sections of mammalian Pancreas, adrenal gland, testis and ovary.
12. Study of permanent slides of liver, lung and kidney.
13. Study of permanent slides of spinal cord, bone marrow and T.S of cartilage.
14. **Field Study:** Visit to a Pathology lab / Hospital to know about different techniques of biochemical analysis and submission of the report.

IV SEMESTER ZOOLOGY

PRACTICAL –IV

GENETICS AND EVOLUTIONARY BIOLOGY

PRACTICAL

(CREDITS 2)

1. Genetic problems- Monohybrid and Dihybrid cross.
2. Complementary genes: Flower color in sweet pea.
Supplementary genes: Comb patterns in Fowls.
3. Epistatic genes: Plumage colors in Fowls and Multiple genes: Skin color in man.
4. Multiple alleles: ABO blood group in human. And Sex linked inheritance: Drosophila (red and white eye colour) and human (Haemophilia and Colourblindness).
5. Study of Human Karyotypes (normal) and abnormal- (Turner, Klinefelter, Down's and Cri-du-chat syndrome (abnormal)).
6. General morphology of *Drosophila melanogaster* (male and female).
7. Mounting of sex comb and wing of Drosophila
8. Identification of mutants of white eye, bar eye, sepia eye, vestigial wing and ebony body of Drosophila
9. Preparation of media and maintenance and breeding of Drosophila – (Demonstration)
10. Study of homology – vertebrate forelimbs and analogy-wing of bird & limb skeleton from suitable specimens/ pictures.
11. Study of aquatic adaptations: Shark & Turtle.
Study of arboreal adaptations: Chamaeleon, Loris.
12. Study of Volant adaptations : Exocoetus Fish, Bat, Pigeon, Draco.
13. Submission of report on-
 - a. Evolution of Horse
 - b. Evolution of Camel
 - c. Evolution of Elephant
 - d. Evolution of Man
14. Experiment on genetic drift-Sampling error and population size.

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.
- Field visits to a Vermiculture / Sericulture / fisheries / apiculture / poultry / dairy farm-
submission of any 1 Report.

V SEMESTER ZOOLOGY

PRACTICAL –V

PRACTICAL **INSECT VECTORS AND DISEASES** **(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**

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.

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

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DEPARTMENT OF ZOOLOGY

Syllabus

CHOICE BASED CREDIT SYSTEM

For B.Sc programmes

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Chemistry, Zoology, Biotechnology

2018-19

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ANIMAL DIVERSITY

PRACTICAL

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PRACTICAL –III
PHYSIOLOGY AND BIOCHEMISTRY

PRACTICAL

(CREDITS 2)

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GENETICS AND EVOLUTIONARY BIOLOGY

PRACTICAL

(CREDITS 2)

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Supplementary genes: Comb patterns in Fowls.
3. Epistatic genes: Plumage colors in Fowls and Multiple genes: Skin color in man.
4. Multiple alleles: ABO blood group in human. And Sex linked inheritance: *Drosophila*(red and white eye colour) and human(Haemophilia and Colourblindness).
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11. Study of aquatic adaptations: Shark & Turtle.
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13. Submission of report on-
 - a. Evolution of Horse
 - b. Evolution of Camel
 - c. Evolution of Elephant
 - d. Evolution of Man
14. Experiment on genetic drift-Sampling error and population size.

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.
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 4. Identifying feature and economic importance of *Helicoverpa (Heliothis) armigera*, *Papilio demoleus*
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Protocooperation – Hermit crab and Sea anemone.
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 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.
- Field visits to a Vermiculture / Sericulture / fisheries / apiculture / poultry / dairy farm-
submission of any 1 Report.

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, Phthirus 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**

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.

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

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE

(AUTONOMOUS INSTITUTION)

(AFFILIATED TO UNIVERSITY OF MYSORE & REACCREDITED BY NAAC WITH A GRADE)

MYSORE-570025

GRADUATE COURSE – SEMESTER SCHEME

2018-19

SYLLABUS

Programmes BSc in Botany, Biochemistry, Microbiology

BSc in Biochemistry, Microbiology, Biotechnology

BIOCHEMISTRY DEPARTMENT

CMF21207

SEMESTER VI

Paper VIII

CLINICAL BIOCHEMISTRY

UNIT –I

6hrs

Introduction: Definition, scope, units, collection & preservation of biological fluids.

Urine: Normal composition of urine – volume, pH, colour, specific gravity. Normal constituents & clinical significance of their variation– urea, uric acid, creatinine, bile pigments. Abnormal constituents and their clinical significance – glucose, albumin, ketone bodies. Urea clearance test.

UNIT –II

6hrs

Blood: Normal constituents of blood & their variation in abnormal conditions – urea, uric acid, creatinine, glucose, bilirubin, total protein, albumin/globulin ratio.

Lipid profile - Cholesterol, triglycerides, lipoproteins, HDL, LDL & VLDL and clinical significance of their variation

UNIT – VI

6hrs

Hematology: Hb%, WBC count- total and differential counting, erythrocyte count, ESR, & platelet counting and their clinical significance.

Cardiac injury profile- CKMB and LDH.

UNIT – VII

Gastric function test: Introduction, tests of gastric function – one test and its clinical significance

Pancreatic Function test: Tests for serum amylase and lipase and their clinical significance.

Kidney function test: Clearance tests- Creatinine clearance test and its clinical significance

PRACTICAL- CLINICAL BIOCHEMISTRY

1. Qualitative analysis of abnormal constituents of urine – Glucose, albumin, bile pigments, bile salts & ketone bodies.
2. Determination of titrable acidity of urine.
3. Estimation of Urea in urine by DAMO method.
4. Estimation of uric acid in urine
5. Estimation of SGOT
6. Estimation of SGPT
7. Estimation of Bilirubin by direct bilirubin method

DSE -1: NUTRITIONAL BIOCHEMISTRY (THEORY)

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, GTT and glycosylated Hb, Differential diagnosis of B12 and folate.

Unit: 8 FOOD & DRUG INTERACTIONS & NUTRICEUTICALS: Nutrient interactions affecting ADME of drugs, Alcohol and nutrient deficiency, Antidepressants, psychoactive drugs and nutrient interactions, Appetite changes with drug intakes and malnutrition. Food as medicine.

PRACTICALS

1. Bioassay for vitamin B12/B1.
2. Homocystiene estimation.
3. Serum/ urine MMA estimation.
4. Anthropometric identifications for Kwashiorkor, Marasmus and Obesity.
5. Determiation of oxidative stress: TBARS, antioxidant enzymes in hemolysate.
6. Vitamin A/E estimation in serum.
7. Bone densitometry /bone ultrasound test demonstration (visit to a nearby clinic)
8. Proximate analysis of food samples- Moisture, fibre, protein fat and carbohydrate (by difference) (3 practicals)
9. Detection of adulterants in food.
10. Estimation of Calcium in ragi.
11. Estimation of Vitamin – C in lemon or gooseberries by DPPH method
12. Estimation of Lactose in milk by Benedict's method
13. Estimation of Vitamin – E by alpha- alpha bipyridyl method in a given sample (Cod liver oil)

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE

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MYSORE-570025

GRADUATE COURSE – SEMESTER SCHEME

2018-19

SYLLABUS

Programmes BSc in Botany, Biochemistry, Microbiology

BSc in Biochemistry, Microbiology, Biotechnology

BIOCHEMISTRY DEPARTMENT

CMF21207

SEMESTER VI

Paper VIII

CLINICAL BIOCHEMISTRY

UNIT –I

6hrs

Introduction: Definition, scope, units, collection & preservation of biological fluids.

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UNIT –II

6hrs

Blood: Normal constituents of blood & their variation in abnormal conditions – urea, uric acid, creatinine, glucose, bilirubin, total protein, albumin/globulin ratio.

Lipid profile - Cholesterol, triglycerides, lipoproteins, HDL, LDL & VLDL and clinical significance of their variation

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6hrs

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DSE -1: NUTRITIONAL BIOCHEMISTRY (THEORY)

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, GTT and glycosylated Hb, Differential diagnosis of B12 and folate.

Unit: 8 FOOD & DRUG INTERACTIONS & NUTRICEUTICALS: Nutrient interactions affecting ADME of drugs, Alcohol and nutrient deficiency, Antidepressants, psychoactive drugs and nutrient interactions, Appetite changes with drug intakes and malnutrition. Food as medicine.

PRACTICALS

1. Bioassay for vitamin B12/B1.
2. Homocystiene estimation.
3. Serum/ urine MMA estimation.
4. Anthropometric identifications for Kwashiorkor, Marasmus and Obesity.
5. Determiation of oxidative stress: TBARS, antioxidant enzymes in hemolysate.
6. Vitamin A/E estimation in serum.
7. Bone densitometry /bone ultrasound test demonstration (visit to a nearby clinic)
8. Proximate analysis of food samples- Moisture, fibre, protein fat and carbohydrate (by difference) (3 practicals)
9. Detection of adulterants in food.
10. Estimation of Calcium in ragi.
11. Estimation of Vitamin – C in lemon or gooseberries by DPPH method
12. Estimation of Lactose in milk by Benedict's method
13. Estimation of Vitamin – E by alpha- alpha bipyridyl method in a given sample (Cod liver oil)

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 Edward Jenner and Louis Pasteur.

Antigens: Definition, haptens, epitopes, 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, Hemagglutination, ELISA, immunofluorescent, 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's Immunobiology. 7th edition Garland Science Publishers, New York.
5. Peakman M, and Vergani D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinberg.
- Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell

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.

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

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 scientificpublishers. 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 OrganCulture. Narosa Publishing House.

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. Comprehend 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, Lubert Stryer, 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 and Sons, 1995.
5. Biochemistry by Mary K. Campbell & Shawn O. Farrell, 5th Edition, Cengage 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

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. Comprehend 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

8. Qualitative analysis of Carbohydrates.
9. Qualitative analysis of Lipids.
10. Estimation of reducing sugar by DNS method.
11. Estimation of Protein by Biuret method.
12. Estimation of amino acid by ninhydrin method /formal titration
13. Determination of activity and specific activity of enzyme-Salivary amylase.
14. Effect of pH on enzyme activity
- 8.. Effect of temperature on enzyme activity.
12. Effect of metal ions on enzyme activity.
13. Preparation of buffer solution.
14. Identification of amino acids by circular paper chromatography.

REFERENCES

9. Nelson, D.L., Cox, M.M. 2004 Lehninger Principles of Biochemistry, 4 th edition, W.H. Freeman and Company, New York, USA.
10. Biochemistry, Lubert Stryer, 6th Edition, WH Freeman, 2006.
11. Biochemistry by Robert K. Murray, David A Bender, Kathleen Harper's illustrated M.Botham, Peter J. Kennelly, Victor W. Rodwell, P. Anthony Weil. 28th Edition, McGrawHill, 2009.
12. Biochemistry, Donald Voet and Judith Voet, 2nd Edition, Publisher: John Wiley and Sons, 1995.
13. Biochemistry by Mary K.Campbell& Shawn O.Farrell, 5th Edition, Cengage Learning,2005.
14. Fundamentals of Enzymology Nicholas Price and Lewis Stevens Oxford University Press 1999
15. Fundamentals of Enzyme Kinetics Athel Cornish-Bowden Portland Press 2004
16. Practical Enzymology Hans Bisswanger Wiley-VCH 2004

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.

Ecofriendly bioproducts: 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 Jeseff Winter
4. Le CT (2003) Introductory biostatistics. 1st edition, John Wiley, USA
5. Glaser AN (2001) High Yield™ 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.

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.

Ecofriendly bioproducts: 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.
 - e. Estimation of chloride in sewage water sample.
 - f. Estimation of residual chloride in sewage water sample.
 - g. Estimation of carbon dioxide in sewage water sample.
4. Identification of microbial flora in the given water sample.
- 9 . Estimation of percentage of alcohol by specific gravity bottle method
- 10
 - a. Photographic demonstration of septic tank, sand filters, Imhoff's tank and biosensors.
 - f. Photographic demonstration of creation of superbug.
 - g. Photographic demonstration of genetically modified microbes.
 - h. Photographic demonstration of genetically modified plants.
 - i. Photographic demonstration of genetically modified animals.

Biostatistics problems

- 11 Problems on graphical and diagrammatic representation of data(histogram, bar graph and pie chart)
- 12 Calculation of mean, median, mode, standard deviation

REFERENCES

8. Environmental Science, S.C. Santra
9. Environmental Biotechnology, Pradipta Kumar Mohapatra
10. Environmental Biotechnology – Concepts and Applications, Hans-Joachim Jordening and Jeseff Winter
11. Le CT (2003) Introductory biostatistics. 1st edition, John Wiley, USA
12. Glaser AN (2001) High Yield™ Biostatistics. Lippincott Williams and Wilkins, USA
13. Edmondson A and Druce D (1996) Advanced Biology Statistics, Oxford University Press.
14. Danial W (2004) Biostatistics : A foundation for Analysis in Health Sciences, John Wiley and SonsInc.

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.

Ecofriendly bioproducts: 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.
- h. Estimation of chloride in sewage water sample.
- i. Estimation of residual chloride in sewage water sample.
- j. Estimation of carbon dioxide in sewage water sample.
4. Identification of microbial flora in the given water sample.
13. Estimation of percentage of alcohol by specific gravity bottle method
- 14 a. Photographic demonstration of septic tank, sand filters, Imhoff's tank and biosensors.
- j. Photographic demonstration of creation of superbug.
- k. Photographic demonstration of genetically modified microbes.
- l. Photographic demonstration of genetically modified plants.
- m. Photographic demonstration of genetically modified animals.

Biostatistics problems

- 15 Problems on graphical and diagrammatic representation of data(histogram, bar graph and pie chart)
- 16 Calculation of mean, median, mode, standard deviation

REFERENCES

15. Environmental Science, S.C. Santra
16. Environmental Biotechnology, Pradipta Kumar Mohapatra
17. Environmental Biotechnology – Concepts and Applications, Hans-Joachim Jordening and Jesef Winter
18. Le CT (2003) Introductory biostatistics. 1st edition, John Wiley, USA
19. Glaser AN (2001) High Yield™ Biostatistics. Lippincott Williams and Wilkins, USA
20. Edmondson A and Druce D (1996) Advanced Biology Statistics, Oxford University Press.
21. Danial W (2004) Biostatistics : A foundation for Analysis in Health Sciences, John Wiley and Sons Inc.

CME23206

V SEMESTER

BT 5.2: Immunology and Medical Biotechnology

48 hours

PART-A

Immunology:

Unit-I

Historical account and chronological events of Edward Jenner and Louis Pasteur. 6 Hrs
Types of immunity – Innate- mechanism of innate immunity. Adaptive immunity – active and passive and adoptive immunity. Antigen: Definition, epitopes, antigenicity, blood group antigens. Antibodies: Definition, types, structure of IgG.

Unit-II

6 Hrs
Cells involved in immune system – T- cells, B-cells, antigen presentation and macrophages, their role in antigen recognition, clonal selection, and immunological memory.
Organs of immune system: Primary and secondary lymphoid organs –structure and functions. **Immuno techniques: Precipitation reaction, immuno diffusion-ODD and RID, RIA, Hemagglutination, ELISA, immunofluorescent, Western blotting.**

Unit-III

6 Hrs
Immunological aspects of viral (HIV), bacterial and parasitic infection (one example each)
Immunization: Passive and active, primary and secondary responses, adjuvant.
Immunological disorders: Hypersensitivity, auto immune disorders- organ specific and systemic specific Grave's diseases, Hashimoto's disease, systemic lupus erythematosus.

Unit-IV

6 Hrs
Major histocompatibility complex: Definition, H2 complex, HLA, functions of MHC. Complement proteins: role of classical complement pathway in immune response. Transplantation immunology: Types of grafts, graft acceptance, graft rejection, host vs graft rejection

PART-B

Medical biotechnology

Unit-I

6 Hrs
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, diagnostic proteins eg: AIDS diagnosis.

Unit-II

6 Hrs

Nucleic acid analysis: Features of DNA probes and its applications in diagnosis, diagnosis infectious diseases, identification of *Mycobacterium tuberculosis* in clinical samples using PCR.

Antibiotics: Introduction, strain development and improvement, production of penicillin using genetically engineered organisms.

Enzymes in therapy: List of enzymes and their therapeutic applications.

Unit-III

6 Hrs

Monoclonal antibodies: Introduction, production of monoclonal antibodies, Monoclonal antibodies in therapy-for infectious disease and cancer.

Human gene therapy: Definition, differences between somatic and germ line gene therapy, one example each, principle and applications.

Antisense

technology: Principle and applications

Unit-IV

6 Hrs

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.

Transgenic plants for production of biopharmaceutical (tobacco, tomatoes, and potatoes)

V Semester

Practical BT-5.4: Immunology and Medical biotechnology

1. Blood typing :

- a) ABO blood grouping
- b) Rh blood grouping.

2. Immuno diffusion :

- a) ODD
- b) RID.

3. Demonstration of ELISA

4. Western blotting

5. MIC assay.

6. Serum analysis: SGPT and SGOT.

7. Separation of Serum from blood & precipitation of immunoglobulin.

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 Edward Jenner and Louis Pasteur.

Antigens: Definition, haptens, epitopes, 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, Hemagglutination, ELISA, immunofluorescent, 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's Immunobiology. 7th edition Garland Science Publishers, New York.
5. Peakman M, and Vergani D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinberg.
- Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell

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.

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

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 scientificpublishers. 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 OrganCulture. Narosa Publishing House.

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. Comprehend 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, Lubert Stryer, 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 and Sons, 1995.
5. Biochemistry by Mary K. Campbell & Shawn O. Farrell, 5th Edition, Cengage 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

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. Comprehend 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

8. Qualitative analysis of Carbohydrates.
9. Qualitative analysis of Lipids.
10. Estimation of reducing sugar by DNS method.
11. Estimation of Protein by Biuret method.
12. Estimation of amino acid by ninhydrin method /formal titration
13. Determination of activity and specific activity of enzyme-Salivary amylase.
14. Effect of pH on enzyme activity
- 8.. Effect of temperature on enzyme activity.
12. Effect of metal ions on enzyme activity.
13. Preparation of buffer solution.
14. Identification of amino acids by circular paper chromatography.

REFERENCES

9. Nelson, D.L., Cox, M.M. 2004 Lehninger Principles of Biochemistry, 4 th edition, W.H. Freeman and Company, New York, USA.
10. Biochemistry, Lubert Stryer, 6th Edition, WH Freeman, 2006.
11. Biochemistry by Robert K. Murray, David A Bender, Kathleen Harper's illustrated M.Botham, Peter J. Kennelly, Victor W. Rodwell, P. Anthony Weil. 28th Edition, McGrawHill, 2009.
12. Biochemistry, Donald Voet and Judith Voet, 2nd Edition, Publisher: John Wiley and Sons, 1995.
13. Biochemistry by Mary K.Campbell& Shawn O.Farrell, 5th Edition, Cengage Learning,2005.
14. Fundamentals of Enzymology Nicholas Price and Lewis Stevens Oxford University Press 1999
15. Fundamentals of Enzyme Kinetics Athel Cornish-Bowden Portland Press 2004
16. Practical Enzymology Hans Bisswanger Wiley-VCH 2004

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.

Ecofriendly bioproducts: 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 Jeseff Winter
4. Le CT (2003) Introductory biostatistics. 1st edition, John Wiley, USA
5. Glaser AN (2001) High Yield™ 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.

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.

Ecofriendly bioproducts: 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.
 - e. Estimation of chloride in sewage water sample.
 - f. Estimation of residual chloride in sewage water sample.
 - g. Estimation of carbon dioxide in sewage water sample.
4. Identification of microbial flora in the given water sample.
- 9 . Estimation of percentage of alcohol by specific gravity bottle method
- 10
 - a. Photographic demonstration of septic tank, sand filters, Imhoff's tank and biosensors.
 - f. Photographic demonstration of creation of superbug.
 - g. Photographic demonstration of genetically modified microbes.
 - h. Photographic demonstration of genetically modified plants.
 - i. Photographic demonstration of genetically modified animals.

Biostatistics problems

- 11 Problems on graphical and diagrammatic representation of data(histogram, bar graph and pie chart)
- 12 Calculation of mean, median, mode, standard deviation

REFERENCES

8. Environmental Science, S.C. Santra
9. Environmental Biotechnology, Pradipta Kumar Mohapatra
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13. Edmondson A and Druce D (1996) Advanced Biology Statistics, Oxford University Press.
14. Danial W (2004) Biostatistics : A foundation for Analysis in Health Sciences, John Wiley and SonsInc.

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.

Ecofriendly bioproducts: 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.
- h. Estimation of chloride in sewage water sample.
- i. Estimation of residual chloride in sewage water sample.
- j. Estimation of carbon dioxide in sewage water sample.
4. Identification of microbial flora in the given water sample.
13. Estimation of percentage of alcohol by specific gravity bottle method
- 14 a. Photographic demonstration of septic tank, sand filters, Imhoff's tank and biosensors.
- j. Photographic demonstration of creation of superbug.
- k. Photographic demonstration of genetically modified microbes.
- l. Photographic demonstration of genetically modified plants.
- m. Photographic demonstration of genetically modified animals.

Biostatistics problems

- 15 Problems on graphical and diagrammatic representation of data(histogram, bar graph and pie chart)
- 16 Calculation of mean, median, mode, standard deviation

REFERENCES

15. Environmental Science, S.C. Santra
16. Environmental Biotechnology, Pradipta Kumar Mohapatra
17. Environmental Biotechnology – Concepts and Applications, Hans-Joachim Jordening and Jesef Winter
18. Le CT (2003) Introductory biostatistics. 1st edition, John Wiley, USA
19. Glaser AN (2001) High Yield™ Biostatistics. Lippincott Williams and Wilkins, USA
20. Edmondson A and Druce D (1996) Advanced Biology Statistics, Oxford University Press.
21. Danial W (2004) Biostatistics : A foundation for Analysis in Health Sciences, John Wiley and SonsInc.

CME23206

V SEMESTER

BT 5.2: Immunology and Medical Biotechnology

48 hours

PART-A

Immunology:

Unit-I

Historical account and chronological events of Edward Jenner and Louis Pasteur. 6 Hrs
Types of immunity – Innate- mechanism of innate immunity. Adaptive immunity – active and passive and adoptive immunity. Antigen: Definition, epitopes, antigenicity, blood group antigens. Antibodies: Definition, types, structure of IgG.

Unit-II

6 Hrs
Cells involved in immune system – T- cells, B-cells, antigen presentation and macrophages, their role in antigen recognition, clonal selection, and immunological memory.
Organs of immune system: Primary and secondary lymphoid organs –structure and functions. **Immuno techniques: Precipitation reaction, immuno diffusion-ODD and RID, RIA, Hemagglutination, ELISA, immunofluorescent, Western blotting.**

Unit-III

6 Hrs
Immunological aspects of viral (HIV), bacterial and parasitic infection (one example each)
Immunization: Passive and active, primary and secondary responses, adjuvant.
Immunedisorders: Hypersensitivity, auto immune disorders- organ specific and systemic specific Grave's diseases, Hashimoto's disease, systemic lupus erythematosus.

Unit-IV

6 Hrs
Major histocompatibility complex: Definition, H2complex, HLA, functions of MHC. Complement proteins: role of classical complement pathway in immune response. Transplantation immunology: Types of grafts, graft acceptance, graft rejection, host vs graft rejection

PART-B

Medical biotechnology

Unit-I

6 Hrs
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, diagnostic proteins eg: AIDS diagnosis.

Unit-II

6 Hrs

Nucleic acid analysis: Features of DNA probes and its applications in diagnosis, diagnosis infectious diseases, identification of *Mycobacterium tuberculosis* in clinical samples using PCR.

Antibiotics: Introduction, strain development and improvement, production of penicillin using genetically engineered organisms.

Enzymes in therapy: List of enzymes and their therapeutic applications.

Unit-III

6 Hrs

Monoclonal antibodies: Introduction, production of monoclonal antibodies, Monoclonal antibodies in therapy-for infectious disease and cancer.

Human gene therapy: Definition, differences between somatic and germ line gene therapy, one example each, principle and applications.

Antisense

technology: Principle and applications

Unit-IV

6 Hrs

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.

Transgenic plants for production of biopharmaceutical (tobacco, tomatoes, and potatoes)

V Semester

Practical BT-5.4: Immunology and Medical biotechnology

1. Blood typing :

- a) ABO blood grouping
- b) Rh blood grouping.

2. Immuno diffusion :

- a) ODD
- b) RID.

3. Demonstration of ELISA

4. Western blotting

5. MIC assay.

6. Serum analysis: SGPT and SGOT.

7. Separation of Serum from blood & precipitation of immunoglobulin.

**JSS COLLEGE OF ARTS, COMMERCE AND
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B N ROAD, MYSURU- 570 025



DEPARTMENT OF BOTANY

Syllabus

CHOICE BASED CREDIT SYSTEM

For B.Sc programmes

Chemistry, Botany, Zoology

Botany, Biochemistry, Microbiology

2018-19

V SEMESTER

Credits 2

Theory: 30 Lectures

Course outcome

After completion of the course the student is able to:

CO1 Specify the classification and characteristics of gardening

CO2 Understand in depth nursery management

CO3 Identify in details with examples ornamental plants

SEC-1: Floriculture

Unit 1: Introduction: History of gardening;

(2 Lectures)

Importance and scope of floriculture and landscape gardening

Unit 2: Nursery Management and Routine Garden Operations:

(8 Lectures)

Sexual and vegetative methods of propagation; Soil sterilization; Seed sowing; Pricking; Planting and transplanting; Shading; Stopping or pinching; Defoliation; Wintering; Mulching; Topiary; Role of plant growth regulators

Unit 3: Ornamental Plants:

(4 Lectures)

Flowering annuals; Herbaceous perennials; Divine vines; Shade and ornamental trees; Ornamental bulbous and foliage plants; Cacti and succulents; Palms and Cycads; Ferns and *Selaginellas*; Cultivation of plants in pots; Indoor gardening; Bonsai.

Unit 4: Principles of Garden Designs:

(4 Lectures)

English, Italian, French, Persian, Mughal and Japanese gardens; Features of a garden (Garden wall, Fencing, Steps, Hedge, Edging, Lawn, Flower beds, Shrubbery, Borders, Water garden Some Famous gardens of India.

Unit 5: Landscaping Places of Public Importance:

(4 Lectures)

Landscaping highways and Educational institutions

Unit 6: Commercial Floriculture:

(6 Lectures)

Factors affecting flower production; Production and packaging of cut flowers; Flower arrangements; Methods to prolong vase life; Cultivation of Important cut flowers (Carnation, Aster, Chrysanthemum, Dahlia, Gerbera, Gladiolous, Marigold,Rose, Liliun, Orchids).

Unit 7: Diseases and Pests of Ornamental Plants.

(2 Lectures

References

1. Randhawa, G.S. and Mukhopadhyay, A. 1986. Floriculture in India Allied Publishers

2018-19

BMF25208

BOTANY THEORY

III B.Sc. SEMESTER VI: PAPER VIII

Molecular Biology, Genetic Engineering, Plant Biotechnology, Plant Breeding & Plant Propagation

Duration : 3 Hours/Week

Max. Marks : 100

Total : 48 Hours

[Theory Exam : 80 + IA : 20 (Based on the tests conducted)]

UNIT 1 : MOLECULAR BIOLOGY

1. Definition and Scope
2. DNA: Chemistry, Structure and functions, DNA replication.(Eukaryotic)
RNA : Chemistry, Structure, types and functions
3. Nucleic Acids as genetic material : Avery *et al's* experiment, Frankel Conrat's experiment.
4. Gene concept : Cistron, Recon and Muton – Prokaryotic & Eukaryotic gene structure.
5. Central Dogma of Molecular biology, Genetic code : Features, Wobble concept, Protein synthesis : Transcription , Splicing & Translation..
6. Gene regulation in Prokaryotes (Lac Operon concept) & Eukaryotes (Britten- Davidson's model).

14 hours

UNIT 2 : GENETIC ENGINEERING

1. Introduction : Definition and Scope
2. Tools of Genetic engineering
 - i) Donor DNA
 - ii) Vectors – Plasmids, Viruses, Cosmid, Artificial chromosomes.
 - iii) Enzymes – RENs and Ligases.
 - iv) Host cells – *E.coli*/Yeast.
 - v) Bioreactor (Fermenter)

3. Steps involved in Recombinant DNA technology
4. Induction of recombinant DNA into host cells; Microprojectile, Electroporation, *Agrobacterium* mediated gene transfer.
5. Polymerase Chain Reaction (PCR) and its applications.
6. A brief account of Blotting Techniques.
7. Genomics :
 - i) DNA finger printing
 - ii) Gene therapy
8. Hazards and safe guards of Genetic Engineering **12 hours**

UNIT 3: PLANT BIOTECHNOLOGY

1. Introduction and scope.
2. Tissue culture-Technique, differentiation, dedifferentiation, redifferentiation and totipotency.
3. Application in Agriculture and Horticulture.
4. Organogenesis, isolation and culturing of protoplast.
5. Somatic hybridization, somatic embryos and synthetic seeds.
6. Anther culture –haploid production and its significance.
7. Transgenic plants ,production of enzymes. **14hours**
8. A brief account of IPR.

UNIT 4 : PLANT PROPAGATION AND PLANT BREEDING

A. Plant propagation :

1. Methods of vegetative propagation – Stem cutting, Grafting, Trenching, Layering-types & Significance
2. Basic Nursery methods and Green house technique.

B. Plant Breeding :

1. Aims and Objectives, Techniques in Plant breeding, Hybridization (Intraspecific, Interspecific and Intergeneric), Hybrid vigour and Hybrid seed production. Germplasm maintenance, pollen banks and quarantine
2. Plant Breeding centers in India – a general account.

08 hours

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BOTANY THEORY

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2. Plant Breeding centers in India – a general account.

08 hours

Section A: Inorganic Chemistry

1. Separation of mixtures by chromatography: Measure the R_f value in each case.
(Combination of two ions to be given)
Paper chromatographic separation of Fe³⁺, Al³⁺ and Cr³⁺ or Paper chromatographic separation of Ni²⁺, Co²⁺, Mn²⁺ and Zn²⁺
2. Preparation of any two of the following complexes and measurement of their conductivity:
 - (i) tetraamminecarbonatocobalt (III) nitrate
 - (ii) tetraamminecopper (II) sulphate
 - (iii) potassium trioxalatoferrate (III) trihydrate

Compare the conductance of the complexes with that of M/1000 solution of NaCl, MgCl₂ and LiCl₃.

Section B: Volumetric analysis

1. Estimation of iron in the given sample of Hematite by dichromate method
2. Estimation of % of calcium in lime stone 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
6. Determination of COD of water.
7. Estimation of available chlorine in bleaching powder
8. Estimation of total hardness of different samples of water using EDTA & ZnSO₄.

CHEMISTRY PRACTICAL - DSE LAB 6B

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15. Estimation of available chlorine in bleaching powder
16. Estimation of total hardness of different samples of water using EDTA & ZnSO₄.

CMF24008

DSE-1A

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: Learn in depth metallurgy, organometallic compounds and bioinorganic chemistry

CO2: Understand in depth heteronuclear aromatic compounds, active methylene compounds

CO3: Learn in detail with examples spectroscopy

DSE-1A:

Section A: Inorganic Chemistry-4

(30 Lectures)

Metallurgy: Terms and principles involved in metallurgy, Ellingham's diagram, Types of metallurgy: Pyro metallurgy- extraction of Nickel by sulphide ore- general metallurgy followed by Mond's process (purification, Manganese from oxides ores- Reduction by the Aluminothermite process- refining by electrolytic process.

Hydro metallurgy: Extraction of Gold from native ore by cyanide process, and refining by quaternary 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 Electroplating.

(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, bonding and applications of alkyls 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 metal carbonyls.

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 nonmetals:

Boron : Boron hydrides – Diborane – preparation, properties, uses and structure
Carbon: 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, hydroxylamine 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 oxocyanogen. (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⁺, Mg²⁺ ions: Na/K pump; Role of Mg²⁺ ions in energy production and chlorophyll. Role of Ca²⁺ 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

Heterocyclic Compounds: 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. Electrophilic 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 its 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 malonate preparation, Mechanism of Claisen condensation, keto-enol tautomerism 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, λ_{\max} , chromophore, auxochrome, bathochromic and hypsochromic shifts. Woodward rules for calculating λ_{\max} 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.
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DSE-1A

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DSE-1A:

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DEPARTMENT OF CHEMISTRY

I SEMESTER :

<p>Paper : CHEMISTRY LAB: DSC 2A LAB</p> <p>Section A: Inorganic Chemistry – Volumetric Analysis</p> <ol style="list-style-type: none">1. Estimation of sodium hydroxide using HCl and sodium carbonate crystals2. Estimation of oxalic acid KMnO_4.And Mohr's salt.3. Estimation of Mohr's salt using KMnO_4. and oxalic acid crystals4. Estimation of Fe (II) ions by titrating it with $\text{K}_2\text{Cr}_2\text{O}_7$ using internal indicator.5. Estimation of Cu (II) ions iodometrically using NaS_2O_3.6. Estimation of Hydrogen peroxide using KMnO_4 and Sodium oxalate crystals7. Estimation of oxalic acid and Sulphuric acid present in a given mixture.8. Estimation of oxalic acid using NaOH solution and PHP crystals.
<p>Section B: Organic Chemistry:</p> <ol style="list-style-type: none">1. Detection of extra elements (N, S, Cl, Br, I) in organic compounds (containing upto two extra elements).2. Separation of mixtures by Chromatography: Measure the Rf value in each case (combination of two compounds to be given)<ol style="list-style-type: none">a) Identify and separate the components of a given mixture of two amino acids (glycine, aspartic acid, glutamic acid, tyrosine or any other amino acid) by paper chromatography.b) Identify and separate the sugars present in the given mixture by paper chromatography.

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSURU

DEPARTMENT OF CHEMISTRY

II SEMESTER :

Paper : **CHEMISTRY LAB: DSC 2B LAB**

Section A: Physical Chemistry

Conductance

- I. Determination of cell constant
- II. Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.
- III. Perform the following conductometric titrations:
 - i. Strong acid vs strong base
 - ii. Weak acid vs strong base

Potentiometry

Perform the following potentiometric titrations:

- i. Strong acid vs. strong base
- ii. Weak acid vs. strong base
- iii. Potassium dichromate vs. Mohr's salt

Colorimetric estimation of Cu^{2+} / Fe^{3+}

Determination of refractive index of the mixture

Ionic equilibria

pH measurements

- a) Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH-meter.
- b) PH titration of strong acid with strong base.
- c) Determination of pKa of weak acid by potentiometric titration.
- d) Preparation of buffer solutions:
 - I. Sodium acetate-acetic acid.
 - II. Ammonium chloride-ammonium hydroxide

Measurement of the pH of buffer solutions and comparison of the values with theoretical values

Section B: Organic Chemistry

1. Purification of organic compounds by crystallization (from water and alcohol) and distillation.
2. Criteria of Purity: Determination of melting and boiling points.
3. Preparations: Mechanism of various reactions involved to be discussed. Recrystallisation, determination of melting point and calculation of quantitative yields to be done.
 - (a) Bromination of Phenol/Aniline
 - (b) Benzoylation of amines/phenols
 - (c) Oxime and 2,4-dinitrophenylhydrazone of aldehyde/ketone.
 - (d) Preparation of acetanilide from aniline.
 - (e) Preparation of p-bromo acetanilide
 - (f) Preparation of benzoic acid from benzaldehyde by oxidation.

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSURU

DEPARTMENT OF CHEMISTRY

III SEMESTER :

Section A: Physical Chemistry

Section A: Physical Chemistry

Thermo chemistry

1. Determination of heat capacity of calorimeter for different volumes.
2. Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
3. Determination of enthalpy of ionization of acetic acid.

4. Determination of Transition temperature of the given salt hydrate.
5. Determination of enthalpy of hydration of copper sulphate.
6. Determination of CST OF phenol water system
7. Determination of % of NaCl

Section B: Organic Chemistry

I Systematic Qualitative Organic Analysis of Organic Compounds possessing monofunctional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and preparation of one derivative.

II

1. Separation of amino acids by paper chromatography
2. Determination of the concentration of glycine solution by formylation method.
3. Titration curve of glycine
4. Action of salivary amylase on starch
5. Effect of temperature on the action of salivary amylase on starch.
6. Differentiation between a reducing and a nonreducing sugar.

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSURU

DEPARTMENT OF CHEMISTRY

IV SEMESTER :

CHEMISTRY LAB-DSC 2D LAB:

Section A: Inorganic Chemistry

Semi-micro qualitative analysis (using H₂S or other methods) of mixtures - not more than four ionic species (two anions and two cations, excluding insoluble salts) out of the following:

Cations : NH₄⁺, Pb²⁺, Bi³⁺, Cu²⁺, Cd²⁺, Fe³⁺, Al³⁺, Co²⁺, Ni²⁺, Mn²⁺, Zn²⁺, Ba²⁺, Sr²⁺, Ca²⁺, Na⁺, K⁺

Anions : CO₃²⁻, S²⁻, SO₃²⁻, S₂O₃²⁻, NO₃⁻, CH₃COO⁻, Cl⁻, Br⁻, I⁻, SO₄²⁻, PO₄³⁻, BO₃³⁻, C₂O₄²⁻, F⁻

1. Estimate the amount of nickel present in a given solution as bis(dimethylglyoximate) nickel(II) or aluminium as oximate in a given solution gravimetrically.

1. Estimation of (i) Mg^{2+} or (ii) Zn^{2+} by complexometric titrations using EDTA.
2. Estimation of total hardness of a given sample of water by complexometric titration.

B: Physical Chemistry

I. Surface tension measurement (use of organic solvents excluded).

- a) Determination of the surface tension of a liquid or a dilute solution using a stalagmometer.
- b) Study of the variation of surface tension of a detergent solution with concentration.

II. Viscosity measurement (use of organic solvents excluded)

- a. Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald's viscometer.
- b. Study of the variation of viscosity of an aqueous solution with concentration of solute.

III Determination molecular weight of the given non volatile solute by Walker Lumsden method.

(III) Chemical Kinetics

Study the kinetics of the following reactions.

1. Initial rate method: Iodide-persulphate reaction
2. Integrated rate method:
 - a. Acid hydrolysis of methyl acetate with hydrochloric acid.
 - b. Saponification of ethyl acetate.
 - c. Kinetics of rate of decomposition of H_2O_2 catalysed by $FeCl_3$

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSURU

DEPARTMENT OF CHEMISTRY

V SEMESTER : CHEMISTRY PRACTICAL DSE LAB 5B

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 (AgNO_3 and potassium chromate).
6. Estimation of total alkalinity of water samples (CO_3^{2-} , HCO_3^-) using double titration method.
7. Measurement of dissolved CO_2 .
8. Study of some of the common bio-indicators of pollution.
9. Estimation of SPM in air samples.
10. Preparation of borax/ boric acid.

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSURU

DEPARTMENT OF CHEMISTRY

V SEMESTER :

CHEMISTRY PRACTICAL - DSE LAB:5A

Section A: Gravimetric estimations

1. Gravimetric estimation of Barium as barium sulphate.
2. Gravimetric estimation of Iron as Iron oxide
3. Gravimetric estimation of Copper as Copper thiocyanate
4. Gravimetric estimation of Nickel as nickel dimethylglyoximate
5. Gravimetric estimation of magnesium as Magnesium hydroxyquinolate
6. Gravimetric estimation of Sulphate as barium sulphate
7. Gravimetric estimation of Manganese from pyrolusite ore

Section B: Volumetric estimations

1. Determination of Iodine value of edible oil
2. Determination saponification value of edible oil
3. Separation of Green leaf pigments by TLC
4. Determination of amount of acetic acid in a given wine sample
5. Determination of total acidity of vinegar
6. Determination of vitamin C in orange juice.

Section A: Inorganic Chemistry

1. Separation of mixtures by chromatography: Measure the R_f value in each case.
(Combination of two ions to be given)
Paper chromatographic separation of Fe³⁺, Al³⁺ and Cr³⁺ or Paper chromatographic separation of Ni²⁺, Co²⁺, Mn²⁺ and Zn²⁺
2. Preparation of any two of the following complexes and measurement of their conductivity:

- (i) tetraamminecarbonatocobalt (III) nitrate
- (ii) tetraamminecopper (II) sulphate
- (iii) potassium trioxalatoferrate (III) trihydrate

Compare the conductance of the complexes with that of M/1000 solution of NaCl, MgCl₂ and LiCl₃.

Section B: Volumetric analysis

1. Estimation of iron in the given sample of Hematite by dichromate method
2. Estimation of % of calcium in lime stone 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
6. Determination of COD of water.
7. Estimation of available chlorine in bleaching powder
8. Estimation of total hardness of different samples of water using EDTA & ZnSO₄.

CHEMISTRY PRACTICAL - DSE LAB 6B

Section A: Inorganic Chemistry

3. Separation of mixtures by chromatography: Measure the R_f value in each case.
(Combination of two ions to be given)
Paper chromatographic separation of Fe³⁺, Al³⁺ and Cr³⁺ or Paper chromatographic separation of Ni²⁺, Co²⁺, Mn²⁺ and Zn²⁺
4. Preparation of any two of the following complexes and measurement of their conductivity:
 - (iv) tetraamminecarbonatocobalt (III) nitrate
 - (v) tetraamminecopper (II) sulphate
 - (vi) potassium trioxalatoferrate (III) trihydrate

Compare the conductance of the complexes with that of M/1000 solution of NaCl, MgCl₂ and LiCl₃.

Section B: Volumetric analysis

9. Estimation of iron in the given sample of Hematite by dichromate method
10. Estimation of % of calcium in lime stone by oxalate method
11. Estimation of manganese in the given sample of pyrolusite
12. Estimation of magnesium in the given sample of Dolomite by EDTA method
13. Determination of % purity of copper in the given sample of copper wire
14. Determination of COD of water.
15. Estimation of available chlorine in bleaching powder
16. Estimation of total hardness of different samples of water using EDTA & ZnSO₄.

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DSE-1A

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: Learn in depth metallurgy, organometallic compounds and bioinorganic chemistry

CO2: Understand in depth heteronuclear aromatic compounds, active methylene compounds

CO3: Learn in detail with examples spectroscopy

DSE-1A:

Section A: Inorganic Chemistry-4

(30 Lectures)

Metallurgy: Terms and principles involved in metallurgy, Ellingham's diagram, Types of metallurgy: Pyro metallurgy- extraction of Nickel by sulphide ore- general metallurgy followed by Mond's process (purification, Manganese from oxides ores- Reduction by the Aluminothermite process- refining by electrolytic process.

Hydro metallurgy: Extraction of Gold from native ore by cyanide process, and refining by quaternary 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 Electroplating.

(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, bonding and applications of alkyls 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 metal carbonyls.

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 nonmetals:

Boron : Boron hydrides – Diborane – preparation, properties, uses and structure
Carbon: 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, hydroxylamine 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 oxocyanogen. (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⁺, Mg²⁺ ions: Na/K pump; Role of Mg²⁺ ions in energy production and chlorophyll. Role of Ca²⁺ 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

Heterocyclic Compounds: 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. Electrophilic 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 its 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 malonate preparation, Mechanism of Claisen condensation, keto-enol tautomerism 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, λ_{\max} , chromophore, auxochrome, bathochromic and hypsochromic shifts. Woodward rules for calculating λ_{\max} 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.
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- I.L. Finar: Organic Chemistry (Vol. I & II), E.L.B.S.
- John R. Dyer: Applications of Absorption Spectroscopy of Organic Compounds, Prentice Hall.
- R.M. Silverstein, G.C. Bassler & T.C. Morrill: Spectroscopic Identification of Organic Compounds, John Wiley & Sons.
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DSE-1A

SEMESTER-VI

**ORGANOMETALLICS, BIOINORGANIC CHEMISTRY,
POLYNUCLEAR HYDROCARBONS AND UV, IR SPECTROSCOPY**

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DSE-1A:

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Stabilization of protein structures and structural role (bones).

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Section B: Organic Chemistry-4

(30 Lectures)

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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 malonate preparation, Mechanism of Claisen condensation, keto-enol tautomerism 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, λ_{\max} , chromophore, auxochrome, bathochromic and hypsochromic shifts. Woodward rules for calculating λ_{\max} of conjugated dienes

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DEPARTMENT OF CHEMISTRY

I SEMESTER :

<p>Paper : CHEMISTRY LAB: DSC 2A LAB</p> <p>Section A: Inorganic Chemistry – Volumetric Analysis</p> <ol style="list-style-type: none">1. Estimation of sodium hydroxide using HCl and sodium carbonate crystals2. Estimation of oxalic acid KMnO_4. And Mohr's salt.3. Estimation of Mohr's salt using KMnO_4. and oxalic acid crystals4. Estimation of Fe (II) ions by titrating it with $\text{K}_2\text{Cr}_2\text{O}_7$ using internal indicator.5. Estimation of Cu (II) ions iodometrically using NaS_2O_3.6. Estimation of Hydrogen peroxide using KMnO_4 and Sodium oxalate crystals7. Estimation of oxalic acid and Sulphuric acid present in a given mixture.8. Estimation of oxalic acid using NaOH solution and PHP crystals.
<p>Section B: Organic Chemistry:</p> <ol style="list-style-type: none">1. Detection of extra elements (N, S, Cl, Br, I) in organic compounds (containing upto two extra elements).2. Separation of mixtures by Chromatography: Measure the Rf value in each case (combination of two compounds to be given)<ol style="list-style-type: none">a) Identify and separate the components of a given mixture of two amino acids (glycine, aspartic acid, glutamic acid, tyrosine or any other amino acid) by paper chromatography.b) Identify and separate the sugars present in the given mixture by paper chromatography.

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DEPARTMENT OF CHEMISTRY

II SEMESTER :

Paper : **CHEMISTRY LAB: DSC 2B LAB**

Section A: Physical Chemistry

Conductance

- I. Determination of cell constant
- II. Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.
- III. Perform the following conductometric titrations:
 - i. Strong acid vs strong base
 - ii. Weak acid vs strong base

Potentiometry

Perform the following potentiometric titrations:

- i. Strong acid vs. strong base
- ii. Weak acid vs. strong base
- iii. Potassium dichromate vs. Mohr's salt

Colorimetric estimation of Cu^{2+} / Fe^{3+}

Determination of refractive index of the mixture

Ionic equilibria

pH measurements

- a) Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH-meter.
- b) PH titration of strong acid with strong base.
- c) Determination of pKa of weak acid by potentiometric titration.
- d) Preparation of buffer solutions:
 - I. Sodium acetate-acetic acid.
 - II. Ammonium chloride-ammonium hydroxide

Measurement of the pH of buffer solutions and comparison of the values with theoretical values

Section B: Organic Chemistry

1. Purification of organic compounds by crystallization (from water and alcohol) and distillation.
2. Criteria of Purity: Determination of melting and boiling points.
3. Preparations: Mechanism of various reactions involved to be discussed. Recrystallisation, determination of melting point and calculation of quantitative yields to be done.
 - (a) Bromination of Phenol/Aniline
 - (b) Benzoylation of amines/phenols
 - (c) Oxime and 2,4-dinitrophenylhydrazone of aldehyde/ketone.
 - (d) Preparation of acetanilide from aniline.
 - (e) Preparation of p-bromo acetanilide
 - (f) Preparation of benzoic acid from benzaldehyde by oxidation.

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DEPARTMENT OF CHEMISTRY

III SEMESTER :

Section A: Physical Chemistry

Section A: Physical Chemistry

Thermo chemistry

1. Determination of heat capacity of calorimeter for different volumes.
2. Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
3. Determination of enthalpy of ionization of acetic acid.

4. Determination of Transition temperature of the given salt hydrate.
5. Determination of enthalpy of hydration of copper sulphate.
6. Determination of CST OF phenol water system
7. Determination of % of NaCl

Section B: Organic Chemistry

I Systematic Qualitative Organic Analysis of Organic Compounds possessing monofunctional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and preparation of one derivative.

II

1. Separation of amino acids by paper chromatography
2. Determination of the concentration of glycine solution by formylation method.
3. Titration curve of glycine
4. Action of salivary amylase on starch
5. Effect of temperature on the action of salivary amylase on starch.
6. Differentiation between a reducing and a nonreducing sugar.

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSURU

DEPARTMENT OF CHEMISTRY

IV SEMESTER :

CHEMISTRY LAB-DSC 2D LAB:

Section A: Inorganic Chemistry

Semi-micro qualitative analysis (using H₂S or other methods) of mixtures - not more than four ionic species (two anions and two cations, excluding insoluble salts) out of the following:

Cations : NH₄⁺, Pb²⁺, Bi³⁺, Cu²⁺, Cd²⁺, Fe³⁺, Al³⁺, Co²⁺, Ni²⁺, Mn²⁺, Zn²⁺, Ba²⁺, Sr²⁺, Ca²⁺, Na⁺, K⁺

Anions : CO₃²⁻, S²⁻, SO₃²⁻, S₂O₃²⁻, NO₃⁻, CH₃COO⁻, Cl⁻, Br⁻, I⁻, SO₄²⁻, PO₄³⁻, BO₃³⁻, C₂O₄²⁻, F⁻

1. Estimate the amount of nickel present in a given solution as bis(dimethylglyoximate) nickel(II) or aluminium as oximate in a given solution gravimetrically.

1. Estimation of (i) Mg^{2+} or (ii) Zn^{2+} by complexometric titrations using EDTA.
2. Estimation of total hardness of a given sample of water by complexometric titration.

B: Physical Chemistry

I. Surface tension measurement (use of organic solvents excluded).

- a) Determination of the surface tension of a liquid or a dilute solution using a stalagmometer.
- b) Study of the variation of surface tension of a detergent solution with concentration.

II. Viscosity measurement (use of organic solvents excluded)

- a. Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald's viscometer.
- b. Study of the variation of viscosity of an aqueous solution with concentration of solute.

III Determination molecular weight of the given non volatile solute by Walker Lumsden method.

(III) Chemical Kinetics

Study the kinetics of the following reactions.

1. Initial rate method: Iodide-persulphate reaction
2. Integrated rate method:
 - a. Acid hydrolysis of methyl acetate with hydrochloric acid.
 - b. Saponification of ethyl acetate.
 - c. Kinetics of rate of decomposition of H_2O_2 catalysed by $FeCl_3$

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSURU

DEPARTMENT OF CHEMISTRY

V SEMESTER : CHEMISTRY PRACTICAL DSE LAB 5B

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 (AgNO_3 and potassium chromate).
6. Estimation of total alkalinity of water samples (CO_3^{2-} , HCO_3^-) using double titration method.
7. Measurement of dissolved CO_2 .
8. Study of some of the common bio-indicators of pollution.
9. Estimation of SPM in air samples.
10. Preparation of borax/ boric acid.

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DEPARTMENT OF CHEMISTRY

V SEMESTER :

CHEMISTRY PRACTICAL - DSE LAB:5A

Section A: Gravimetric estimations

1. Gravimetric estimation of Barium as barium sulphate.
2. Gravimetric estimation of Iron as Iron oxide
3. Gravimetric estimation of Copper as Copper thiocyanate
4. Gravimetric estimation of Nickel as nickel dimethylglyoximate
5. Gravimetric estimation of magnesium as Magnesium hydroxyquinolate
6. Gravimetric estimation of Sulphate as barium sulphate
7. Gravimetric estimation of Manganese from pyrolusite ore

Section B: Volumetric estimations

1. Determination of Iodine value of edible oil
2. Determination saponification value of edible oil
3. Separation of Green leaf pigments by TLC
4. Determination of amount of acetic acid in a given wine sample
5. Determination of total acidity of vinegar
6. Determination of vitamin C in orange juice.

Section A: Inorganic Chemistry

1. Separation of mixtures by chromatography: Measure the R_f value in each case.
(Combination of two ions to be given)
Paper chromatographic separation of Fe³⁺, Al³⁺ and Cr³⁺ or Paper chromatographic separation of Ni²⁺, Co²⁺, Mn²⁺ and Zn²⁺
2. Preparation of any two of the following complexes and measurement of their conductivity:
 - (i) tetraamminecarbonatocobalt (III) nitrate
 - (ii) tetraamminecopper (II) sulphate
 - (iii) potassium trioxalatoferrate (III) trihydrate

Compare the conductance of the complexes with that of M/1000 solution of NaCl, MgCl₂ and LiCl₃.

Section B: Volumetric analysis

1. Estimation of iron in the given sample of Hematite by dichromate method
2. Estimation of % of calcium in lime stone 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
6. Determination of COD of water.
7. Estimation of available chlorine in bleaching powder
8. Estimation of total hardness of different samples of water using EDTA & ZnSO₄.

CHEMISTRY PRACTICAL - DSE LAB 6B

Section A: Inorganic Chemistry

3. Separation of mixtures by chromatography: Measure the R_f value in each case. (Combination of two ions to be given)
Paper chromatographic separation of Fe³⁺, Al³⁺ and Cr³⁺ or Paper chromatographic separation of Ni²⁺, Co²⁺, Mn²⁺ and Zn²⁺
4. Preparation of any two of the following complexes and measurement of their conductivity:
 - (iv) tetraamminecarbonatocobalt (III) nitrate
 - (v) tetraamminecopper (II) sulphate
 - (vi) potassium trioxalatoferrate (III) trihydrate

Compare the conductance of the complexes with that of M/1000 solution of NaCl, MgCl₂ and LiCl₃.

Section B: Volumetric analysis

9. Estimation of iron in the given sample of Hematite by dichromate method
10. Estimation of % of calcium in lime stone by oxalate method
11. Estimation of manganese in the given sample of pyrolusite
12. Estimation of magnesium in the given sample of Dolomite by EDTA method
13. Determination of % purity of copper in the given sample of copper wire
14. Determination of COD of water.
15. Estimation of available chlorine in bleaching powder
16. Estimation of total hardness of different samples of water using EDTA & ZnSO₄.

CMF24008

DSE-1A

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: Learn in depth metallurgy, organometallic compounds and bioinorganic chemistry

CO2: Understand in depth heteronuclear aromatic compounds, active methylene compounds

CO3: Learn in detail with examples spectroscopy

DSE-1A:

Section A: Inorganic Chemistry-4

(30 Lectures)

Metallurgy: Terms and principles involved in metallurgy, Ellingham's diagram, Types of metallurgy: Pyro metallurgy- extraction of Nickel by sulphide ore- general metallurgy followed by Mond's process (purification, Manganese from oxides ores- Reduction by the Aluminothermite process- refining by electrolytic process.

Hydro metallurgy: Extraction of Gold from native ore by cyanide process, and refining by quaternary 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 Electroplating.

(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, bonding and applications of alkyls 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 metal carbonyls.

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 nonmetals:

Boron : Boron hydrides – Diborane – preparation, properties, uses and structure
Carbon: 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, hydroxylamine 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 oxocyanogen.(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⁺, Mg²⁺ ions: Na/K pump; Role of Mg²⁺ ions in energy production and chlorophyll. Role of Ca²⁺ 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

Heterocyclic Compounds: 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. Electrophilic 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 its 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 malonate preparation, Mechanism of Claisen condensation, keto-enol tautomerism 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, λ_{\max} , chromophore, auxochrome, bathochromic and hypsochromic shifts. Woodward rules for calculating λ_{\max} 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.
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DSE-1A

SEMESTER-VI

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DSE-1A:

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DEPARTMENT OF CHEMISTRY

I SEMESTER :

<p>Paper : CHEMISTRY LAB: DSC 2A LAB</p>
<p>Section A: Inorganic Chemistry – Volumetric Analysis</p> <ol style="list-style-type: none">1. Estimation of sodium hydroxide using HCl and sodium carbonate crystals2. Estimation of oxalic acid KMnO_4. And Mohr's salt.3. Estimation of Mohr's salt using KMnO_4. and oxalic acid crystals4. Estimation of Fe (II) ions by titrating it with $\text{K}_2\text{Cr}_2\text{O}_7$ using internal indicator.5. Estimation of Cu (II) ions iodometrically using NaS_2O_3.6. Estimation of Hydrogen peroxide using KMnO_4 and Sodium oxalate crystals7. Estimation of oxalic acid and Sulphuric acid present in a given mixture.8. Estimation of oxalic acid using NaOH solution and PHP crystals.
<p>Section B: Organic Chemistry:</p> <ol style="list-style-type: none">1. Detection of extra elements (N, S, Cl, Br, I) in organic compounds (containing upto two extra elements).2. Separation of mixtures by Chromatography: Measure the Rf value in each case (combination of two compounds to be given)<ol style="list-style-type: none">a) Identify and separate the components of a given mixture of two amino acids (glycine, aspartic acid, glutamic acid, tyrosine or any other amino acid) by paper chromatography.b) Identify and separate the sugars present in the given mixture by paper chromatography.

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DEPARTMENT OF CHEMISTRY

II SEMESTER :

Paper : **CHEMISTRY LAB: DSC 2B LAB**

Section A: Physical Chemistry

Conductance

- I. Determination of cell constant
- II. Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.
- III. Perform the following conductometric titrations:
 - i. Strong acid vs strong base
 - ii. Weak acid vs strong base

Potentiometry

Perform the following potentiometric titrations:

- i. Strong acid vs. strong base
- ii. Weak acid vs. strong base
- iii. Potassium dichromate vs. Mohr's salt

Colorimetric estimation of Cu^{2+} / Fe^{3+}

Determination of refractive index of the mixture

Ionic equilibria

pH measurements

- a) Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH-meter.
- b) PH titration of strong acid with strong base.
- c) Determination of pKa of weak acid by potentiometric titration.
- d) Preparation of buffer solutions:
 - I. Sodium acetate-acetic acid.
 - II. Ammonium chloride-ammonium hydroxide

Measurement of the pH of buffer solutions and comparison of the values with theoretical values

Section B: Organic Chemistry

1. Purification of organic compounds by crystallization (from water and alcohol) and distillation.
2. Criteria of Purity: Determination of melting and boiling points.
3. Preparations: Mechanism of various reactions involved to be discussed. Recrystallisation, determination of melting point and calculation of quantitative yields to be done.
 - (a) Bromination of Phenol/Aniline
 - (b) Benzoylation of amines/phenols
 - (c) Oxime and 2,4-dinitrophenylhydrazone of aldehyde/ketone.
 - (d) Preparation of acetanilide from aniline.
 - (e) Preparation of p-bromo acetanilide
 - (f) Preparation of benzoic acid from benzaldehyde by oxidation.

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DEPARTMENT OF CHEMISTRY

III SEMESTER :

Section A: Physical Chemistry

Section A: Physical Chemistry

Thermo chemistry

1. Determination of heat capacity of calorimeter for different volumes.
2. Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
3. Determination of enthalpy of ionization of acetic acid.

4. Determination of Transition temperature of the given salt hydrate.
5. Determination of enthalpy of hydration of copper sulphate.
6. Determination of CST OF phenol water system
7. Determination of % of NaCl

Section B: Organic Chemistry

I Systematic Qualitative Organic Analysis of Organic Compounds possessing monofunctional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and preparation of one derivative.

II

1. Separation of amino acids by paper chromatography
2. Determination of the concentration of glycine solution by formylation method.
3. Titration curve of glycine
4. Action of salivary amylase on starch
5. Effect of temperature on the action of salivary amylase on starch.
6. Differentiation between a reducing and a nonreducing sugar.

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DEPARTMENT OF CHEMISTRY

IV SEMESTER :

CHEMISTRY LAB-DSC 2D LAB:

Section A: Inorganic Chemistry

Semi-micro qualitative analysis (using H₂S or other methods) of mixtures - not more than four ionic species (two anions and two cations, excluding insoluble salts) out of the following:

Cations : NH₄⁺, Pb²⁺, Bi³⁺, Cu²⁺, Cd²⁺, Fe³⁺, Al³⁺, Co²⁺, Ni²⁺, Mn²⁺, Zn²⁺, Ba²⁺, Sr²⁺, Ca²⁺, Na⁺, K⁺

Anions : CO₃²⁻, S²⁻, SO₃²⁻, S₂O₃²⁻, NO₃⁻, CH₃COO⁻, Cl⁻, Br⁻, I⁻, SO₄²⁻, PO₄³⁻, BO₃³⁻, C₂O₄²⁻, F⁻

1. Estimate the amount of nickel present in a given solution as bis(dimethylglyoximate) nickel(II) or aluminium as oximate in a given solution gravimetrically.

1. Estimation of (i) Mg^{2+} or (ii) Zn^{2+} by complexometric titrations using EDTA.
2. Estimation of total hardness of a given sample of water by complexometric titration.

B: Physical Chemistry

I. Surface tension measurement (use of organic solvents excluded).

- a) Determination of the surface tension of a liquid or a dilute solution using a stalagmometer.
- b) Study of the variation of surface tension of a detergent solution with concentration.

II. Viscosity measurement (use of organic solvents excluded)

- a. Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald's viscometer.
- b. Study of the variation of viscosity of an aqueous solution with concentration of solute.

III Determination molecular weight of the given non volatile solute by Walker Lumsden method.

(III) Chemical Kinetics

Study the kinetics of the following reactions.

1. Initial rate method: Iodide-persulphate reaction
2. Integrated rate method:
 - a. Acid hydrolysis of methyl acetate with hydrochloric acid.
 - b. Saponification of ethyl acetate.
 - c. Kinetics of rate of decomposition of H_2O_2 catalysed by $FeCl_3$

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DEPARTMENT OF CHEMISTRY

V SEMESTER : CHEMISTRY PRACTICAL DSE LAB 5B

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 (AgNO_3 and potassium chromate).
6. Estimation of total alkalinity of water samples (CO_3^{2-} , HCO_3^-) using double titration method.
7. Measurement of dissolved CO_2 .
8. Study of some of the common bio-indicators of pollution.
9. Estimation of SPM in air samples.
10. Preparation of borax/ boric acid.

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DEPARTMENT OF CHEMISTRY

V SEMESTER :

CHEMISTRY PRACTICAL - DSE LAB:5A

Section A: Gravimetric estimations

1. Gravimetric estimation of Barium as barium sulphate.
2. Gravimetric estimation of Iron as Iron oxide
3. Gravimetric estimation of Copper as Copper thiocyanate
4. Gravimetric estimation of Nickel as nickel dimethylglyoximate
5. Gravimetric estimation of magnesium as Magnesium hydroxyquinolate
6. Gravimetric estimation of Sulphate as barium sulphate
7. Gravimetric estimation of Manganese from pyrolusite ore

Section B: Volumetric estimations

1. Determination of Iodine value of edible oil
2. Determination saponification value of edible oil
3. Separation of Green leaf pigments by TLC
4. Determination of amount of acetic acid in a given wine sample
5. Determination of total acidity of vinegar
6. Determination of vitamin C in orange juice.

UG_BBA_BUSINESS DECISIONS-2018-2019

Unit 1: Market Dynamics:

Individual demand, market demand, individual supply, market supply, market equilibrium; Elasticity of demand and supply : Price elasticity of demand, income elasticity of demand, cross price elasticity of demand, elasticity of supply; Theory of consumer behaviour: cardinal utility theory, ordinal utility theory(indifference curves, budget line, consumer choice, price effect, substitution effect, income effect for normal, inferior and Giffen goods), revealed preference theory.

Unit 2: Producer and optimal production choice:

Optimizing behaviour in short run (geometry of product curves, law of diminishing margin productivity, three stages of production), optimizing behaviour in long run (isoquants, iso-cost line, optimal combination of resources) Costs and scale: traditional theory of cost (short run and long run, geometry of cost curves, envelope curves), modern theory of cost (short run and long run), economies of scale, economies of scope.

Unit 3: Theory of firm and market organization :

Perfect competition (basic features, short run equilibrium of firm/industry, long run equilibrium of firm/industry, effect of changes in demand, cost and imposition of taxes) ; monopoly (basic features, short run equilibrium, long run equilibrium, effect of changes in demand, cost and imposition of taxes, comparison with perfect competition, welfare cost of monopoly), price discrimination, multiplant monopoly ; monopolistic competition (basic features, demand and cost, short run equilibrium, long run equilibrium, excess capacity) ; oligopoly (Cournot's model, kinked demand curve model, dominant price leadership model, prisoner's dilemma

Unit 4: Factor Market:

Demand for a factor by a firm under marginal productivity theory (perfect competition in the product market, monopoly in the product market), market demand for a factor, supply of labour, market supply of labour, factor market equilibrium.

UG_BBA_ ORGANISATIONAL BEHAVIOUR -2018-2019

Unit 1: Introduction to Organisational Behaviour:

Organisation- Concept, features and types. Organisational Behaviour – concept, meaning, scope, characteristics and role. Evolution , challenges and opportunities for O.B.

Unit 2: Personality:

Personality – Meaning, characteristics and determinants. Theories – Psychoanalytical Theory. Erikson stages, Cheis Argyeis’s immateriality – Maturity Theory, Traits Theory and Self theory. Personality traits.

Unit 3: Perception, Attitude and Learning:

Perception – concept, nature, process and factors influencing perceptual set.

Attitudes – Meaning, definition, nature, components and sources.

Learning – concept, nature, theories of learning, principles and determinants of learning

Unit 4: Groups and Teams:

Groups – Definitions, types, reasons for group formation. Groups Dynamics – Definition and features. Teams – Meaning , Groups v/s Teams, features, importance and types.

UG_BBA_ STATISTICS FOR BUSINESS -2018-2019

Unit 1: Measures of Central Value:

Meaning, Need for measuring central value. Characteristics of an ideal measure of central value. Types of averages - mean, median, mode, harmonic mean and geometric mean. Merits, Limitations and Suitability of averages. Relationship between averages. Measures of Dispersion: Meaning and Significance. Absolute and Relative measures of dispersion - Range, Quartile Deviation, Mean Deviation, Standard Deviation, Moments, Skewness.

Unit 2: Correlation Analysis:

Meaning and significance. Types of correlation. Methods of studying simple correlation - Karl Pearson's coefficient of correlation, Spearman's Rank correlation coefficient. Regression Analysis: Meaning and significance, Regression vs. Correlation. Linear Regression, Regression lines (X on Y and Y on X) and Standard error of estimate.

Unit 3: Analysis of Time Series and Probability

Analysis of Time Series: Meaning and significance. Utility, Components of time series, Models (Additive and Multiplicative), Measurement of trend: Method of least squares, parabolic trend and logarithmic trend.

Probability: Meaning and need. Theorems of addition and multiplication. Conditional probability. Bayes' theorem, Random Variable- discrete and continuous. Probability Distribution: Meaning, characteristics (Expectation and variance) of Binomial, Poisson, and Normal distribution. s

Unit 4: Introduction to testing of Hypothesis:

Concept; Level of Significance; Process of testing; Test of hypothesis concerning Mean; Test of hypothesis concerning Proportion. Z -test, t – test for single mean and difference of means and ANNOVA – one way and two way.

BDE24001

**SEMESTER V
CORPORATE ANALYSIS AND VALUATION-DSE**

(Credits: Lecture – 05, Tutorial – 01, Practical – 0)

Lectures: 80 Hrs

Tutorials: 16 Hrs

Course Outcome:

On successful completion of this course the students are able to:

CO1: Learn the details of Analysis of Corporate Financial Statements

CO2: Understand the details of various methods of valuation

CO3: Learn in details with application of Discounted Cash flow valuation method

CO4: Learn the classification of estimating discount rates

CO5: Understand in depth Relative valuation

CO6: Identify the details of Impact of inflation on valuation

Unit 1: Analysis of Corporate Financial Statements:

Income statements and Balance sheet through ratio analysis and analyzing the Chairman's statement, Directors' report, management discussion & analysis, report on corporate governance, auditor's report to evaluate the financial soundness of the company. Understanding financial statements of manufacturing and service organisations. Common size analysis and relevant ratios.

Unit 2: Introduction to Valuation:

Value and price, Balance sheet-based methods, Income statement-based methods, Multiples, Goodwill-based methods. Cash flow discounting-based methods. Deciding the appropriate cash flow for discounting. The free cash flow to the firm, free cash flow to equity. Forecasting Cash flows: simple model for forecasting income and cashflows. Earnings, Tax effect, Reinvestment needs, dividend.

Unit 3: Discounted Cash flow Valuation:

Valuation of a company with no growth, constant growth, variable growth and infinite life. Estimating discount rates-cost of equity, cost of debt, tax shield, weighted average cost of capital. The estimation of equity risk premium, calculation of beta, instability of beta, adjusted beta, levered and unlevered beta, bottoms up beta.

Unit 4: Relative Valuation:

standard multiples, comparable companies, potential pitfalls; estimating multiples using regression. Valuation of brands and intellectual capital. Interest rates and company valuation. Impact of inflation on valuation. Reconciling relative and discounted cash flow valuation. Case studies in valuation.

Reference:

1. Foster, George Financial Statement Analysis, 2nd ed., Pearson Education Pvt Ltd
2. Damodaran, A. (2008). Damodaran on Valuation, Security Analysis for investment and Corporate Finance (2nd ed.). Wiley India Pvt. Ltd.
3. Chandra, P. (2011). Corporate Valuation and Value Creation, (1st ed). TMH
4. Pablo Fernandez, Valuation and Common Sense, free download from ssrn.

Note: Latest edition of the text books should be used

BDF21001

SEMESTER VI

CORPORATE RESTRUCTURING – DSC 11

(Credits: Lecture – 05, Tutorial – 01, Practical – 0)

Lectures: 80 Hrs

Tutorials: 16 Hrs

Course Outcome:

On successful completion of this course the students can:

CO1: Understand in detail the problems faced in joint ventures

CO2: Learn the types and structure of joint venture

CO3: Understand in detail the theories of Mergers and Acquisitions

CO4: Learn the details of legal frame work for mergers and acquisitions

CO5: Understand the methods and factors affecting Valuation

CO6: Understand the details of Post merger evaluation and its impact on shareholders' wealth

Unit 1: Joint Ventures:

Concept & Meaning of Joint Ventures, Need & Types of Joint Ventures, Structures & Problems faced in Joint Ventures, Joint Ventures and Strategic Alliance. Some relevant case study of successful and failed joint ventures.

Unit 2: Mergers and Acquisitions:

Introduction to mergers, types of mergers, theories of mergers & acquisitions; Cross-border mergers and acquisitions, issues and challenges in cross border M&A. Analysis of Post-Merger Performance. Demerger, types of demerger, reverse merger, buyback of shares, leverage buy-out strategy, merger strategy - growth, synergy, operating synergy, financial synergy, diversification. Takeover and its types, takeover strategy, takeover bids, legal framework for mergers and acquisitions, leverages and buyouts; Hostile tender offers and various anti-takeover strategies.

Unit 3: Deal Valuation and Evaluation:

Factors affecting valuation basics, methods of valuation, cash flow approaches, Economic Value Added (EVA), sensitivity analysis, valuation under takeover regulation, valuation for slump sale, cost-benefit analysis and swap ratio determination.

Unit 4: Post-Merger Evaluation:

Financial Evaluation of Mergers & Acquisitions, Impact on shareholders' Wealth; Methods of payment and financing options in mergers & acquisitions, financing decision, Merger, Acquisition and Competition law 2002, SEBI (Securities & Exchange Board of India) Takeover Code 2011 and criteria for negotiating friendly takeover.

Reference:

1. Weston, Fred; Chung, Kwang S. & Siu, Jon A.: Takeovers, Restructuring and Corporate Governance, (2nd ed.). Pearson Education
2. Gupta, Manju (2010): Contemporary Issues in Mergers and Acquisitions. Himalaya Publishing
3. Sundarsanam (2006); Creating Value from Mergers and Acquisitions, (1st ed.) Pearson Education
4. Ramanujan. S. (1999); Mergers: The New Dimensions for Corporate Restructuring, McGraw Hill
5. Narayankar, Ravi, (2013): Merger and Acquisitions Corporate Restructuring, Strategy and Practices, (2nded.). International Book House Pvt. Ltd.

Note: Latest edition of the text books should be used

UG_BBA_COST & MANAGEMENT ACCOUNTING-2018-19

Unit 1: Cost concepts:

Meaning, Scope, Objectives, and Importance of Cost Accounting, Cost, Costing, Cost Control, and Cost Reduction. Elements of Cost, Components of total Cost, **Cost sheet.**

Classification of costs: Fixed, Variable, Semi-variable, and Step costs; Product, and Period costs; Direct, and Indirect costs; Relevant, and Irrelevant costs; Shut-down, and Sunk costs; Controllable, and Uncontrollable costs; Avoidable, and Unavoidable costs; Imputed / Hypothetical costs; Out-of-pocket costs; Opportunity costs; Expired, and Unexpired costs; Conversion cost. **Cost Ascertainment: Cost Unit, Cost Center, Profit Center, Cost Allocation and Cost**

Apportionment; Cost Reduction and Cost Control.

Unit 2: Cost-Volume-Profit Analysis:

Contribution, PV Ratio, Breakeven-point, Margin of safety, cost break-even-point, cash break-even-point, Composite break-even-point, Key Factor, Break-even Analysis. Relevant Costs and Decision Making: Pricing, Product Profitability, Make or Buy, Exploring new markets, Shut down or continue.

Process costing: Process losses and wastage, Abnormal effectives.

Unit 3: Budgets and Budgetary Control:

Meaning, Types of Budgets (sales, production, purchase raw material consumption, cash budget). Steps in Budgetary Control, Fixed and Flexible Budgeting, Responsibility Accounting.

Unit 4: Standard Costing and Variance Analysis:

Material, Labour & Overhead variances.

BDA21011

SEMESTER I

ENTREPRENEURSHIP DEVELOPMENT - GE 1

(Credits: Lecture – 03, Tutorial – 01, Practical – 0)

Lectures: 48 Hrs

Tutorials: 16 Hrs

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 mobilisation 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 organisation 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.

BDF25001

**SEMESTER VI
FINANCIAL DERIVATIVES-DSE**

(Credits: Lecture – 05, Tutorial – 01, Practical – 0)

Lectures: 80 Hrs

Tutorials: 16 Hrs

Course Outcome:

On successful completion of this course the students can:

CO1: Learn the classification and characteristics of financial derivatives in India

CO2: Identify and study the relationship between derivatives and other variables

CO3: Learn the characteristics of options and factors affecting option prices

CO4 : Understand the various types of SWAPS

CO5: Understand in depth forward and future contracts and play an important role in dealing with these contract

Unit 1: Introduction:

History of derivatives - origin of derivatives in India - the classification of derivatives – the important features of derivatives – Early delivery, extension and cancellation of forward contracts – financial derivatives market in India.

Unit 2: Forward and Future Contracts:

Meaning of forwards and futures – difference between forwards and futures – Clearing house mechanism - Margin requirements: Initial margin, maintenance margin and margin call – Making to Market – pricing of futures (Problems in preparation of Margin Accounts and Pricing of futures) – Valuation of futures contracts.

Unit 3: Options:

Meaning – Types of Option contracts – factors affecting option prices – Distinction between futures and options. Prices – Upper bounds and lower bounds, early exercise, put-call parity – Time value and Intrinsic value of options – Concept of options In the money, At the money and Out of the money – Computation of Gross pay off and Net pay off from options contracts – Graphical representation of Pay off from options contracts.

Unit 4: Understanding of SWAPS:

Meaning and types – Interest rates swap – Currency Swaps; Credit Derivatives: Credit ratings, Credit Default Swaps.

Reference:

1. Ruey S. Tsay (2005). Analysis of Financial Time Series (2nd ed.). John Wiley.
2. John C. Hull. Options, Futures and Other Derivatives (7th ed.). Pearson Education.
3. Jurgen Franke, Wolfgang Hardle and Christian Hafner. Introduction to Statistics of Financial Markets.
4. R. Madhumathi, M. Ranganatham. Derivatives and risk management (1st ed.)

Redhead, K. Financial Derivatives- An introduction to futures, forwards, options, swaps
Prentice Hall of India
5. Kotreshwar – Derivative Market

Note: Latest edition of text books may be used

BDE22001

SEMESTER V

GST AND CUSTOMS DUTY – DSC 10

(Credits: Lecture – 05, Tutorial – 01, Practical – 0)

Lectures: 80 Hrs

Tutorials: 16 Hrs

Course Outcome:

On successful completion of this course the students are able to:

CO1: Learn in depth the provisions of GST to handle TDS and POS online and off line more efficiently

CO2: Learn the details of computation of GST

CO3: Learn in detail the steps to be followed to determine the assessable value and customs duty

CO4: Understand the details of technology of GST and flow of return filing under GST

CO5: Learn in details and gain knowledge to practice as GST Consultant

Unit 1: **Introduction to GST**- Indirect tax Structure in India, Constitutional requirements, GST Council, Issues in Indirect Tax, Rationale for Transition to GST. GST- Meaning, Definition of GST - Structure of GST -Types of GST- Features of GST, Benefits of GST. Difficulties in implementation of GST.

GSTCompliance requirementdefinitions of Dealer, Manufacturer and Trader. Registration under GST-Persons liable for registration, compulsory registration, Procedure for Registration, Rejection of application for registration, cancellation of Registration,

Unit 2: a) **GST Definitions** - Aggregate Turnover, Agriculturist, Business, Credit note and Debit note, Exempt Supplies, Input, Input service, Input Service Distributor, Intra-state supply of Goods, Job work, Invoice. Composition Levy, Mixed Supply, outward supply, Person, Turnover in State

b) **Levy and Collection of Tax:** Introduction, Supply- meaning and scope of supply, treatment of mixed and composite supply, Liability of tax payable person, Rate and value of tax, transactions without considerations, list of transactions for supply of goods and services and list of transactions for non-supply of goods and services, Reverse charge mechanism,.

Unit 3:**Time of supply and Value of taxable supply**

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.

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 4 : **Input tax credit and Returns**

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)

Returns-Furnishing details of outward supplies and inward supplies, a brief introduction to GST forms-1 to 8, Steps for filing forms, Levy of late fee.

Unit 5: **Customs Act 1962**

Meaning-Notified Goods-Specified goods-Prohibition of Importation and Exportation under section 11-Types of Customs duty. Computation of Assessable Value and Customs duty.

Suggested Readings:

1. GST and Customs Duty - Singhania

BDC21011

SEMESTER III
INCOME TAX - DSC 5

(Credits: Lecture – 04, Tutorial – 01, Practical – 01)

Lectures: 64 Hrs
Tutorials: 16 Hrs
Practical: 32 Hrs

Course Outcome:

On successful completion of this course the students can:

- CO1: Learn in depth the procedure of online filing and able to file online income tax returns
- CO2: Understand in depth Income Tax Act of 1961 and can become tax consultant practitioner
- CO3: Deliberate in detail with examples and appear before IT tribunal on behalf of clients
- CO4: Learn in detail different sections Under IT Act to reduce tax liability
- CO5: Identify the different heads of income and able to compute tax liability

Unit 1: Basic concepts:

Income, agricultural income, person, assessee, assessment year, previous year, gross total income, total income, maximum marginal rate of tax. Residential status of persons and its effect on tax incidence. Exempted income under section 10 (in relation to individuals).

Unit 2: Computation of income under the heads:

Salaries, Income from house property

Unit 3: Computation of income under the heads:

Profits and gains of business & profession, Capital gain, Income from other sources.

Unit 4: Computation Total Income and Tax Liability

Deductions under Chapter VI-A- Computation of total income and tax liability of individuals. Preparation of return of income manually and through software. Provision & Procedures of Compulsory online filing of returns for specified assesses.

Reference:

1. Dr. Vinodk Singhania and Dr. Monica Singhania; Students guide to income tax, Taxman Publications.
2. Girish Ahuja and Ravi Gupta; Systematic Approach to Income Tax: Bharat Law House.
3. Mahesh Chandra, D.C Shukla; Income Tax Law and Practice: Pragati Publications.
4. S.P Goyal; Direct tax planning: Sahitya Bhawan

5. Finance Act for relevant Assessment Year
6. CBDT Circulars
7. Latest court judgements

Note: Latest edition of the text books should be used.

BDE26001

SEMESTER V

**INTERNATIONAL TRADE BLOCKS AND
MULTILATERAL AGENCIES-DSE**

(Credits: Lecture – 05, Tutorial – 01, Practical – 0)

Lectures: 80 Hrs

Tutorials: 16 Hrs

Course Outcome:

On successful completion of this course the students can:

CO 1: Learn the details of Economic theory on international trade

CO2: Understand the characteristics of domestic, foreign, global environment and analyse their impact on international business decision

CO3: Understand the details of regional integration and trade blocks

CO4: Understand the characteristics and types of international investment

CO5: Identify the impact of reform on competitiveness of the Indian firms

CO6: Understand in depth economic institutions

Unit 1: Review of Economic Theory on International Trade:

Basis for international trade; gains from trade; distributional issues, policy instruments and their impact, political economy. Importance, nature and scope of international relation, modes of entry into international business, internationalization process and managerial implications; Domestic, foreign and global environments and their impact on international business decision; Growing concern for green trades.

Unit 2: International economic & trading environment:

Regional integration and trade blocks, regionalism v/s. multilateralism, European Union, integration of developing countries - BRICS, ASEAN, SAARC, SAFTA, NAFTA, G-20; World trade in goods and services - Major trends and developments; World trade and protectionism - Tariff and non-tariff barriers; Counter trade, UNCTAD, WTO, GATT, GATS, TRIM, TRIPS; India's role in facilitating trade relations under BRICS, SAARC, SAFTA, ASEAN and to WTO.

Unit 3: International investment:

Types and significance of foreign investments, factors affecting international investment, growth and dispersion of FDI, Cross border mergers and acquisition, foreign investment in India - Impact of reforms on competitiveness of the Indian Firms, EURO/ADR issues, ECBs; current economic crises in US/Europe/Asia and its impact on economic growth in India.

Unit 4: Economic institutions:

International Monetary Funds (IMF), World Bank (IBRD, IDA, IFC), Asian Development Bank, BRICS Development Bank, Bilateral funding arrangements with special reference to Japan International Cooperation Agencies (JICA), agencies of USA; Case studies on Bilateral financing

arrangements of Indian projects like Delhi Metro, Dedicated Freight corridor, Nuclear Power Plant etc.

Reference:

1. Hill, W. L. Charles and Jain, A.K. (2008). International Business (6th ed.). India: McGrawHill.
2. Fernando, A.C. (2011) .Corporate Governance: Principles, Policies and Practices. India: Pearson Education.
3. Roger, Bennet (1999). International Business, Financial Times. London: Pitman Publishing.
4. Sharan, Vyuptakesh (2003). International Business (2nd ed.). India: Pearson Education.
5. Krueger, Anne O. (2002). Economic Policy Reforms and the Indian Economy.OUP.

Note: Latest edition of the text books should be used

UG_BBA_INVESTMENT ANALYSIS & PORTFOLIO MANAGEMENT -2018-2019

Unit 1: Basics of risk and return:

Concept of returns, application of standard deviation, coefficient of variation, beta, alpha. Bonds : present value of a bond, yield to maturity, yield to call, yield to put, systematic risk, price risk, interest rate risk, default risk. Yield curve and theories regarding shape of yield curve. Unsystematic risk and non-risk factors that influence yields. Duration and modified duration, immunization of a bond portfolio. Fundamental analysis: EIC framework; Economic analysis: Leading lagging & coincident macro-economic indicators, Expected direction of movement of stock prices with macroeconomic variables in the Indian context; Industry analysis: stages of life cycle, Porter's five forces model, SWOT analysis, financial analysis of an industry; Company analysis.

Unit 2: Share valuation:

Dividend discount models - no growth, constant growth, two stage growth model, multiple stages; Relative valuation models using P/E ratio, book value to market value. Technical analysis: meaning, assumptions, difference between technical and fundamental analysis; Price indicators- Dow theory, advances and declines, new highs and lows - circuit filters. Volume indicators- Dow Theory, small investor volumes. Other indicators- futures, institutional activity, Trends: resistance, support, consolidation, momentum- Charts: line chart, bar chart, candle chart, point & figure chart. Patterns: head & shoulders, triangle, rectangle, flag, cup & saucer, double topped, double bottomed, Indicators: moving averages. Efficient market hypothesis; Concept of efficiency: Random walk, Three forms of EMH and implications for investment decisions. (No numerical in EMH and technical analysis)

Unit 3: Portfolio analysis:

Portfolio risk and return, Markowitz portfolio model: risk and return for 2 and 3 asset portfolios, concept of efficient frontier & optimum portfolio. Market Model: concept of beta systematic and unsystematic risk. Investor risk and return preferences: Indifference curves and the efficient frontier, and anticipated inflation. Asset allocation: Asset allocation pyramid, investor life cycle approach, Portfolio management services: Passive – Index funds, systematic investment plans. Active – market timing, style investing.

Unit 4: Capital Asset Pricing Model (CAPM):

Efficient frontier with a combination of risky and risk free assets. Assumptions of single period classical CAPM model. Characteristic line, Capital Market Line, Security market Line. Expected return, required return, overvalued and undervalued assets. Mutual Funds : Introduction, calculation of Net Asset Value (NAV) of a Fund, classification of mutual fund schemes by structure and objective, advantages and disadvantages of investing through mutual funds. Performance Evaluation using Sharpe's Treynor's and Jensen's measures and Fama's Decomposition.

UG_BBA_INVESTMENT BANKING & FINANCIAL SERVICES-2018-2019

Unit 1: Introduction:

An Overview of Indian Financial System, Investment Banking in India, Recent Developments and Challenges ahead, Institutional structure and Functions of Investment / Merchant Banking; SEBI guidelines for Merchant Bankers, Registration, obligations and responsibilities of Lead Managers, Regulations regarding Continuance of association of lead manager with an issue

Unit 2: Issue Management:

Public Issue: classification of companies, eligibility, issue pricing, promoter's contribution, minimum public offer, prospectus, allotment, preferential allotment, private placement, Book Building process, designing and pricing, Green Shoe Option; Right Issue: promoter's contribution, minimum subscription, advertisements, contents of offer document, Bought out Deals, Post issue work & obligations, Investor protection, Broker, sub broker and underwriters

Unit 3: Leasing and Hire Purchase :

Concepts of leasing, types of leasing – financial & operating lease, direct lease and sales & lease back, advantages and limitations of leasing, Lease rental determination; Finance lease evaluation problems (only Lessee's angle), Hire Purchase interest & Installment, difference between Hire Purchase & Leasing, Choice criteria between Leasing and Hire Purchase mathematics of HP, Factoring, forfaiting and its arrangement, Housing Finance : Meaning and rise of housing finance in India, Fixing the amount of loan, repricing of a loan, floating vs. fixed rate, Practical problems on housing finance.

Unit 4: Venture Capital, Insurance, Credit ratings and Securitization:

Concept, history and evolution of VC, the venture investment process, various steps in venture financing, incubation financing.

Insurance: Concept, classification, principles of insurance, IRDA and different regulatory norms, operation of General Insurance, Health Insurance, Life Insurance.

Credit Ratings: Introduction, types of credit rating, advantages and disadvantages of credit ratings, Credit rating agencies and their methodology, International credit rating practices.

Securitization: Concept, securitization as a funding mechanism, Traditional and non traditional mortgages, Graduated-payment mortgages (GPMs), Pledged-Account Mortgages (PAMs), Centralized Mortgage obligations (CMOs), Securitization of non mortgage assets, Securitization in India

UG_BBA_INVESTMENT BANKING & FINANCIAL SERVICES-2018-2019

Unit 1: Introduction:

An Overview of Indian Financial System, Investment Banking in India, Recent Developments and Challenges ahead, Institutional structure and Functions of Investment / Merchant Banking; SEBI guidelines for Merchant Bankers, Registration, obligations and responsibilities of Lead Managers, Regulations regarding Continuance of association of lead manager with an issue

Unit 2: Issue Management:

Public Issue: classification of companies, eligibility, issue pricing, promoter's contribution, minimum public offer, prospectus, allotment, preferential allotment, private placement, Book Building process, designing and pricing, Green Shoe Option; Right Issue: promoter's contribution, minimum subscription, advertisements, contents of offer document, Bought out Deals, Post issue work & obligations, Investor protection, Broker, sub broker and underwriters

Unit 3: Leasing and Hire Purchase :

Concepts of leasing, types of leasing – financial & operating lease, direct lease and sales & lease back, advantages and limitations of leasing, Lease rental determination; Finance lease evaluation problems (only Lessee's angle), Hire Purchase interest & Installment, difference between Hire Purchase & Leasing, Choice criteria between Leasing and Hire Purchase mathematics of HP, Factoring, forfaiting and its arrangement, Housing Finance : Meaning and rise of housing finance in India, Fixing the amount of loan, repricing of a loan, floating vs. fixed rate, Practical problems on housing finance.

Unit 4: Venture Capital, Insurance, Credit ratings and Securitization:

Concept, history and evolution of VC, the venture investment process, various steps in venture financing, incubation financing.

Insurance: Concept, classification, principles of insurance, IRDA and different regulatory norms, operation of General Insurance, Health Insurance, Life Insurance.

Credit Ratings: Introduction, types of credit rating, advantages and disadvantages of credit ratings, Credit rating agencies and their methodology, International credit rating practices.

Securitization: Concept, securitization as a funding mechanism, Traditional and non traditional mortgages, Graduated-payment mortgages (GPMs), Pledged-Account Mortgages (PAMs), Centralized Mortgage obligations (CMOs), Securitization of non mortgage assets, Securitization in India

BDE23001

SEMESTER V
INVESTMENT BANKING & FINANCIAL SERVICES-DSE

(Credits: Lecture – 05, Tutorial – 01, Practical – 0)

Lectures: 80 Hrs

Tutorials: 16 Hrs

Course Outcome:

On successful completion of this course the students are able to:

CO1: Learn the characteristics of Investment banking in India

CO2: Learn the details of Public Issue

CO3: Understand the details of types of leasing

CO4: Understand in detail the feature of Hire Purchase

CO5: Understand the classification and characteristics of Insurance

CO6: Learn in detail the history and evolution of venture Capital

CO7: Learn the details of Securitization

Unit 1: Introduction:

An Overview of Indian Financial System, Investment Banking in India, Recent Developments and Challenges ahead, Institutional structure and Functions of Investment /Merchant Banking; SEBI guidelines for Merchant Bankers, Registration, obligations and responsibilities of Lead Managers, Regulations regarding Continuance of association of lead manager with an issue

Unit 2: Issue Management:

Public Issue: classification of companies, eligibility, issue pricing, promoter's contribution, minimum public offer, prospectus, allotment, preferential allotment, private placement, Book Building process, designing and pricing, Green Shoe Option; Right Issue: promoter's contribution, minimum subscription, advertisements, contents of offer document, Bought out Deals, Post issue work & obligations, Investor protection, Broker, sub broker and underwriters

Unit 3: Leasing and Hire Purchase :

Concepts of leasing, types of leasing – financial & operating lease, direct lease and sales & lease back, advantages and limitations of leasing, Lease rental determination; Finance lease evaluation problems (only Lessee's angle), Hire Purchase interest & Installment, difference between Hire Purchase & Leasing, Choice criteria between Leasing and Hire Purchase mathematics of HP, Factoring, forfaiting and its arrangement, Housing Finance : Meaning and rise of housing finance in India, Fixing the amount of loan, repricing of a loan, floating vs. fixed rate, Practical problems on housing finance.

Unit 4: Venture Capital, Insurance, Credit ratings and Securitization:

Concept, history and evolution of VC, the venture investment process, various steps in **venture financing, incubation financing.**

Insurance: Concept, classification, principles of insurance, IRDA and different regulatory norms, operation of General Insurance, Health Insurance, Life Insurance.

Credit Ratings: Introduction, types of credit rating, advantages and disadvantages of credit ratings, Credit rating agencies and their methodology, International credit rating practices.

Securitization: Concept, securitization as a funding mechanism, Traditional and non traditional mortgages, Graduated-payment mortgages (GPMs), Pledged-Account Mortgages (PAMs), Centralized Mortgage obligations (CMOs), Securitization of non mortgage assets, Securitization in India

Reference:

1. M.Y.Khan,-Financial Services‘ – Tata McGraw –Hill, 3 rd Edition, 2005.
2. Machiraju - Indian Financial System _- Vikas Publishing House, 2 nd Edition, 2002.
3. J.C.Verma - A Manual of Merchant Banking __, Bharath Publishing House, New Delhi,2001.
4. K.Sriram - Hand Book of Leasing, Hire Purchase & Factoring‘, ICFAI, Hyderabad, 1992.

Note: Latest edition of the text books should be used

BDB23011

SEMESTER II
ORGANISATIONAL BEHAVIOUR - GE 2

(Credits: Lecture – 03, Tutorial – 01, Practical – 0)

Lectures: 48 Hrs
Tutorials: 16 Hrs

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 to Organisational Behaviour:

Organisation- Concept, features and types. Organisational Behaviour – concept, meaning, scope, characteristics and role. Evolution , challenges and opportunities for O.B.

Unit 2: Personality:

Personality – Meaning, characteristics and determinants. Theories – Psychoanalytical Theory. Erikson stages, CheisArgyeis’s immateriality – Maturity Theory, Traits Theory and Self theory. Personality traits.

Unit 3: Perception, Attitude and Learning:

Perception – concept, nature, process and factors influencing perceptual set.

Attitudes – Meaning, definition, nature, components and sources.

Learning – concept, nature, theories of learning, principles and determinants of learning

Unit 4: Groups and Teams:

Groups – Definitions, types, reasons for group formation. Groups Dynamics – Definition and features. Teams – Meaning , Groups v/s Teams, features, importance and types.

Reference:

1. Koontz & Heinz Wehrich: Essential of management McGraw Hill (1999)
2. Kaul, Vijay kumar, Management- Text & Cases, Vikas Publishing, New Delhi, 2015
3. Stoner&Wankel: Management
4. Stephen P. Robbins and Mary Coulter: Management, Pearson

5. Y.K. Bhushan: Fundamentals of Business Organisation & Management X Edition
6. Richard L. Daft, Principles Of Management, Cengage Learning, India
7. Robbins Stephen P. : Organisational Behaviour, Pearson Education, 12th Edition

Note: Latest edition of the text books should be used.

BDE25001

SEMESTER V

RESEARCH METHODOLOGY-DSE

(Credits: Lecture – 05, Tutorial – 01, Practical – 0)

Lectures: 80 Hrs

Tutorials: 16 Hrs

Course Outcome:

On successful completion of this course the students can:

CO1: Understand in details with application of research methodology and become a good researcher

CO2: Learn the characteristics and classification of research Design

CO3: Understand in details with examples Sources of Data Collection

CO4: Learn the characteristics of sampling techniques

CO5: Understand in details with application of methods of analysis

CO6: Understand the details of research report

Unit 1: Business Research:

Meaning - Nature and Scope of Business Research – 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. Research Design: Exploratory, Descriptive & Causal.

Unit 2: Primary Data Collection:

Survey v/s Observations. Random sample collection methods. Comparison of self-administered, telephone, mail, emails techniques. Qualitative Research

Tools: Depth Interviews focus groups and projective techniques.

Unit 3: 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. Sampling: Sampling techniques, determination of sample size using statistical techniques, Cronbach's Alpha test for reliability (using software).

Unit 4: Data and the Methods of Analysis:

Analysis of Variance (ANOVA) One-Way & Two-Way, Chi square test (goodness of Fit). Multivariate Data Analysis: Factor Analysis (Principal Component Analysis), Discriminant Analysis. Above statistical test also to be explained using statistical software package. Report writing: Contents of a Research Report, Plagiarism in Business Research – Meaning and effects - Plagiarism detection software

Reference:

1. Zikmund, W.G., Babin, B.J., Carr, J.C. & Griffin, M. (2013). Business Research Methods (9th ed.). Cengage Learning.
2. Johnson, R.A. & Wichern, D.W. (1997) Business Statistics-Decision Making with Data (1st ed.). John Wiley & Sons.
3. Cooper, D.R. & Schindler, P.S. (2008) Business Research Methods (10th ed.). McGraw Hill Education.
- 4..Chawla, D, &Sondhi,N. (2011) Research Methodology Concepts and Cases (1st ed.). Vikas Publishing House
5. Malhotra, N & Dash. S (2010) Marketing Research An Applied Orientation (6th ed.). Pearson, Prentice Hall of India.

Note: Latest edition of the text books should be use

BDF23001

SEMESTER VI
STRATEGIC CORPORATE FINANCE-DSE

(Credits: Lecture – 05, Tutorial – 01, Practical – 0)

Lectures: 80 Hrs

Tutorials: 16 Hrs

Course Outcome:

On successful completion of this course the students can

CO1: Learn in detail the risk management choices

CO2: Understand the details of value enhancement tools and techniques

CO3: Learn the different types of financial strategy for shareholders wealth maximization of strategic corporate finance

CO4: Understand the significance of strategy in financial decision

CO5: Learn the details of Financial Distress and restructuring

CO6: Learn in depth capital structure and factors affecting the capital structure

Unit 1: Introduction to strategic corporate finance:

Strategy v/s Planning, significance of strategy in financial decisions, Different types of financial strategy for Shareholders Wealth Maximization, overall corporate value addition and Economic Value Addition. Strategic Cost Management: Traditional costing Vs Strategic Costing, Relevant costs v/s Irrelevant costs, Different types of strategic costing and their relevance- Target Costing, Activity based Costing, Life Cycle Costing, Quality Costing, Zero Based Budgeting, Strategic cost reduction techniques and value chain analysis. Valuing Real assets in the presence of risk: tracking portfolios and Real Asset valuation, Different Approaches of Valuing Real Assets, Capital Budgeting and Strategic policy.

Unit 2: Fundraising:

Identification of different sources of development capital, determination of capital structure and factors affecting the capital structure, cost of capital and cost saving strategy, production of a business plan and financial forecasts to enable potential funders to assess the proposition. Alternative sources of financing – alternative sources of financing, Different approach to infrastructure projects financing- Public Private Partnership (PPP) and its relevance. Managing credit ratings. Dividend v/s share repurchase policy, problem of too much cash. The issues of stock liquidity and illiquidity.

Financial Distress and restructuring: Meaning of Bankruptcy, Factors leading to bankruptcy, symptoms and predictions of bankruptcy, reorganization of distressed firms, liquidation of firms. Company disposals: retirement sale or the sale of a non-core subsidiary, planned exit, forceful retirement and other disposals. Exit strategy- most appropriate exit route, valuation, timing of sale and tax planning opportunities, identification of potential purchasers, approaching the potential purchaser, negotiate with potential acquirers and selection of a preferred purchaser. Real options:

Financial and real options compared, various types of real options, application of Real options, Drawbacks of Real options

Unit 3: Company Valuation:

An overview of valuation, valuation principles and practices more, the impact of “what if” scenarios, the key financial and commercial factors affecting the business. Value enhancement tools & techniques, the link between valuation and corporate finance Management Buy-outs: Establishing feasibility of the buy-out, Negotiating the main terms of the transaction with the vendor including price and structure, Developing the business plan and financial forecasts in conjunction with the buy-out team for submission to potential funders, negotiations with potential funders so that the most appropriate funding offers are selected. Management Buy-ins: Management Buy-in/Buy-outs (“BIMBOs”), Vendor initiated buy-outs/buy-ins. Due Diligence: financial due diligence for both purchasers and financial institutions.

Unit 4: Strategic risk management:

Strategic risk management, the substitutability of capital structure and risk management choices, such as process control efforts, financial, physical, and operational hedging, value-based management.

Reference:

1. Aswath Damodaran: Corporate finance theory and practice; John Wiley & Sons, Inc.
2. Aswath Damodaran: Strategic Risk Taking: A Framework for Risk Management ; Prentice Hall
3. I. M. Pandey: Financial Management; Vikas Publishing House
4. Strategic Financial Management: Prasanna Chandra; McGraw Hill Education (India) Private Limited

Note: Latest edition of text books may be used.

UG_B.COM_ BUSINESS ORGANISATION AND MANAGEMENT -2018-19

Unit 1: Foundation Of Indian Business

Manufacturing And Service Sectors; Small And Medium Enterprises - Problems And Government Policy. Technological Innovations And Skill Development. 'Make In India' Movement. Emerging Opportunities In Business; Franchising, Outsourcing, And E-Commerce.

Unit 2: Business Enterprises

Forms Of Business Organisation: Sole Proprietorship, Joint Hindu Family Firm, Partnership Firm, Joint Stock Company, Cooperative Society; Limited Liability Partnership; Forms Of Public Enterprises. Multinational Corporations.

Unit 3: Management

The Process Of Management: Planning; Decision-Making; Strategy Formulation. Organizing: - Types Of Organisational Structure - Departmentation - Kinds . Delegation And Decentralisation Of Authority - Groups And Teams.

Unit 4: Leadership, Motivation And Control

Leadership: Concept And Styles; Trait And Situational Theory Of Leadership. Motivation: Concept And Importance; Maslow Need Hierarchy Theory; Herzberg Two Factors Theory. Control: Concept And Process.

Unit 5: Functional Areas Of Management

Marketing Management:- Meaning & Definitions, Marketing Concepts, Functions, Elements Of Marketing Mix.

Financial Management: Concept And Objectives - Scope, Finance Manager- Role & Functions. Sources Of Finance, Financial Decisions.

Human Resource Management: Concept And Functions. Role, Status And Competencies Of HR Manager.

UG_B.COM_ BUSINESS RESEARCH METHODS-2018-2019

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.

UG_B.COM_ BUSINESS RESEARCH METHODS-2018-2019

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.

UG_B.COM_ ENTREPRENEURSHIP DEVELOPMENT-2018-2019

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 Sfc, Banks, Sidbi, Nbc-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.

1.4 FINANCIAL ACCOUNTING - I

Unit 1: Introduction

Accounting - Meaning And Definitions, Objectives, Functions, Advantages And Limitations Of Accounting, Users Of Financial Accounting Information And Their Needs. Systems Of Book- Keeping – Rules Of Double Entry - Preparation Of Journal, Ledger And Trial Balance. Accounting Principles - Accounting Concepts And Conventions. Accounting Standards: Concept, Benefits, Procedure For Issuing Accounting Standards In India. Ifrs – Need And Procedure

Unit 2: Final Accounts

Final Accounts Of Sole Trading Concern- Preparation Of Manufacturing, Trading And Profit And Loss Account And Balance Sheet With Adjustments.

Unit 3: Bills Of Exchange

Meaning – Characteristics – Kinds – Noting, Protest-Discounting, Endorsement, Dishonour – Rebate & Renewals Of Bills. Problems On Trade Bills Only

Unit 4: Branch Account

Meaning And Objectives. Dependent Branches – Concept, Accounting Aspects; Debtors System, Stock And Debtors System, Branch Final Accounts System. Independent Branches: Concept Accounting Treatment. Goods Invoiced By Ho At Cost And Invoice Price.

Unit5: Departmental Accounts

Meaning, Objectives, Advantages Of Keeping Departmental Accounts, Basis For Allocation Of Joint Expenses, Internal Transfer Of Goods, Preparation Of Profit And Loss Account And Balance Sheet.

Unit 6: Computerized Accounting Systems

26 Practical Lab

Computerized Accounting Systems: Computerized Accounts By Using Any Popular Accounting Software: Creating A Company; Configure And Features Settings; Creating Accounting Ledgers And Groups; Creating Stock Items And Groups; Vouchers Entry; Generating Reports – Cash Book, Ledger Accounts, Trial Balance, Profit And Loss Account, Balance Sheet, Funds Flow Statement, Cash Flow Statement. Selecting And Shutting A Company; Backup And Restore Data Of A Company.

UG_B.COM_ INCOME TAX-II-2018-2019

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-

UG_B.COM_ PRINCIPLES OF MARKETING-2018-2019

Unit 1: Introduction:

Nature, Scope And Importance Of Marketing; Evolution Of Marketing; Selling V/S Marketing; Marketing Environment: Concept, Importance, And Components (Economic, Demographic, Technological, Natural, Socio-Cultural And Legal).

Unit 2: Consumer Behaviour & Market Segmentation

A. Consumer Behaviour: Nature And Importance, Consumer Buying Decision Process; Factors Influencing Consumer Buying Behaviour.

B. Market Segmentation: Concept, Importance And Bases; Target Market Selection; Positioning Concept, Product Differentiation Vs. Market Segmentation.

Unit 3: Product

Concept And Importance, Product Classifications; Concept Of Product Mix; Branding, Packaging And Labelling.

Unit 4: Pricing & Place

A. Pricing: Significance. Factors Affecting Price Of A Product. Methods Of Pricing.

B. Physical Distribution: Channels Of Distribution - Meaning And Importance; Types Of Distribution Channels; Functions Of Middle Man; Factors Affecting Choice Of Distribution Channel; Wholesaling And Retailing; Types Of Retailers;

Unit 5: Promotion

A. Promotion: Nature And Importance Of Promotion; Types Of Promotion: Advertising, Personal Selling, Public Relations & Sales Promotion, And Their Distinctive Characteristics; Promotion Mix And Factors Affecting Promotion Mix Decisions;

B. Recent Developments In Marketing: Social Marketing, Online Marketing, Services Marketing, Green Marketing, Rural Marketing; Consumerism.

CNE22001

SEMESTER V

AUDITING AND CORPORATE GOVERNANCE – DSE1

(Credits: Lecture – 05, Tutorial – 01, Practical – 0)

Lectures: 80hrs

Tutorials: 16hrs

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 errors and frauds and minimize them in maintenance of books
of accounts

CO4: Learn in depth to practice as an Auditor

CO5: Identify in details the importance of Internal Control and Internal Check

Unit 1: Introduction

Auditing: Introduction, Meaning, Objectives, Basic Principles and Techniques; Classification of Audit, Audit Planning, Internal Control – Internal Check and Internal Audit; Audit Procedure – Vouching and verification of Assets & Liabilities.

Unit 2: Auditor's responsibility

Auditor's responsibility to consider frauds and errors in financial statements. Recognizing errors and frauds- Responsibility-Prevention of frauds and errors. Professional code and ethics (in brief). Computer based audit procedures.

Unit 3: Special Areas of Audit

Special Areas of Audit: Special features of Cost audit, Tax audit, and Management audit; **Recent Trends in Auditing:** Basic considerations of audit in EDP Environment; Auditing Standards; **Relevant Case Studies/Problems;**

Unit 4: Corporate Governance

Conceptual framework of Corporate Governance: Theories & Models, Broad Committees; **Corporate Governance Reforms.** **Major Corporate Scandals in India and Abroad:** Common Governance Problems Noticed in various Corporate Failures. Codes & Standards on Corporate Governance

Unit 5: Business Ethics

Morality and ethics, business values and ethics, approaches and practices of business ethics, corporate ethics, ethics program, codes of ethics, ethics committee; Ethical Behaviour: Concepts and advantages; Rating Agencies; **Green Governance;** Clause 49 and Listing Agreement.

Unit 6: Corporate Social Responsibility (CSR):

Concept of CSR, Corporate Philanthropy, Strategic Planning and Corporate Social Responsibility; Relationship of CSR with Corporate Sustainability; CSR and Business Ethics, CSR and Corporate Governance; CSR provisions under the Companies Act 2013; CSR Committee; CSR Models, Codes, and Standards on CSR.

Reference:

1. Ravinder Kumar and Virender Sharma, *Auditing Principles and Practice*, PHI Learning
2. ArunaJha, *Auditing*.Taxmann Publication.
3. A. K. Singh, and Gupta Lovleen. *Auditing Theory and Practice*.Galgotia Publishing Company.
4. Anil Kumar, *Corporate Governance: Theory and Practice*, Indian Book House, New Delhi
5. MC Kuchhal, *Modern Indian Company Law*, ShriMahavir Book Depot. (Publishers). (Relevant Chapters)
6. KV Bhanumurthy and Usha Krishna, *Politics, Ethics and Social Responsibility of Business*, Pearson Education
7. N Balasubramanian, *A Casebook on Corporate Governance and Stewardship*, McGraw Hill Education
8. B.N. Ghosh, *Business Ethics and Corporate Governance*, McGraw Hill Education
9. S K Mandal, *Ethics in Business and Corporate Governance*, McGraw Hill Education
10. Bob Tricker, *Corporate Governance-Principles, Policies, and Practice* (Indian Edition), Oxford University Press
11. Christine Mallin, *Corporate Governance (Indian Edition)*, Oxford University Press
12. Relevant Publications of ICAI on *Auditing* (CARO).
13. Sharma, J.P., *Corporate Governance, Business Ethics, and CSR*, Ane Books Pvt Ltd, New Delhi

Note: Latest edition of text books may be used

UG_B.COM_AUDITING AND CORPORATE GOVERNANCE-2018-2019

Unit 1: Introduction

Auditing: Introduction, Meaning, Objectives, Basic Principles And Techniques; Classification Of Audit, Audit Planning, Internal Control – Internal Check And Internal Audit; Audit Procedure – Vouching And Verification Of Assets & Liabilities.

Unit 2: Auditor's Responsibility

Auditor's Responsibility To Consider Frauds And Errors In Financial Statements. Recognizing Errors And Frauds- Responsibility-Prevention Of Frauds And Errors. Professional Code And Ethics (In Brief). Computer Based Audit Procedures.

Unit 3: Special Areas Of Audit

Special Areas Of Audit: Special Features Of Cost Audit, Tax Audit, And Management Audit; **Recent Trends In Auditing:** Basic Considerations Of Audit In Edp Environment; Auditing Standards; **Relevant Case Studies/Problems;**

Unit 4: Corporate Governance

Conceptual Framework Of Corporate Governance: Theories & Models, Broad Committees; **Corporate Governance Reforms. Major Corporate Scandals In India And Abroad:** Common Governance Problems Noticed In Various Corporate Failures. Codes & Standards On Corporate Governance

Unit 5: Business Ethics

Morality And Ethics, Business Values And Ethics, Approaches And Practices Of Business Ethics, Corporate Ethics, Ethics Program, Codes Of Ethics, Ethics Committee; Ethical Behaviour: Concepts And Advantages; Rating Agencies; **Green Governance;** Clause 49 And Listing Agreement.

UG_B.COM_AUDITING AND CORPORATE GOVERNANCE-2018-2019

Unit 1: Introduction

Auditing: Introduction, Meaning, Objectives, Basic Principles And Techniques; Classification Of Audit, Audit Planning, Internal Control – Internal Check And Internal Audit; Audit Procedure – Vouching And Verification Of Assets & Liabilities.

Unit 2: Auditor's Responsibility

Auditor's Responsibility To Consider Frauds And Errors In Financial Statements. Recognizing Errors And Frauds- Responsibility-Prevention Of Frauds And Errors. Professional Code And Ethics (In Brief). Computer Based Audit Procedures.

Unit 3: Special Areas Of Audit

Special Areas Of Audit: Special Features Of Cost Audit, Tax Audit, And Management Audit; **Recent Trends In Auditing:** Basic Considerations Of Audit In Edp Environment; Auditing Standards; **Relevant Case Studies/Problems;**

Unit 4: Corporate Governance

Conceptual Framework Of Corporate Governance: Theories & Models, Broad Committees; **Corporate Governance Reforms.** **Major Corporate Scandals In India And Abroad:** Common Governance Problems Noticed In Various Corporate Failures. Codes & Standards On Corporate Governance

Unit 5: Business Ethics

Morality And Ethics, Business Values And Ethics, Approaches And Practices Of Business Ethics, Corporate Ethics, Ethics Program, Codes Of Ethics, Ethics Committee; Ethical Behaviour: Concepts And Advantages; Rating Agencies; **Green Governance;** Clause 49 And Listing Agreement.

CND32001

SEMESTER - IV

Banking & Insurance

4 Hours/week

Course Objectives:

- To familiarize the students about banking services.
- To enable them to acquire knowledge about Insurance Business.

Unit - 1:Introduction to Banking :

Meaning, Definition of banking – various types of banks – functions of banks, Role's of banks in economic development. Universal banking – Meaning and scope.

12 Hours

Unit - 2: Banking Companies Regulation Act- 1949. RBI Act – 1934, and their features, Insurance Act 1938 and its features.

14 Hours

Unit - 3: RBI, Commercial banks- Regional Rural Banks, Co-operatives banks, payment

banks – their features and function. Role of banks in financial inclusion.

12 Hours

Unit 4:Recent Trends in Banking:

ICT in Banks – Core banking, Internet Banking, Mobile banking, ATM and their importance.RTGS, ECS and NEFT.

10 Hours

Unit 5: Insurance:

Life Insurance corporation of India. General Insurance Corporation of India and its subsidiaries – privatisation of Insurance. Basic principles of Insurance – Insurer, Insured .indemnification and principles of subrogation

12 Hours

Book for references:

1. Indian banking –Shekar and shekar
2. Banking Theory & Practices - B S Raman
3. Banking system in India – Gordon N Natarajan

CNB22011

SEMESTER II

BUSINESS MATHEMATICS AND STATISTICS – DSC5

(Credits: Lecture – 05, Tutorial – 01, Practical – 0)

Lectures: 80hrs

Tutorials: 16 hrs

Course Outcome:

On successful completion of this course the students can:

CO1: Understand in depth the classification and operation of matrices

CO2: Learn in details with applications of calculus to solve business problems

CO3: Understand in detail the characteristics and application of regression

CO4: Learn in depth the classification and characteristics of Trend analysis and able to determine future trend

CO5: Understand in details the classification and application of correlation

Part – A: Business Mathematics

Unit 1: Matrices

Definition of a matrix. Types of matrices; Algebra of matrices. Calculation of values of determinants up to third order; Adjoin of a matrix; Finding inverse of a matrix through ad joint; Applications of matrices to solution of simple business and economic problems.

Unit 2: Differential Calculus

Mathematical functions and their types – linear, quadratic, polynomial; Concepts of limit and continuity of a function; Concept of differentiation; Rules of differentiation – simple standard forms. Applications of differentiation – elasticity of demand and supply; Maxima and Minima of functions (involving second or third order derivatives) relating to cost, revenue and profit.

Unit 3: Basic Mathematics of Finance

Simple and compound interest Rates of interest – nominal, effective and continuous – their interrelationships; Compounding and discounting of a sum using different types of rates.

Part – B: Business Statistics

Unit 1: Uni-variate Analysis

Measures of Central Tendency including arithmetic mean, geometric mean and harmonic mean: properties and applications; mode and median. Measures of Variation: absolute and relative. Range, quartile deviation and mean deviation; Variance and Standard deviation: calculation and properties.

Unit 2: Bi-variate Analysis

Simple Linear Correlation Analysis: Meaning, and measurement. Karl Pearson's co-efficient and Spearman's rank correlation Simple Linear Regression Analysis: Regression equations and estimation. Relationship between correlation and regression coefficients

Unit 3: Time-based Data: Index Numbers and Time-Series Analysis

Meaning and uses of index numbers; Construction of index numbers: Aggregative and average of relatives – simple and weighted, Tests of adequacy of index numbers, Construction of consumer price indices.

Components of time series; additive and multiplicative models; Trend analysis: Finding trend by moving average method and Fitting of linear trend line using principle of least squares.

Reference:

1. Mizrahi and John Sullivan. *Mathematics for Business and Social Sciences*. Wiley and Sons.
2. Budnick, P. *Applied Mathematics*. McGraw Hill Publishing Co.
3. N. D. Vohra, *Business Mathematics and Statistics*, McGraw Hill Education (India) Pvt Ltd
4. J.K. Thukral, *Mathematics for Business Studies*, Mayur Publications
5. J. K. Singh, *Business Mathematics*, Himalaya Publishing House.
6. J. K. Sharma, *Business Statistics*, Pearson Education.
7. S.C. Gupta, *Fundamentals of Statistics*, Himalaya Publishing House.
8. S.P. Gupta and Archana Gupta, *Elementary Statistics*, Sultan Chand and Sons, New Delhi.
9. Richard Levin and David S. Rubin, *Statistics for Management*, Prentice Hall of India, New Delhi.
10. M.R. Spiegel, *Theory and Problems of Statistics*, Schaum's Outlines Series, McGraw Hill Publishing Co.

Note: Latest edition of text books may be used.

CNE29001

SEMESTER V

BUSINESS RESEARCH METHODOLOGY– GE1

(Credits: Lecture – 05, Tutorial – 01, Practical – 0)

Lectures: 80hrs

Tutorials: 16hrs

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: Learn in depth and able to suggest remedial measures for various business issues

CO4: Identify and contribute to the discipline of commerce and management through the research

Unit 1

Meaning, Nature and Scope of Business Research – 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. Research Design: Exploratory, Descriptive & Causal.

Unit 2

Primary Data Collection: Survey Vs. Observations. Random sample collection methods.

Comparison of self-administered, telephone, mail, emails techniques. Qualitative Research

Tools: Depth Interviews focus groups and projective techniques.

Unit 3

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. Sampling: Sampling techniques, determination of sample size using statistical techniques, Cronbach's Alpha test for reliability (using software).

Unit 4

Data and the Methods of Analysis: Analysis of Variance (ANOVA) One-Way & Two-Way, Chi square test (goodness of Fit). Multivariate Data Analysis: Factor Analysis (Principal Component Analysis), Discriminant Analysis. Above statistical test also to be explained using statistical software package. Report writing: Contents of a Research Report. Plagiarism in Business Research – Meaning & Effects; Plagiarism detection software

Reference:

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 (1sted.). John Wiley & Sons.

5. Cooper, D.R. & Schindler, P.S. (2008) Business Research Methods (10thed.). McGraw Hill Education. Education Private Limited

Note: Latest edition of text books may be used.

CNC21011

SEMESTER III

CORPORATE ACCOUNTING – DSC7

(Credits: Lecture – 05, Tutorial – 01, Practical – 0)

Lectures: 80hrs

Tutorials: 16 hrs

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 characteristics and classification of shares and able to determine value of Shares and goodwill

CO3: Identify the characteristics of intermediate in stock exchange and start career as stock

Broker

CO4: Identify and analyse the flow of funds into and from the business

CO5: Understand the details of NPA in banking

CO6: Learn in depth about Holding and Subsidiary company and play a vital role in preparation in consolidated Balance Sheet

Collection of quoted / market prices of listed shares in stock exchanges and calculation of share values.

Unit 1. Accounting for Share Capital & Debentures

Issue, forfeiture and reissue of forfeited shares: concept & process of book building; Issue of rights and bonus shares; Buy back of shares; Issue and Redemption of preference shares. Issue of Debentures with conditions for redemption.

Unit 2. (a) Final Accounts

Preparation of profit and loss account and balance sheet of corporate entities, excluding

Calculation of managerial remuneration, Disposal of company profits.

(b) Amalgamation of Companies

Concepts and accounting treatment as per Accounting Standard: 14 (ICAI).

Internal reconstruction.

Unit 3. Valuation of Goodwill and Valuation of Shares

Concepts, Methods and valuation of Goodwill and Shares.

Unit 4. Accounts of Holding Companies/Parent Companies

Preparation of consolidated balance sheet with one subsidiary company; Relevant provisions of Accounting Standard: 21 (ICAI).

Unit 5. Accounts of Banking Companies

Difference between balance sheet of banking and non-banking companies; Prudential norms; Asset structure of a commercial bank; Non-performing assets (NPA)

Unit 6. Cash Flow Statement

Concept of funds, Preparation of cash flow statement as per Indian Accounting Standard (Ind-AS): 7.

Note:

1. The relevant Indian Accounting Standards in line with the IFRS for all the above topics should be covered.

2. Any revision of relevant Indian Accounting Standard would become applicable immediately.

Reference:

1. J.R. Monga, *Fundamentals of Corporate Accounting*. Mayur Paper Backs, New Delhi.
2. M.C. Shukla, T.S. Grewal, and S.C. Gupta. *Advanced Accounts*. Vol.-II. S. Chand & Co., New Delhi.
3. S.N. Maheshwari, and S. K. Maheshwari. *Corporate Accounting*. Vikas Publishing House, New Delhi.
4. Ashok Sehgal, *Fundamentals of Corporate Accounting*. Taxman Publication, New Delhi.
5. V.K. Goyal and Ruchi Goyal, *Corporate Accounting*. PHI Learning.
6. Jain, S.P. and K.L. Narang. *Corporate Accounting*. Kalyani Publishers, New Delhi.
7. Bhushan Kumar Goyal, *Fundamentals of Corporate Accounting*, International Book House
8. P. C. Tulsian and Bharat Tulsian, *Corporate Accounting*, S.Chand
9. Amitabha Mukherjee, Mohammed Hanif, *Corporate Accounting*, McGraw Hill Education
10. Compendium of Statements and Standards of Accounting. The Institute of Chartered Accountants of India, New Delhi.

Note: Latest edition of text books may be used.

CND21011

SEMESTER IV

COST ACCOUNTING – DSC9

(Credits: Lecture – 05, Tutorial – 01, Practical – 0)

Lectures: 80hrs

Tutorials: 16hrs

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: Introduction

Meaning, objectives and advantages of cost accounting; Difference between cost accounting and financial accounting; Cost concepts and classifications; Elements of cost; Installation of a costing system; Role of a cost accountant in an organisation

Unit -2 : Material & Labour

- a) **Materials:** Material/inventory control techniques. Accounting and control of purchases, storage and issue of materials. Methods of pricing of materials issues — FIFO, LIFO, Simple Average, Weighted Average, Replacement, Standard Cost. Treatment of Material Losses .
- b) **Labour:** Accounting and Control of labour cost. Time keeping and time booking. Concept and treatment of idle time, over time, labour turnover and fringe benefits. Methods of wage payment and the Incentive schemes- Halsey, Rowan, Taylor's Differential piece wage.

Unit 3 : Overheads

Classification, allocation, apportionment and absorption of overheads; Under- and over-absorption; Capacity Levels and Costs; Treatments of certain items in costing like interest on capital, packing expenses, bad debts, research and development expenses; Activity based cost allocation.

Unit 4 : Methods of Costing

Unit costing, Job costing, Contract costing, Process costing (process losses, valuation of work in progress), Service costing (only transport).

Unit 5: Book Keeping in Cost Accounting

Integral and non-integral systems; Reconciliation of cost and financial accounts

Reference:

1. Charles T. Horngren, Srikant M. Datar, Madhav V. Rajan, *Cost Accounting: A Managerial Emphasis*, Pearson Education.
2. JawaharLal, *Cost Accounting*. McGraw Hill Education
3. Nigam, B.M. Lall and I.C. Jain. *Cost Accounting: Principles and Practice*. PHI Learning

4. Rajiv Goel, *Cost Accounting*. International Book House
5. Singh, Surender. *Cost Accounting*, Scholar Tech Press, New Delhi.
6. Jain, S.P. and K.L. Narang. *Cost Accounting: Principles and Methods*. Kalyani Publishers
7. Arora, M.N. *Cost Accounting – Principles and Practice*. Vikas Publishing House, New Delhi.
8. Maheshwari, S.N. and S.N. Mittal. *Cost Accounting: Theory and Problems*. ShriMahavir Book Depot, New Delhi.
9. Iyengar, S.P. *Cost Accounting*. Sultan Chand & Sons
10. H.V. Jhamb, *Fundamentals of Cost Accounting*, Ane Books Pvt. Ltd.

Note: Latest edition of text books may be used.

CND23011

SEMESTER IV

E-COMMERCE – SEC2

(Credits: Lecture – 03, Tutorial – 0, Practical – 01)

Lectures: 48hrs

Tutorials: 0hrs

Practical: 64hrs

Course Outcome:

On successful completion of this course the students can:

CO1: Specify the classification and characteristics of online transactions

CO2: Learn in details with examples and pursue careers in analyzing characteristics such as website traffic, sales conversion, abandonment rates, search engine optimization and web traffic drivers

CO3: Understand the details of job in information technology, business or marketing

CO4: Deliberate the characteristics of Impact of E-Commerce on traditional marketing

CO5: Understand in detail the technological environment of the business

Unit 1: Introduction:

Meaning, nature, concepts, advantages, disadvantages and reasons for transacting online, types of E-Commerce, e-commerce business models (introduction , key elements of a business model and categorizing major E-commerce business models), e-commerce drivers.

Technology used in E-commerce: The dynamics of world wide web and internet- meaning, evolution and features ; Designing, building and launching e-commerce website (A systematic approach involving decisions regarding selection of hardware, software, outsourcing vs. In-house development of a website)

Unit 2: Security and Encryption

Need and concepts, the e-commerce security environment: (dimension, definition and scope of security), security threats in the E-commerce environment (security intrusions and breaches, attacking methods like hacking, sniffing, cyber-vandalism etc.), technology solutions (Encryption, secure channels of communication, protecting networks and protecting servers and clients)

Unit 3: IT Act 2000 and Cyber Crimes

IT Act 2000: Definitions, Digital signature, Electronic governance, Attribution, acknowledgement and dispatch of electronic records, Regulation of certifying authorities, Digital signatures certificates, Duties of subscribers,

Penalties and adjudication, Appellate Tribunal, Offences and Cyber-crimes

Unit 4: E-payment System

8 Lectures, 4 Practical Lab

Models and methods of e-payments (Debit Card, Credit Card, Smart Cards, e-cash, e-cheque), digital signatures (procedure, working and legal position), payment gateways, net banking – meaning, concepts, importance, electronic fund transfer, automated clearing house, automated ledger posting., risks involved in e-payments.

Unit 5: On-line Business Transactions

8 Lectures, 4 Practical Lab

Meaning, purpose, advantages and disadvantages of transacting online, E-commerce applications in various industries like {banking, insurance, payment of utility bills, online marketing, e-tailing (popularity, benefits, problems and features), online services (financial, travel and career), auctions, online portal, e- learning, publishing and entertainment} Online shopping (Amazon, snap deal, alibaba, flip kart, etc.)

Unit 6: Web Designing

18 Practical Lab

Introduction to HTML; tags and attributes: Text Formatting, Fonts, Hypertext Links, Tables, Images, Lists, Forms, Frames, Cascading Style Sheets.

Note:

There shall be 3 Credit Hrs. For lectures + One Credit hr. (2 Practical periods per week per batch) for Practical Lab

Reference:

1. Kenneth C. Laudon and Carlo GuercioTraver, *E-Commerce*, Pearson Education.
2. David Whiteley, *E-commerce: Strategy, Technology and Applications*, McGraw Hill Education.
3. Bharat Bhaskar, *Electronic Commerce: Framework, Technology and Application, 4th Ed.*, McGraw Hill Education.
4. PT Joseph, *E-Commerce: An Indian Perspective*, PHI Learning
5. KK Bajaj and Debjani Nag, *E-commerce*, McGraw Hill Education
6. TN Chhabra, *E-Commerce*, DhanpatRai& Co.
7. SushilaMadan, *E-Commerce*, Taxmann
8. TN Chhabra, Hem Chand Jain, and Aruna Jain, *An Introduction to HTML*, DhanpatRai& Co.

Note: Latest edition of text books may be used.

CNF32001

SEMESTER VI

ENTREPRENEURSHIP DEVELOPMENT – GE2

(Credits: Lecture – 05, Tutorial – 01, Practical – 0)

Lectures: 80hrs

Tutorials: 16hrs

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

schemes

CO3: Identify in detail with examples to easily different financial schemes offered by Banks and Government Agencies

CO4: Understand in depth and identify secure customers

CO5: Learn in depth the behaviour of customers and identify the changed customer needs

UNIT- 1 Entrepreneurial Development Prospective

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 organisation 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 Institution

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 loans for MSME's, schemes, appraisal, sanctions, repayment.

Reference:

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
5. Innovative Entrepreneurship – Practice and Principles – Drucker P.F.

Note: The Latest edition of text books and Acts should be used.

CNF28001

SEMESTER VI

FUNDAMENTALS OF INVESTMENT – DSE4

(Credits: Lecture – 05, Tutorial – 01, Practical – 0)

Lectures: 80hrs

Tutorials: 16hrs

Course Outcome:

On successful completion of this course the students can:

CO1: Learn and analyse the techniques of investment and able to become a wise investor

CO2: Understand in detail the tools and techniques adopted to analyse financial transactions

and able to become financial consultant and adviser

CO3: Deliberate in detail with application of different techniques to manage portfolio and

financial derivatives

CO4: Understand in depth and analyse different investment alternatives in the market

CO5: Identify the reasons for grievances to handle investor's grievances and protect them

Unit 1: The Investment Environment

The investment decision process, Types of Investments – Commodities, Real Estate and Financial Assets, the Indian securities market, the market participants and trading of securities, security market indices, sources of financial information, Concept of return and risk, Impact of Taxes and Inflation on return.

Unit 2: Fixed Income Securities

Bond features, types of bonds, estimating bond yields, Bond Valuation types of bond risks, default risk and credit rating.

Unit 3: Approaches to Equity Analysis

Introductions to Fundamental Analysis, Technical Analysis and Efficient Market Hypothesis, dividend capitalisation models, and price-earnings multiple approach to equity valuation.

Unit 4: Portfolio Analysis and Financial Derivatives

Portfolio and Diversification, Portfolio Risk and Return; Mutual Funds; Introduction to Financial Derivatives. Origin of Derivatives in India-Classification of Derivatives-Features of Derivatives-Financial Derivatives Markets in India.

Unit 5: Investor Protection

Role of SEBI and stock exchanges in investor protection; Investor grievances and their redressal system, insider trading, investors' awareness and activism.

Reference:

1. C.P. Jones, *Investments Analysis and Management*, Wiley, 8thed.
2. Prasanna Chandra, *Investment Analysis and Portfolio Management*, McGraw Hill Education
3. R.P. Rustogi, *Fundamentals of Investment*, Sultan Chand & Sons, New Delhi.
4. N.D. Vohra and B.R. Bagri, *Futures and Options*, McGraw Hill Education
5. Mayo, *An Introduction to Investment*, Cengage Learning.

Note: Latest edition of text books may be used.

CNC22011

SEMESTER III

INCOME TAX LAW AND PRACTICE – DSC8

(Credits: Lecture – 04, Tutorial – 01, Practical – 01)

Lectures: 64hrs,

Tutorials: 16 hrs

Practical: 32hrs

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: Learn in depth online filing of Income tax returns

CO3: Identify the different heads of income and able to compute tax liability

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

Unit 1: Introduction

Basic concepts: Income, agricultural Income, person, assessee, assessment year, previous year, gross total income, total income, maximum marginal rate of tax; Permanent Account Number (PAN) Residential status; Scope of total income on the basis of residential status, Meaning of Double Tax avoidance agreement. Exempted income under section 10

Unit 2: Computation of Income under different heads – 1

Income from Salaries; Income from house property

Unit 3: Computation of Income under different heads – 2

Profits and gains of business or profession; Capital gains; Income from other sources

Unit 4: Computation of Total Income and Tax Liability

Income of other persons included in assessee's total income; Deductions from gross total income; u/s 80 C, 80 D, 80E, 80G, , 80GG , 80U. Computation of total income for individuals. Computation of Tax liability of individuals and firms. Two leading cases decided by the Supreme Court..

Unit 5: Preparation of Return of Income Practical Lab 26

Filing of returns: Manually, On-line filing of Returns of Income & TDS; Provision & Procedures of Compulsory On-Line filing of returns for specified assesses.

Reference:

1. Singhanian, Vinod K. And Monica Singhanian. *Students' Guide to Income Tax, University Edition*. Taxmann Publications Pvt. Ltd., New Delhi.
2. Ahuja, Girish and Ravi Gupta. *Systematic Approach to Income Tax*. Bharat Law House, Delhi.

Journals

1. *Income Tax Reports*. Company Law Institute of India Pvt. Ltd., Chennai.
2. *Taxman*. Taxman Allied Services Pvt. Ltd., New Delhi.
3. *Current Tax Reporter*. Current Tax Reporter, Jodhpur.

Note: Latest edition of text books may be used.

CNF26001

SEMESTER VI

INTERNATIONAL BUSINESS– DSE4

(Credits: Lecture – 05, Tutorial – 01, Practical – 0)

Lectures: 80hrs

Tutorials: 16hrs

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

Seminar on different Theories of International Trade and understanding government intervention in formulating trade policy.

Unit 1: International Business:

a. Introduction to International Business: International business vs. Domestic business: Complexities of international business; Modes of entry into international business. **Globalisation and its importance in world economy; Impact of globalization.**

b. International Business Environment: National and foreign environments and their components – economic, cultural and political-legal environments

Unit 2 :Theories of International Trade:

a. Theories of International Trade– an overview (Classical Theories, Product Life Cycle theory, Theory of National Competitive Advantage); Commercial Policy Instruments – tariff and nontariff measures – difference and Impact on trade, types of tariff and non-tariff barriers (Subsidy, Quota and Embargo in detail) ; Balance of payment account and its components.

b. *International Organizations and Arrangements:* WTO – Its objectives, principles, organizational structure and functioning; An overview of other organizations – UNCTAD;; Commodity and other trading agreements (OPEC).

Unit 3 :Regional Economic Co-operation:

a. *Regional Economic Co-operation:* Forms of regional groupings; Integration efforts among countries in Europe, North America and Asia (NAFTA, EU , ASEAN and SAARC) .

b. *International Financial Environment:* International financial system and institutions (IMF and World Bank – Objectives and Functions) ; Foreign exchange markets and risk management;

Foreign investments – types and flows; foreign investment in Indian perspective.

Unit 4: Organisational structure for international business operations:

a. Organisational structure for international business operations; International business negotiations.

b. *Developments and Issues in International Business:* Outsourcing and its potentials for India; Role of IT in international business; International business and ecological considerations.

Unit 5Foreign Trade Promotion Measures and Organizations in India:

a) Foreign Trade Promotion Measures and Organizations in India; Special economic zones (SEZs) and export oriented units (EOUs), ; Measures for promoting foreign investments into and from India; Indian joint ventures and acquisitions abroad.

b) Financing of foreign trade and payment terms – sources of trade finance (Banks, factoring, forfeiting, Banker's Acceptance and Corporate Guarantee) and forms of payment (Cash in advance, Letter of Credit, Documentary Collection, Open Account)

Reference:

1. International Business – P. SubbaRao
2. International Business - Francis Cherunilam
3. International Business – C.B Gupta
4. International Business – K.S Ashwathappa.

Note: Latest edition of text books may be used.

CNF30001

SEMESTER VI

MARKETING MANAGEMENT – GE2

(Credits: Lecture – 05, Tutorial – 01, Practical – 0)

Lectures: 80hrs

Tutorials: 16hrs

Course Outcome:

On successful completion of this course the students can:

CO1: Understand in detail the functions of marketing and able to become marketing manager

CO2: Learn in depth and analyse tastes and preferences of customers and able to launch a
new product

CO3: Understand in detail the requirements of customers and able to forecast the demand for
the products

CO4: Learn in depth the procedure to conduct market survey and able to understand buyer
behaviour

CO5: Identify the benefits of various distribution channels and able to make comparative
analysis of different channels of distribution

Unit 1: Introduction To Marketing Management

Meaning & Definition of marketing management– Goals – Concepts of Marketing – Approaches to Marketing.

Recent trends in Marketing Introduction, E-business – Tele-marketing – M-Business – Green Marketing – Relationship Marketing – Retailing – Concept Marketing and Virtual Marketing (Meaning Only).

Unit 2: Marketing Environment

Meaning – Demographic – Economic – Natural – Technological – Political – Legal – Socio – Cultural Environment

Unit 3: Marketing Mix

Meaning – Elements Product – Product Mix – Product Line – Product Lifecycle – Product Planning – New Product Development – Failure of New Product.

Branding – branding decisions- brand development- brand valuation– Pricing Policy and pricing strategies.

Promotion- promotion mix and factors affecting promotion mix decisions.

Unit 4: Customer Relationship Management

Meaning and Definition – **Role of CRM** – Advantages and Disadvantages.

Unit 5: Marketing Research & Ethics

- a) **Marketing Research – Meaning and Importance**
- b) **A brief study of Logistics Management**
- c) **Ethics and social responsibility in marketing.**

REFERENCE

1. P N Reddy & Appanniah, Marketing Management, HPH.
2. Kuranakaran, Marketing Management, Himalaya Publishers.
3. Rekha & Vibha, Marketing Management, VBH.
4. Philip Kotler, Marketing Management, Prentice Hall.
35. Bose Biplab, Marketing Management, Himalaya Publishers.
6. J.C. Gandhi, Marketing Management, Tata McGraw Hill.

7. Ramesh & Jayanti Prasad: Marketing Management, I.K. International
8. William J. Stanton, Michael J. Etzel, Bruce J. Walker, Fundamentals of Marketing, McGraw Hill Education.
9. Sontakki, Marketing Management, Kalyani Publishers.
10. K. Venkataramana, Marketing Management, SHBP.

Note: The Latest edition of text books and Acts should be used.

CNE27001

SEMESTER V

PRINCIPLES OF EVENT MANAGEMENT – DSE2

(Credits: Lecture – 05, Tutorial – 01, Practical – 0)

Lectures: 80hrs

Tutorials: 16hrs

Course Outcome:

On successful completion of this course the students can:

CO1: Learn in detail and application of techniques for conducting brain storming sessions

CO2: Identify in depth the techniques of effective event management

CO3: Understand the characteristics of public relation officer and can pursue the profession

of PRO

CO4: Learn the details to start their own event management enterprise

CO5: Understand and acquire the required knowledge to conduct corporate event

Unit: 1 INTRODUCTION TO EVENT MANAGEMENT

Event- Meaning- Why Event Management- Analysis of Event, Scope of Event, Decision Makers- Event Manager Technical Staff- Establishing of Policies & Procedure- Developing Record Keeping Systems.

Unit: 2 EVENT MANAGEMENT PROCEDURES

Principles for holding an Event, General Details, Permissions- Policies, Government and Local Authorities, - Phonographic Performance License, Utilities- Five Bridge Ambulance Catering, Electricity, Water Taxes Applicable.

Unit: 3 CONDUCT OF AN EVENT

Preparing a Planning Schedule, Organizing Tables, Assigning Responsibility, Communication and Budget of Event- Checklist, Computer aided Event Management– Roles & Responsibilities of Event Managers for Different Events.

Unit: 4 PUBLIC RELATIONS

Introductions to Public Relations- Concept- Nature- Importance- Limitations- Media- Types of Media- Media Management, Public Relation Strategy & Planning. Brain Storming Sessions- Writings for Public Relations.

Unit: 5 CORPORATE EVENTS

Planning of Corporate Event, Job Responsibility of Corporate Events Organizer, Arrangements, Budgeting, Safety of Guests and Participants, Creating Blue Print, Need for Entertainment in Corporate Events And Reporting.

Reference:

1. Event Entertainment and Production – Author: Mark Sonderm CSEP Publisher: Wiley & Sons, Inc. ISBN: 0-471-26306-0
2. GhouseBasha – Advertising & Media Mgt
3. Anne Stephen – Event Management
4. K. Venkataramana, Event Management, SHBP.
5. Special Event Production – Doug Matthews – ISBN 978-0-7506-8523-8
6. The Complete Guide to successful Event Planning – Shannon Kilkenny
7. Human Resource Management for Events – Lynn Van der Wagen (Author)
8. Successful Team Management (Paperback) – Nick Hayed (Author)
9. Event Management & Public Relations by Savita Mohan – Enkay Publishing House
10. Event Management & Public Relations By Swarup K. Goyal – Adhyayan Publisher – 2009

Note: Latest edition of text books may be used.

CNF23001

SEMESTER VI

SERVICE MANAGEMENT – DSE3

(Credits: Lecture – 05, Tutorial – 01, Practical – 0)

Lectures: 80hrs

Tutorials: 16hrs

Course Outcome:

On successful completion of this course the students can:

CO1: Understand in detail and identify the requirements to start Tours and Travels Agency

and able to manage effectively

CO2: Learn in depth to manage a retail business efficiently

CO3: Learn in depth the procedure to prepare advertisement copy and able to start

advertisement agency

CO4: Understand the required characteristics to become an event manager and able to

manage effectively

CO5: Specify in depth the required tools and techniques pertaining to management of

transaction based service process

Unit 1: Services

Meaning, importance, types. Services management –meaning, definitions, objectives and importance.

Unit 2: Travel and Tourism Management

Meaning- motives- types- impact of tourism- tourism industry in India, impact of tourism on India's economic development- meaning and features of a tour operator- types of tour operator. Tourism marketing; need for marketing in tourism – tourism promotion – travel agency

operation and services- national tourism organizations- challenges of tourism industry – future of tourism industry in India.

Unit 3: Retail Management

Meaning, nature, classification- functions of retailing- retail formats and types- factors influencing retail consumer- retail operations; stores administration, premises management, inventory management, customer service, space management - POP displays, visual merchandising. Importance of retailing industry and challenges of retailing industry.

Unit 4: Hospital Management

Meaning and objectives- types of hospitals- inventory control and purchase management- services by hospitals: laundry, dietary, dispensary, security and ambulance services. Management of blood bank and donated organs.

Unit 5: Advertisement and Event Management

Meaning , definition and importance of advertising – Types of advertising –Advertisement copy and layouts- social and economic effects of advertising-. Event Management – Meaning, definition, concepts and Principles, advantages and disadvantages. Event managers – roles and responsibilities, events organizing procedure.

Unit 6: HOTEL MANAGEMENT

Meaning of hotels- types of hotels- hotel chains- services provided by hotels- functional areas of hotels- types of rooms- tariff structure and plans. Food – types of food, food organization department and its importance- differences between large and small hotels- hotel industry in India.

Reference:

1. Managing Customer Relationships: A Strategic Framework by Don Peppers and Martha Rogers, 2011
2. **Perfecting the Art of Customer Service** by the Disney Institute and Theodore Kinni, 2011
3. **The Amazement Revolution: Seven Customer Service Strategies to Create an Amazing Customer (and Employee) Experience** by ShepHyken, 2011
4. **Powerful Phrases for Effective Customer Service: Over 700 Ready-to-Use Phrases and Scripts That Really Get Results** by Renee Evenson, 2012
5. **Customer Service: Career Success Through Customer Loyalty, Fifth Edition** by Paul R. Timm, 2010.

Note: Latest edition of text books may be used.

DLF21611

VI Semester
Skill Enhancement Course (SEC)-1: DATA ANALYSIS

Course outcome

On completion of the Course, students will:

- CO1. Understand the classification and characteristics of Population Census versus Sample Survey.
- CO2. Specify the details of Measures of Central Tendency
- CO3. Understand in depth Karl Pearson Method
- CO4. Learn in details with application, if applicable, Normal Distributions
- CO5. Learn the details of Introduction to Probability theory

Course Description:

This course introduces the student to collection and presentation of data. Discusses how data can be summarized and analyzed for drawing statistical inferences. The students will be introduced to important data sources that are available and will also be trained in the use free statistical software to analyze data.

- I.** Data: Meaning, Types, Importance of Data, Sources of Data. **Population Census versus Sample Survey.** **14**
- II.** **Univariate frequency distributions.** Measures of Central tendency: Mean, Median and Mode, Measures of Dispersion, Skeweness and kurtosis. **15**
- III.** Bivariate frequency distribution. Correlation, Karl Pearson Method-Spearman's **Rank Correlation-Regression- Estimator.** **14**
- IV.** Introduction to probability theory- Notions of random experiment , sample space. Event, probability of an event. Conditional probability. **Independence of events.** **Random variables and Probability distributions. Binomial and normal distributions.** **17**

Reference:

- P. H. Karmel and M. Polasek (1978), Applied Statistics for Economics
- M. R. Spiegel, Theory and Problems of probability And Statistics
- Veerachamy –Quantitative methods for Economics-(New Age International)
- Anderson, David R, Dennis, Sweeney & Thomas A Williams Statistics for Business & Economics (New Age International)
- C. K. Renukarya – Mathematics and Statistics for Economics (Chethana Book house)
- Suresh. B. H-Quantitative Techniques (Chethana Book house)

DLE21611

V Semester
Skill Enhancement Course (SEC)-1: Financial Economics

Course outcome

On completion of the Course, students will:

CO1. Learn in depth Basic theory of interest.

CO2. Learn in details with examples Investment decisions under uncertainty.

CO3. Deliberate the classification and characteristics of Portfolios of assets.

CO4. Understand the details of Capital Asset Pricing Model.

Course Description:

This course introduces students to the economics of finance, essential aspects of financial asset valuation. The students are introduced to numerical techniques in finance using spreadsheet programmes such as Microsoft Excel. The course will impart skills that will be useful in a variety of business settings including investment banks, asset management companies and in the field of financial and business journalism.

- I Deterministic cash-flow streams :** **22**
Basic theory of Interest, Investment decisions under uncertainty: Pay back period Method, Net Present Value Method, Internal Rate of return Method, fixed Income securities: Bond, Prices and Yields, Interest rate sensitivity and duration the term structure of Interest rates, spot rates and forward rates.
- II. Single-period random cash flows:** **21**
Random asset returns; portfolios of assets: portfolio mean and variance: feasible combinations of mean and variance: Portfolio analysis: the Markowitz model and Two fund theorems: risk-free assets and the one-fund theorem.
- III. Capital Asset Pricing Model(CAPM):** **17**
The Capital Market: Capital Asset Pricing Model: Securities Market: use of the CAPM model in investment analysis and as a pricing formula.

Reference:

- David G. Luenberger. Investment Science - Oxford University Press.USA.1997
Richard A. Brealey and Stewart C. Myers - Principles of Corporate Finance, McGraw-Hill, 7th Edition
Burton G. Malkiel. A Random Walk Down Wall Street, W. W. Norton & Company, 2003
Simon Benninga, Financial Modeling, MIT Press, USA, 1997
L. V. Chandler-Money & Banking (S. Chand & Company)
D. M. Mithani - Money & Banking and Financial System (Himalaya Publishing house)
R. R. Paul-Monetary Economics (kalyani Publishers)
B. Gupta-Monetary Economics (S. Chand & Company)

DLF21611

VI Semester
Skill Enhancement Course (SEC)-1: DATA ANALYSIS

Course outcome

On completion of the Course, students will:

- CO1. Understand the classification and characteristics of Population Census versus Sample Survey.
- CO2. Specify the details of Measures of Central Tendency
- CO3. Understand in depth Karl Pearson Method
- CO4. Learn in details with application, if applicable, Normal Distributions
- CO5. Learn the details of Introduction to Probability theory

Course Description:

This course introduces the student to collection and presentation of data. Discusses how data can be summarized and analyzed for drawing statistical inferences. The students will be introduced to important data sources that are available and will also be trained in the use free statistical software to analyze data.

- I.** Data: Meaning, Types, Importance of Data, Sources of Data. **Population Census versus Sample Survey.** **14**
- II.** **Univariate frequency distributions.** Measures of Central tendency: Mean, Median and Mode, Measures of Dispersion, Skeweness and kurtosis. **15**
- III.** Bivariate frequency distribution. Correlation, Karl Pearson Method-Spearman's **Rank Correlation-Regression- Estimator.** **14**
- IV.** Introduction to probability theory- Notions of random experiment , sample space. Event, probability of an event. Conditional probability. **Independence of events.** **Random variables and Probability distributions. Binomial and normal distributions.** **17**

Reference:

- P. H. Karmel and M. Polasek (1978), Applied Statistics for Economics
- M. R. Spiegel, Theory and Problems of probability And Statistics
- Veerachamy –Quantitative methods for Economics-(New Age International)
- Anderson, David R, Dennis, Sweeney & Thomas A Williams Statistics for Business & Economics (New Age International)
- C. K. Renukarya – Mathematics and Statistics for Economics (Chethana Book house)
- Suresh. B. H-Quantitative Techniques (Chethana Book house)

DLE21611

V Semester
Skill Enhancement Course (SEC)-1: Financial Economics

Course outcome

On completion of the Course, students will:

CO1. Learn in depth Basic theory of interest.

CO2. Learn in details with examples Investment decisions under uncertainty.

CO3. Deliberate the classification and characteristics of Portfolios of assets.

CO4. Understand the details of Capital Asset Pricing Model.

Course Description:

This course introduces students to the economics of finance, essential aspects of financial asset valuation. The students are introduced to numerical techniques in finance using spreadsheet programmes such as Microsoft Excel. The course will impart skills that will be useful in a variety of business settings including investment banks, asset management companies and in the field of financial and business journalism.

- I Deterministic cash-flow streams :** **22**
Basic theory of Interest, Investment decisions under uncertainty: Pay back period Method, Net Present Value Method, Internal Rate of return Method, fixed Income securities: Bond, Prices and Yields, Interest rate sensitivity and duration the term structure of Interest rates, spot rates and forward rates.
- II. Single-period random cash flows:** **21**
Random asset returns; portfolios of assets: portfolio mean and variance: feasible combinations of mean and variance: Portfolio analysis: the Markowitz model and Two fund theorems: risk-free assets and the one-fund theorem.
- III. Capital Asset Pricing Model(CAPM):** **17**
The Capital Market: Capital Asset Pricing Model: Securities Market: use of the CAPM model in investment analysis and as a pricing formula.

Reference:

- David G. Luenberger. Investment Science - Oxford University Press.USA.1997
Richard A. Brealey and Stewart C. Myers - Principles of Corporate Finance, McGraw-Hill, 7th Edition
Burton G. Malkiel. A Random Walk Down Wall Street, W. W. Norton & Company, 2003
Simon Benninga, Financial Modeling, MIT Press, USA, 1997
L. V. Chandler-Money & Banking (S. Chand & Company)
D. M. Mithani - Money & Banking and Financial System (Himalaya Publishing house)
R. R. Paul-Monetary Economics (kalyani Publishers)
B. Gupta-Monetary Economics (S. Chand & Company)

DLF21611

VI Semester
Skill Enhancement Course (SEC)-1: DATA ANALYSIS

Course outcome

On completion of the Course, students will:

- CO1. Understand the classification and characteristics of Population Census versus Sample Survey.
- CO2. Specify the details of Measures of Central Tendency
- CO3. Understand in depth Karl Pearson Method
- CO4. Learn in details with application, if applicable, Normal Distributions
- CO5. Learn the details of Introduction to Probability theory

Course Description:

This course introduces the student to collection and presentation of data. Discusses how data can be summarized and analyzed for drawing statistical inferences. The students will be introduced to important data sources that are available and will also be trained in the use free statistical software to analyze data.

- I.** Data: Meaning, Types, Importance of Data, Sources of Data. **Population Census versus Sample Survey.** **14**
- II.** **Univariate frequency distributions.** Measures of Central tendency: Mean, Median and Mode, Measures of Dispersion, Skeweness and kurtosis. **15**
- III.** Bivariate frequency distribution. Correlation, Karl Pearson Method-Spearman's **Rank Correlation-Regression- Estimator.** **14**
- IV.** Introduction to probability theory- Notions of random experiment , sample space. Event, probability of an event. Conditional probability. **Independence of events.** **Random variables and Probability distributions. Binomial and normal distributions.** **17**

Reference:

- P. H. Karmel and M. Polasek (1978), Applied Statistics for Economics
- M. R. Spiegel, Theory and Problems of probability And Statistics
- Veerachamy –Quantitative methods for Economics-(New Age International)
- Anderson, David R, Dennis, Sweeney & Thomas A Williams Statistics for Business & Economics (New Age International)
- C. K. Renukarya – Mathematics and Statistics for Economics (Chethana Book house)
- Suresh. B. H-Quantitative Techniques (Chethana Book house)

DLE21611

V Semester
Skill Enhancement Course (SEC)-1: Financial Economics

Course outcome

On completion of the Course, students will:

CO1. Learn in depth Basic theory of interest.

CO2. Learn in details with examples Investment decisions under uncertainty.

CO3. Deliberate the classification and characteristics of Portfolios of assets.

CO4. Understand the details of Capital Asset Pricing Model.

Course Description:

This course introduces students to the economics of finance, essential aspects of financial asset valuation. The students are introduced to numerical techniques in finance using spreadsheet programmes such as Microsoft Excel. The course will impart skills that will be useful in a variety of business settings including investment banks, asset management companies and in the field of financial and business journalism.

- I Deterministic cash-flow streams :** **22**
Basic theory of Interest, Investment decisions under uncertainty: Pay back period Method, Net Present Value Method, Internal Rate of return Method, fixed Income securities: Bond, Prices and Yields, Interest rate sensitivity and duration the term structure of Interest rates, spot rates and forward rates.
- II. Single-period random cash flows:** **21**
Random asset returns; portfolios of assets: portfolio mean and variance: feasible combinations of mean and variance: Portfolio analysis: the Markowitz model and Two fund theorems: risk-free assets and the one-fund theorem.
- III. Capital Asset Pricing Model(CAPM):** **17**
The Capital Market: Capital Asset Pricing Model: Securities Market: use of the CAPM model in investment analysis and as a pricing formula.

Reference:

- David G. Luenberger. Investment Science - Oxford University Press.USA.1997
Richard A. Brealey and Stewart C. Myers - Principles of Corporate Finance, McGraw-Hill, 7th Edition
Burton G. Malkiel. A Random Walk Down Wall Street, W. W. Norton & Company, 2003
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JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE

(Autonomous)

B N ROAD, MYSURU- 570 025

DEPARTMENT OF ELECTRONICS

Syllabus

CHOICE BASED CREDIT SYSTEM

For B.Sc programme

Physics, Mathematics, Electronics

Syllabus on Skill Development

2018-19

PRACTICAL 1
NETWORK ANALYSIS AND ANALOG ELECTRONICS

1. To familiarize with basic electronic components (R, C, L, diodes, transistors), Digital Multimeter, Function Generator and Oscilloscope.
2. Measurement of Amplitude, Frequency & Phase difference using Oscilloscope.
3. Verification of Thevenin's theorem and (b) Norton's theorem.
4. Verification of (a) Superposition Theorem and (b) Reciprocity Theorem
5. Verification of the Maximum Power Transfer Theorem.
6. Study of the I-V Characteristics of (a) p-n junction Diode and (b) Zener diode.
7. Study of (a) Half wave rectifier and (b) Full wave rectifier (FWR) with C filter and without filter
8. Zener diode as voltage regulator (at the output of Full Wave Rectifier)
9. Study of the I-V Characteristics of UJT
10. Study of the output and transfer I-V characteristics of common source JFET.
11. Study of Fixed Bias and Voltage divider bias configuration for CE transistor.
12. Study of Single Stage CE amplifier.
13. Study of the RC Phase Shift Oscillator.
14. Study the Colpitt's oscillator.

(Note: Minimum of Eight experiments to be conducted)

PRACTICAL 2

LINEAR AND DIGITAL INTEGRATED CIRCUITS LAB

Section – A: Op-Amp. Circuits (Hardware)

1. To design an Inverting & Non-inverting amplifier using Op-amp (741,351) for DC voltage of given gain
2. To design an Inverting amplifier using Op-amp (741) & to study its frequency response(for AC voltage)
3. To design non-inverting amplifier using Op-amp (741) & to study frequency response(for AC voltage)
4. To Add / Subtract two dc voltages using Op-amp in inverting mode.
5. To study the zero-crossing detector and comparator.
6. To investigate the use of an op-amp as an Integrator.
7. To investigate the use of an op-amp as a Differentiator.
8. To study a Wien bridge oscillator using an op-amp.
9. To design an Astable Multivibrator of given specification using IC 555 Timer.
10. To design a Butterworth Low Pass active Filter (1st order) & to study Frequency Response.
11. To design a Butterworth High Pass active Filter (1st order) & to study Frequency Response.
12. R – 2R digital to analog converter (DAC).

Section-B: Digital circuits (Hardware)

1. To simplify the given Boolean expression and to construct logic circuit using basic gates
2. To study NAND & NOR gates as Universal gates
3. Half Adder and Full Adder.
4. Half Subtractor and Full Subtractor.
5. 4 bit binary Adder-Subtractor using Full adder IC.
6. Seven segment decoder.
7. Study of Encoder
8. To build Flip-Flop (RS, Clocked RS, D-type and JK) circuits using NAND gates.
9. To build JK Master-slave flip-flop using Flip-Flop ICs.
10. To build a Counter using D-type/JK Flip-Flop ICs and study timing diagram.

11. To make a Shift Register (serial-in and serial-out) using D-type/JK Flip-Flop ICs.

Section-C: SPICE/MULTISIM simulations for electronic circuits and devices

1. To verify the Thevenin's and Norton Theorems.
2. Design and analyze the series and parallel LCR circuits
3. Design the inverting and non-inverting amplifier using an Op-Amp of given gain
4. Design and Verification of op-amp as integrator and differentiator
5. Design the 1st order active low pass and high pass filters of given cut-off frequency
6. Design a Wein Bridge oscillator of given frequency.
7. Design clocked SR and JK Flip-Flop's using NAND Gates
8. Design 4-bit asynchronous counter using Flip-Flop ICs
9. Design the CE amplifier of a given gain and its frequency response.

(Minimum of 05 experiments from section A, B and C to be done)

CMC26104

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)

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

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

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.

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

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.

CME26404

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

Familiarization with multimeter, voltmeter and ammeter.

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 - Single-phase and three-phase alternating current sources. Rules to analyze AC sourced electrical circuits. 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.

CME26604

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

**JSS COLLEGE OF ARTS, COMMERCE AND
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B.N. ROAD, MYSURU-570025**



DEPARTMENT OF GEOGRAPHY

**Revised Syllabus for Undergraduate (UG)
CBCS scheme – 2018-19**

DLF23011 (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).

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CBCS scheme – 2018-19**

DLF23011 (A)

VI – Semester
Geography VI: DISASTER MANAGEMENT

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- 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

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1. Government of India. (1997) Vulnerability Atlas of India. New Delhi, Building Materials & Technology Promotion Council, Ministry of Urban Development, Government of India.
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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).

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DEPARTMENT OF JOURNALISM

**Revised Syllabus for Undergraduate (UG) Journalism
With CBCS scheme Effective from 2018-19**

Semester: 6
Code: DLF27415
Paper: Film Communication and Appreciation

- CO1 Learn in depth Introduction to Cinema Language
- CO2 Identify the details of nature of scenes
- CO3 Understand the details of types of shots
- CO4 Identify the characteristics of montage language
- CO5 Specify the characteristics of types of sounds
- CO6 Understand the details of use of colors
- CO7 Specify in depth development of classical Hollywood cinema
- CO8 Learn the details of cinema and the nation
- CO9 Deliberate the details of globalization and Indian cinema

Unit:1- Cinema Language-visual language-**types of shots- nature of scene-continuity editing- montage language- types of sounds- use of colors- stylistic elements- differences between story-plot-screen play**

Unit:2- Film form- **style of German expression- Film Noir- Italian Neo realism- French new wave genre- the development of classical Hollywood cinema**

Unit:3- Visions of 3rd cinema-nonfiction cinema- feminist cinema theory- auteur- **film authorship**-a special focus on ray/Kurusawa

Unit:4- Hindi cinema1950- cinema and the nation- **the Indian new wave**- globalization and Indian cinema- **the multiplex Era-film culture**

References:

1. Andre Bazin-The Ontology of the Photographic Image
2. Sergei Eisenstein- A Dialectic Approach to Film Form
3. Tom Gunning- Non Continuity, Continuity, Dis Continuity: A theory of Genre in early Films.
4. David Bordwell- Classical Hollywood Cinema: Narrational Principles and Procedure
5. Paul Schraeder- Notes on Film Noir
6. Robert Stam- The cult of the Auteur
7. Richard Dyer- Heavens Bodies: Film Stars and Society.
8. Mahadev Prasad- Ideology of Hindi Film



**JSS COLLEGE OF ARTS, COMMERCE AND
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**DEPARTMENT OF
MATHEMATICS**

Syllabus

CHOICE BASED CREDIT SYSTEM

For B.Sc programmes

- **Physics, Mathematics, Chemistry**
- **Physics, Mathematics, Computer Science**
- **Physics, Mathematics, Electronics**
- **Physics, Mathematics, Computer Maintenance**

PROGRAMME: BSc PCM, PROGRAMME CODE: BSc-01 (2017-18)

SL No	SEMESTER	Title of the paper	DSC/DSE/SEC	Course code	No. of Credits			Total Credits
					L	T	P	
1	I Semester	Differential Calculus	DSC-I	CMA 27001	4	0	2	6
2	II Semester	Differential Equations	DSC-II	CMB27001	4	0	2	6
3	III Semester	Real Analysis	DSC-III	CMC 27001	4	0	2	6
4	IV Semester	Algebra	DSC-IV	CMD 27001	4	0	2	6
5	V Semester	Linear Algebra	DSE-I	CME 27001	5	0	1	6
6	VI Semester	Complex Analysis	DSE-II	CMF 27001	5	0	1	6
7	V Semester/ VI Semester	Vector calculus	SEC	CMF 27201	2	0	0	0

PROGRAMME: BSc PMCS, PROGRAMME CODE: BSc-02 (2017-18)

SL No	SEMESTER	Title of the paper	DSC/DSE/SEC	Course code	No. of Credits			Total Credits
					L	T	P	
1	I Semester	Differential Calculus	DSC-I	CMA 27002	4	0	2	6
2	II Semester	Differential Equations	DSC-II	CMB27002	4	0	2	6
3	III Semester	Real Analysis	DSC-III	CMC 27002	4	0	2	6
4	IV Semester	Algebra	DSC-IV	CMD 27002	4	0	2	6
5	V Semester	Linear Algebra	DSE-I	CME 27002	5	0	1	6
6	VI Semester	Complex Analysis	DSE-II	CMF 27002	5	0	1	6
7	V Semester/ VI Semester	Vector calculus	SEC	CMF 27202	2	0	0	0

PROGRAMME: BSc PMCM, PROGRAMME CODE: BSc-03 (2017-18)

SL No	SEMESTER	Title of the paper	DSC/DSE/SEC	Course code	No. of Credits			Total Credits
					L	T	P	
1	I Semester	Differential Calculus	DSC-I	CMA 27003	4	0	2	6
2	II Semester	Differential Equations	DSC-II	CMB27003	4	0	2	6
3	III Semester	Real Analysis	DSC-III	CMC 27003	4	0	2	6
4	IV Semester	Algebra	DSC-IV	CMD 27003	4	0	2	6
5	V Semester	Linear Algebra	DSE-I	CME 27003	5	0	1	6
6	VI Semester	Complex Analysis	DSE-II	CMF 27003	5	0	1	6

7	V Semester/ VI Semester	Vector calculus	SEC	CMF 27203	2	0	0	0
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PROGRAMME: BSc PME, PROGRAMME CODE: BSc-04 (2017-18)

SL No	SEMESTER	Title of the paper	DSC/DSE/SEC	Course code	No. of Credits			Total Credits
					L	T	P	
1	I Semester	Differential Calculus	DSC-I	CMA 27004	4	0	2	6
2	II Semester	Differential Equations	DSC-II	CMB27004	4	0	2	6
3	III Semester	Real Analysis	DSC-III	CMC 27004	4	0	2	6
4	IV Semester	Algebra	DSC-IV	CMD 27004	4	0	2	6
5	V Semester	Linear Algebra	DSE-I	CME 27004	5	0	1	6
6	VI Semester	Complex Analysis	DSE-II	CMF 27004	5	0	1	6
7	V Semester/ VI Semester	Vector calculus	SEC	CMF 27204	2	0	0	0

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
4:0:1	70	-	30	70	-	30	3h	-
2:0:0	70	-	30	50	-	30	2h	-

Note: L-Lecture, T-Tutorial, P-Practical; Th- Theory, Pr-Practical,

I A- Internal Assessment

SEMESTER -I

Course code: CMA27001/ CMA27002/ CMA27003/ CMA27004

Credits: Theory – 04, Practical – 02

Theories: 60 Lectures

COURSE OUTCOME:

After successful completion of the course, the student is able to

- CO1. Learn in details with examples curvature
- CO2. Learn in depth applications of Taylor's theorem
- CO3. Understand the details of mean value theorems
- CO4. Learn the details of linear approximation theorem
- CO5. Understand in details with examples partial derivatives
- CO6. Specify in details with examples asymptotes
- CO7. Identify the classification and characteristics of envelopes
- CO8. Deliberate the details of maxima and minima
- CO9. Understand in details with examples indeterminate forms

DSC I: Differential Calculus

Unit I : Limit and Continuity (ϵ and δ definition), Types of discontinuities, Differentiability of functions, Successive differentiation, Leibnitz's theorem, Partial differentiation, Euler's theorem on homogeneous functions.

Unit II: Linear Approximation theorem, Tangents and normals, Monotone functions, Maxima and Minima, Curvature, Radius of curvature, Centre of curvature, Evolutes

Unit III : Rolle's theorem, Mean Value theorems, Taylor's theorem with Lagrange's and Cauchy's forms of remainder, Taylor's series, Maclaurin's series of $\sin x$, $\cos x$, e^x , $\log(1+x)$, $(1+x)^m$, Maxima and Minima, Indeterminate forms.

Unit IV: Asymptotes, Envelopes, Singular points – Multiple points – Cusp, Node and conjugate points, Orthogonal Trajectories, Tracing of curves,

Reference Books:

1. Frank Ayres and Elliott Mendelson, Schaum's Outline of Calculus, 5th ed. USA: Mc. Graw Hill., 2008.
2. G B Thomas and R L Finney, Calculus and analytical geometry, Addison Wesley, 1995.
3. H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc., 2002
4. J Edwards, An elementary treatise on the differential calculus: with Applications and numerous example, Reprint. Charleston, USA BiblioBazaar, 2010.

5. Lipman Bers – Calculus, Volumes 1 and 2
6. N. Piskunov – Differential and Integral Calculus
7. N P Bali, Differential Calculus, India: Laxmi Publications (P) Ltd., 2010.
8. Serge Lang – First Course in Calculus
9. S Narayanan & T. K. Manicavachogam Pillay, Calculus.:S. Viswanathan Pvt. Ltd., vol. I & II 1996.
10. Shanthi Narayan and P K Mittal, Differential Calculus, Reprint. New Delhi: S Chand and Co. Pvt. Ltd., 2014.

PRACTICAL COMPONENT-1

1. Introduction to Scilab.
2. Operators; trigonometric, inverse trigonometric functions in scilab.
3. Plotting of standard Cartesian curves using Scilab.
4. Plotting of standard polar curves using Scilab.
5. Plotting of standard parametric curves using Scilab.
6. Introduction to Maxima.
7. Creating variables, functions.
8. Creating a Maxima program (simple examples, loops, control sequence).
9. Differentiation and integration using maxima inbuilt functions.
10. Plotting of standard curves- Cartesian, Polar using Maxima.
11. Plotting of standard parametric curves using Maxima.
12. Geometrical meaning of Rolle's theorem of the functions on the given interval.
13. To verify Rolle's theorem , Lagrange's theorem and cauchy's mean value theorem
14. Finding Taylor's theorem for a given function.
15. To illustrate left hand and right hand limits for discontinuous functions.
16. To illustrate continuity of a function.
17. To illustrate differentiability of a function.

SEMESTER-II

Course code: CMB27001/ CMB27002/ CMB27003/ CMB27004

Credits: Theory – 04, Practical – 02

Theories: 60 Lectures

COURSE OUTCOME:

After successful completion of the course, the student is able to

C01. Understand in depth variable separable

C0 2. Specify the characteristics of homogeneous equations

C03. Identify the details of exact equation

C04. Learn in depth simultaneous differential equations

C05. Write down in depth total differential equation

C06. Identify in depth linear non homogeneous equations

C07. Write down in depth linear partial differential equation

C08. Deliberate the characteristics of lagrange's method

DSC II: Differential Equations

Unit I: Linear differential equations of First order, Separation of variables, Equations with homogeneous coefficients, Exact differential equations, Linear differential equations of the form $\frac{dy}{dx} + Py = Q$, Integrating factors, rules to find an integrating factor, Bernoulli's Equations, Equations with coefficients linear in x and y.

Unit II: First order higher degree equations solvable for x, y, p, Clairaut's form. Methods for solving higher-order differential equations. Basic theory of linear differential equations, Wronskian, and its properties. Solving a differential equation by reducing its order, Simultaneous differential equations and Total differential equations.

Unit III: Linear homogenous equations with constant coefficients, Linear non-homogenous equations, The method of variation of parameters, Exact equations, Inverse Differential operators, The Cauchy-Euler equation.

Unit IV: Order and degree of partial differential equations, Concept of linear and non-linear partial differential equations, Formation of first order partial differential equations, Linear partial differential equation of first order, Lagrange's method, Charpit's method.

Reference Books:

1. Daniel A Murray – Introductory Course to Differential equations
Earl David Rainville and Philip Edward Bedient – A short course in Differential equations, Prentice Hall College Div; 6th edition.
2. M D Raisinghania, Advanced Differential Equations, S Chand and Co. Pvt. Ltd., 2013.
F. Ayres, Schaum's outline of theory and problems of Differential Equations, 1st ed. USA McGraw-Hill, 2010
3. S Narayanan and T K Manicavachogam Pillay, Differential Equations .: S V Publishers Private Ltd., 1981.
4. G F Simmons, Differential equation with Applications and historical notes, 2nd ed.: McGraw-Hill Publishing Company, Oct 1991.
5. G. Stephenson – An introduction to Partial Differential Equations.
6. B. S. Grewal – Higher Engineering Mathematics
E. Kreyszig – Advanced Engineering Mathematics
7. E. D. Rainville and P E Bedient – A Short Course in Differential Equations
8. D. A Murray – Introductory Course in Differential Equations.
9. G. P. Simmons – Differential Equations
10. F. Ayres – Differential Equations (Schaum Series)
11. Martin Brown – Application of Differential Equations.
12. Shepley L. Ross, Differential Equations, 3rd Ed, John Wiley and Sons, 1984.

PRACTICAL COMPONENTS-II

1. Obtaining partial derivatives of some standard functions
2. Solution of Differential equation and plotting the solution-I
3. Solution of Differential equation and plotting the solution-II
4. Solution of Differential equation and plotting the solution-III
5. Solution of Differential equation and plotting the solution-IV
6. Finding complementary function and particular integral of constant coefficient second and higher order ordinary differential equations.
7. Solving second order linear partial differential equations in two variables with constant coefficient.

8. Solutions to the problems on total and simultaneous differential equations.
9. Solutions to the problems on different types of partial differential equations.
10. Solution of Cauchy problem for first order partial differential equation.
11. Plotting the characteristics for the first order partial differential equation.
12. Plot the integral surfaces of a given first order partial differential equation with initial data.

SEMESTER III

Course code: CMC27001/ CMC27002/ CMC27003/ CMC27004

Credits: Theory – 04, Practical – 02

Theories: 60 Lectures

COURSE OUTCOMES:

After successful completion of the course, the student is able to

CO1. Deliberate in details with examples finite and infinite sets

CO2. Identify the details of countable and uncountable sets

CO3. Specify the details of sequence

CO4. Learn the characteristics of infinite series

CO5. Deliberate in details with examples comparison test

CO6. Identify the characteristics of sequence and series of function

CO7. Learn the details of uniform convergence

CO8. Understand in details with examples power series and radius of convergence.

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 \mathbb{R} , Archimedean property of \mathbb{R} , intervals. Concept of cluster points and statement of Bolzano-Weierstrass 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 and integrability and differentiability of functions, Power series and radius of convergence.

Reference Books:

1. S.C Malik –Real Analysis
2. Murray R Spiegel – Laplace Transforms
3. S.C.Malik and Savita Arora, *Mathematical Analysis*, 2nd ed. New Delhi, India: New Age international (P) Ltd., 1992
4. Richard R Goldberg, *Methods of Real Analysis*, Indian ed.
5. Asha Rani Singhal and M .K Singhal, *A first course in Real Analysis*
6. E.Kreyszig- *Advanced Engineering Mathematics*, Wiley India Pvt. Ltd.
7. Raisinghania M. D., *Laplace and Fourier Transforms* S. Chand publications.

Practical components-III

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 $(n+1)^{\text{th}}$ terms.
9. Testing the convergence of binomial, exponential and logarithmic series and finding the sum.
10. To find the sum of the series and its radius of convergence.

SEMESTER IV

CMD27001/ CMD27002/ CMD27003/ CMD27004

(Credits: Theory-04, Practicals-02)

Theory: 60

Lectures

COURSE OUTCOMES:

After successful completion of the course, the student is able to

CO1. Understand in details with examples abelian group

CO2. Identify in details with examples permutation group

CO3. Learn the details of subgroups

CO4. Identify the classification and characteristics of cosets

CO5. Specify the details of commutative ring

CO6. Write down in depth ideals

CO7. Deliberate the characteristics of integral domains and fields

CO8. Write down in details with examples homomorphism

DSC IV: Algebra

Unit I: Definition and examples of groups, examples of abelian and non-abelian groups, the group Z_n 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 quaternion'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.

Unit III: Definition and examples of rings, examples of commutative and non-commutative rings: rings from number systems, Z_n 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: Z_p , Q , R , and C . Field of rational functions. Homeomorphisms', Isomorphism'.

Reference Books :

1. Natarajan, Manicavasagam Pillay and Ganapathy – Algebra
2. I. N. Herstein – Topics in Algebra.
3. Joseph Gallian – Contemporary Abstract Algebra, Narosa Publishing House, New Delhi, Fourth Edition.
4. G. D. Birkhoff and S Maclane – A brief Survey of Modern Algebra.
5. J B Fraleigh – A first course in Abstract Algebra.
6. Michael Artin – Algebra, 2nd ed. New Delhi, India: PHI Learning Pvt. Ltd., 2011.
7. Vashista, A First Course in Modern Algebra, 11th ed.: Krishna Prakasan Mandir, 1980.
8. R Balakrishnan and N.Ramabadran, A Textbook of Modern Algebra, 1st ed. New Delhi, India: Vikas publishing house pvt. Ltd., 1991.
9. T. K. Manicavasagam Pillai and K S Narayanan – Modern Algebra Volume 2

Practical component-IV

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 G.C.D of polynomials.
16. Finding units and associates.
17. Test for rational roots.

SEMESTER V

CME 27001/CME27002/CME27003/CME27004

(Credits: Theory-04, Practicals-02)

Theory: 60

Lectures

COURSE OUTCOMES:

After successful completion of the course, the student is able to

CO1. Understand the details of vector space

CO2. Specify the characteristics of dimension of subspaces

CO3. Write down the characteristics of euclidean vectorspace

CO4. Understand the details of orthogonal projection

CO5. Learn in depth linear transformations

CO6. Understand in details with examples rank and nullity

CO7. Learn in details with examples eigen values and eigen vectors

CO8. Write down the characteristics of isomorphism, automorphism theorems

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.

Unit II: Inner Product, Inner Product of any two vectors in $V(\mathbb{R})$, 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 coordinate matrix.

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. Gopalakrishna – University Algebra
6. Saymour Lipschitz – Theory and Problems of Linear Algebra.
7. S.C Mallik –Real Analysis.
8. B.S Grewal – Higher engineering mathematics.

Practical components –V

Credit :2

Hour: 4 Hour per week

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.



**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, Chemistry**
- **Physics, Mathematics, Computer Science**
- **Physics, Mathematics, Electronics**
- **Physics, Mathematics, Computer Maintenance**

PROGRAMME: BSc PCM, PROGRAMME CODE: BSc-01 (2017-18)

SL No	SEMESTER	Title of the paper	DSC/DSE/SEC	Course code	No. of Credits			Total Credits
					L	T	P	
1	I Semester	Differential Calculus	DSC-I	CMA 27001	4	0	2	6
2	II Semester	Differential Equations	DSC-II	CMB27001	4	0	2	6
3	III Semester	Real Analysis	DSC-III	CMC 27001	4	0	2	6
4	IV Semester	Algebra	DSC-IV	CMD 27001	4	0	2	6
5	V Semester	Linear Algebra	DSE-I	CME 27001	5	0	1	6
6	VI Semester	Complex Analysis	DSE-II	CMF 27001	5	0	1	6
7	V Semester/ VI Semester	Vector calculus	SEC	CMF 27201	2	0	0	0

PROGRAMME: BSc PMCS, PROGRAMME CODE: BSc-02 (2017-18)

SL No	SEMESTER	Title of the paper	DSC/DSE/SEC	Course code	No. of Credits			Total Credits
					L	T	P	
1	I Semester	Differential Calculus	DSC-I	CMA 27002	4	0	2	6
2	II Semester	Differential Equations	DSC-II	CMB27002	4	0	2	6
3	III Semester	Real Analysis	DSC-III	CMC 27002	4	0	2	6
4	IV Semester	Algebra	DSC-IV	CMD 27002	4	0	2	6
5	V Semester	Linear Algebra	DSE-I	CME 27002	5	0	1	6
6	VI Semester	Complex Analysis	DSE-II	CMF 27002	5	0	1	6
7	V Semester/ VI Semester	Vector calculus	SEC	CMF 27202	2	0	0	0

PROGRAMME: BSc PMCM, PROGRAMME CODE: BSc-03 (2017-18)

SL No	SEMESTER	Title of the paper	DSC/DSE/SEC	Course code	No. of Credits			Total Credits
					L	T	P	
1	I Semester	Differential Calculus	DSC-I	CMA 27003	4	0	2	6
2	II Semester	Differential Equations	DSC-II	CMB27003	4	0	2	6
3	III Semester	Real Analysis	DSC-III	CMC 27003	4	0	2	6
4	IV Semester	Algebra	DSC-IV	CMD 27003	4	0	2	6
5	V Semester	Linear Algebra	DSE-I	CME 27003	5	0	1	6
6	VI Semester	Complex Analysis	DSE-II	CMF 27003	5	0	1	6

7	V Semester/ VI Semester	Vector calculus	SEC	CMF 27203	2	0	0	0
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PROGRAMME: BSc PME, PROGRAMME CODE: BSc-04 (2017-18)

SL No	SEMESTER	Title of the paper	DSC/DSE/SEC	Course code	No. of Credits			Total Credits
					L	T	P	
1	I Semester	Differential Calculus	DSC-I	CMA 27004	4	0	2	6
2	II Semester	Differential Equations	DSC-II	CMB27004	4	0	2	6
3	III Semester	Real Analysis	DSC-III	CMC 27004	4	0	2	6
4	IV Semester	Algebra	DSC-IV	CMD 27004	4	0	2	6
5	V Semester	Linear Algebra	DSE-I	CME 27004	5	0	1	6
6	VI Semester	Complex Analysis	DSE-II	CMF 27004	5	0	1	6
7	V Semester/ VI Semester	Vector calculus	SEC	CMF 27204	2	0	0	0

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
4:0:1	70	-	30	70	-	30	3h	-
2:0:0	70	-	30	50	-	30	2h	-

Note: L-Lecture, T-Tutorial, P-Practical; Th- Theory, Pr-Practical,

I A- Internal Assessment

SEMESTER -I

Course code: CMA27001/ CMA27002/ CMA27003/ CMA27004

Credits: Theory – 04, Practical – 02

Theories: 60 Lectures

COURSE OUTCOME:

After successful completion of the course, the student is able to

- CO1. Learn in details with examples curvature
- CO2. Learn in depth applications of Taylor's theorem
- CO3. Understand the details of mean value theorems
- CO4. Learn the details of linear approximation theorem
- CO5. Understand in details with examples partial derivatives
- CO6. Specify in details with examples asymptotes
- CO7. Identify the classification and characteristics of envelopes
- CO8. Deliberate the details of maxima and minima
- CO9. Understand in details with examples indeterminate forms

DSC I: Differential Calculus

Unit I : Limit and Continuity (ϵ and δ definition), Types of discontinuities, Differentiability of functions, Successive differentiation, Leibnitz's theorem, Partial differentiation, Euler's theorem on homogeneous functions.

Unit II: Linear Approximation theorem, Tangents and normals, Monotone functions, Maxima and Minima, Curvature, Radius of curvature, Centre of curvature, Evolutes

Unit III : Rolle's theorem, Mean Value theorems, Taylor's theorem with Lagrange's and Cauchy's forms of remainder, Taylor's series, Maclaurin's series of $\sin x$, $\cos x$, e^x , $\log(1+x)$, $(1+x)^m$, Maxima and Minima, Indeterminate forms.

Unit IV: Asymptotes, Envelopes, Singular points – Multiple points – Cusp, Node and conjugate points, Orthogonal Trajectories, Tracing of curves,

Reference Books:

1. Frank Ayres and Elliott Mendelson, Schaum's Outline of Calculus, 5th ed. USA: Mc. Graw Hill., 2008.
2. G B Thomas and R L Finney, Calculus and analytical geometry, Addison Wesley, 1995.
3. H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc., 2002
4. J Edwards, An elementary treatise on the differential calculus: with Applications and numerous example, Reprint. Charleston, USA BiblioBazaar, 2010.

5. Lipman Bers – Calculus, Volumes 1 and 2
6. N. Piskunov – Differential and Integral Calculus
7. N P Bali, Differential Calculus, India: Laxmi Publications (P) Ltd., 2010.
8. Serge Lang – First Course in Calculus
9. S Narayanan & T. K. Manicavachogam Pillay, Calculus.:S. Viswanathan Pvt. Ltd., vol. I & II 1996.
10. Shanthi Narayan and P K Mittal, Differential Calculus, Reprint. New Delhi: S Chand and Co. Pvt. Ltd., 2014.

PRACTICAL COMPONENT-1

1. Introduction to Scilab.
2. Operators; trigonometric, inverse trigonometric functions in scilab.
3. Plotting of standard Cartesian curves using Scilab.
4. Plotting of standard polar curves using Scilab.
5. Plotting of standard parametric curves using Scilab.
6. Introduction to Maxima.
7. Creating variables, functions.
8. Creating a Maxima program (simple examples, loops, control sequence).
9. Differentiation and integration using maxima inbuilt functions.
10. Plotting of standard curves- Cartesian, Polar using Maxima.
11. Plotting of standard parametric curves using Maxima.
12. Geometrical meaning of Rolle's theorem of the functions on the given interval.
13. To verify Rolle's theorem , Lagrange's theorem and cauchy's mean value theorem
14. Finding Taylor's theorem for a given function.
15. To illustrate left hand and right hand limits for discontinuous functions.
16. To illustrate continuity of a function.
17. To illustrate differentiability of a function.

SEMESTER-II

Course code: CMB27001/ CMB27002/ CMB27003/ CMB27004

Credits: Theory – 04, Practical – 02

Theories: 60 Lectures

COURSE OUTCOME:

After successful completion of the course, the student is able to

C01. Understand in depth variable separable

C0 2. Specify the characteristics of homogeneous equations

C03. Identify the details of exact equation

C04. Learn in depth simultaneous differential equations

C05. Write down in depth total differential equation

C06. Identify in depth linear non homogeneous equations

C07. Write down in depth linear partial differential equation

C08. Deliberate the characteristics of lagrange's method

DSC II: Differential Equations

Unit I: Linear differential equations of First order, Separation of variables, Equations with homogeneous coefficients, Exact differential equations, Linear differential equations of the form $\frac{dy}{dx} + Py = Q$, Integrating factors, rules to find an integrating factor, Bernoulli's Equations, Equations with coefficients linear in x and y.

Unit II: First order higher degree equations solvable for x, y, p, Clairaut's form. Methods for solving higher-order differential equations. Basic theory of linear differential equations, Wronskian, and its properties. Solving a differential equation by reducing its order, Simultaneous differential equations and Total differential equations.

Unit III: Linear homogenous equations with constant coefficients, Linear non-homogenous equations, The method of variation of parameters, Exact equations, Inverse Differential operators, The Cauchy-Euler equation.

Unit IV: Order and degree of partial differential equations, Concept of linear and non-linear partial differential equations, Formation of first order partial differential equations, Linear partial differential equation of first order, Lagrange's method, Charpit's method.

Reference Books:

1. Daniel A Murray – Introductory Course to Differential equations
Earl David Rainville and Philip Edward Bedient – A short course in Differential equations, Prentice Hall College Div; 6th edition.
2. M D Raisinghania, Advanced Differential Equations, S Chand and Co. Pvt. Ltd., 2013.
F. Ayres, Schaum's outline of theory and problems of Differential Equations, 1st ed. USA McGraw-Hill, 2010
3. S Narayanan and T K Manicavachogam Pillay, Differential Equations .: S V Publishers Private Ltd., 1981.
4. G F Simmons, Differential equation with Applications and historical notes, 2nd ed.: McGraw-Hill Publishing Company, Oct 1991.
5. G. Stephenson – An introduction to Partial Differential Equations.
6. B. S. Grewal – Higher Engineering Mathematics
E. Kreyszig – Advanced Engineering Mathematics
7. E. D. Rainville and P E Bedient – A Short Course in Differential Equations
8. D. A Murray – Introductory Course in Differential Equations.
9. G. P. Simmons – Differential Equations
10. F. Ayres – Differential Equations (Schaum Series)
11. Martin Brown – Application of Differential Equations.
12. Shepley L. Ross, Differential Equations, 3rd Ed, John Wiley and Sons, 1984.

PRACTICAL COMPONENTS-II

1. Obtaining partial derivatives of some standard functions
2. Solution of Differential equation and plotting the solution-I
3. Solution of Differential equation and plotting the solution-II
4. Solution of Differential equation and plotting the solution-III
5. Solution of Differential equation and plotting the solution-IV
6. Finding complementary function and particular integral of constant coefficient second and higher order ordinary differential equations.
7. Solving second order linear partial differential equations in two variables with constant coefficient.

8. Solutions to the problems on total and simultaneous differential equations.
9. Solutions to the problems on different types of partial differential equations.
10. Solution of Cauchy problem for first order partial differential equation.
11. Plotting the characteristics for the first order partial differential equation.
12. Plot the integral surfaces of a given first order partial differential equation with initial data.

SEMESTER III

Course code: CMC27001/ CMC27002/ CMC27003/ CMC27004

Credits: Theory – 04, Practical – 02

Theories: 60 Lectures

COURSE OUTCOMES:

After successful completion of the course, the student is able to

CO1. Deliberate in details with examples finite and infinite sets

CO2. Identify the details of countable and uncountable sets

CO3. Specify the details of sequence

CO4. Learn the characteristics of infinite series

CO5. Deliberate in details with examples comparison test

CO6. Identify the characteristics of sequence and series of function

CO7. Learn the details of uniform convergence

CO8. Understand in details with examples power series and radius of convergence.

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 \mathbb{R} , Archimedean property of \mathbb{R} , intervals. Concept of cluster points and statement of Bolzano-Weierstrass 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 and integrability and differentiability of functions, Power series and radius of convergence.

Reference Books:

1. S.C Malik –Real Analysis
2. Murray R Spiegel – Laplace Transforms
3. S.C.Malik and Savita Arora, *Mathematical Analysis*, 2nd ed. New Delhi, India: New Age international (P) Ltd., 1992
4. Richard R Goldberg, *Methods of Real Analysis*, Indian ed.
5. Asha Rani Singhal and M .K Singhal, *A first course in Real Analysis*
6. E.Kreyszig- *Advanced Engineering Mathematics*, Wiley India Pvt. Ltd.
7. Raisinghania M. D., *Laplace and Fourier Transforms* S. Chand publications.

Practical components-III

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 $(n+1)^{\text{th}}$ terms.
9. Testing the convergence of binomial, exponential and logarithmic series and finding the sum.
10. To find the sum of the series and its radius of convergence.

SEMESTER IV

CMD27001/ CMD27002/ CMD27003/ CMD27004

(Credits: Theory-04, Practicals-02)

Theory: 60

Lectures

COURSE OUTCOMES:

After successful completion of the course, the student is able to

CO1. Understand in details with examples abelian group

CO2. Identify in details with examples permutation group

CO3. Learn the details of subgroups

CO4. Identify the classification and characteristics of cosets

CO5. Specify the details of commutative ring

CO6. Write down in depth ideals

CO7. Deliberate the characteristics of integral domains and fields

CO8. Write down in details with examples homomorphism

DSC IV: Algebra

Unit I: Definition and examples of groups, examples of abelian and non-abelian groups, the group Z_n 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 quaternion'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.

Unit III: Definition and examples of rings, examples of commutative and non-commutative rings: rings from number systems, Z_n 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: Z_p , Q , R , and C . Field of rational functions. Homeomorphisms', Isomorphism'.

Reference Books :

1. Natarajan, Manicavasagam Pillay and Ganapathy – Algebra
2. I. N. Herstein – Topics in Algebra.
3. Joseph Gallian – Contemporary Abstract Algebra, Narosa Publishing House, New Delhi, Fourth Edition.
4. G. D. Birkhoff and S Maclane – A brief Survey of Modern Algebra.
5. J B Fraleigh – A first course in Abstract Algebra.
6. Michael Artin – Algebra, 2nd ed. New Delhi, India: PHI Learning Pvt. Ltd., 2011.
7. Vashista, A First Course in Modern Algebra, 11th ed.: Krishna Prakasan Mandir, 1980.
8. R Balakrishnan and N.Ramabadran, A Textbook of Modern Algebra, 1st ed. New Delhi, India: Vikas publishing house pvt. Ltd., 1991.
9. T. K. Manicavasagam Pillai and K S Narayanan – Modern Algebra Volume 2

Practical component-IV

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 G.C.D of polynomials.
16. Finding units and associates.
17. Test for rational roots.

SEMESTER V

CME 27001/CME27002/CME27003/CME27004

(Credits: Theory-04, Practicals-02)

Theory: 60

Lectures

COURSE OUTCOMES:

After successful completion of the course, the student is able to

CO1. Understand the details of vector space

CO2. Specify the characteristics of dimension of subspaces

CO3. Write down the characteristics of euclidean vectorspace

CO4. Understand the details of orthogonal projection

CO5. Learn in depth linear transformations

CO6. Understand in details with examples rank and nullity

CO7. Learn in details with examples eigen values and eigen vectors

CO8. Write down the characteristics of isomorphism, automorphism theorems

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.

Unit II: Inner Product, Inner Product of any two vectors in $V(\mathbb{R})$, 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 coordinate matrix.

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. Gopalakrishna – University Algebra
6. Saymour Lipschitz – Theory and Problems of Linear Algebra.
7. S.C Mallik –Real Analysis.
8. B.S Grewal – Higher engineering mathematics.

Practical components –V

Credit :2

Hour: 4 Hour per week

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.



**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, Chemistry**
- **Physics, Mathematics, Computer Science**
- **Physics, Mathematics, Electronics**
- **Physics, Mathematics, Computer Maintenance**

PROGRAMME: BSc PCM, PROGRAMME CODE: BSc-01 (2017-18)

SL No	SEMESTER	Title of the paper	DSC/DSE/SEC	Course code	No. of Credits			Total Credits
					L	T	P	
1	I Semester	Differential Calculus	DSC-I	CMA 27001	4	0	2	6
2	II Semester	Differential Equations	DSC-II	CMB27001	4	0	2	6
3	III Semester	Real Analysis	DSC-III	CMC 27001	4	0	2	6
4	IV Semester	Algebra	DSC-IV	CMD 27001	4	0	2	6
5	V Semester	Linear Algebra	DSE-I	CME 27001	5	0	1	6
6	VI Semester	Complex Analysis	DSE-II	CMF 27001	5	0	1	6
7	V Semester/ VI Semester	Vector calculus	SEC	CMF 27201	2	0	0	0

PROGRAMME: BSc PMCS, PROGRAMME CODE: BSc-02 (2017-18)

SL No	SEMESTER	Title of the paper	DSC/DSE/SEC	Course code	No. of Credits			Total Credits
					L	T	P	
1	I Semester	Differential Calculus	DSC-I	CMA 27002	4	0	2	6
2	II Semester	Differential Equations	DSC-II	CMB27002	4	0	2	6
3	III Semester	Real Analysis	DSC-III	CMC 27002	4	0	2	6
4	IV Semester	Algebra	DSC-IV	CMD 27002	4	0	2	6
5	V Semester	Linear Algebra	DSE-I	CME 27002	5	0	1	6
6	VI Semester	Complex Analysis	DSE-II	CMF 27002	5	0	1	6
7	V Semester/ VI Semester	Vector calculus	SEC	CMF 27202	2	0	0	0

PROGRAMME: BSc PMCM, PROGRAMME CODE: BSc-03 (2017-18)

SL No	SEMESTER	Title of the paper	DSC/DSE/SEC	Course code	No. of Credits			Total Credits
					L	T	P	
1	I Semester	Differential Calculus	DSC-I	CMA 27003	4	0	2	6
2	II Semester	Differential Equations	DSC-II	CMB27003	4	0	2	6
3	III Semester	Real Analysis	DSC-III	CMC 27003	4	0	2	6
4	IV Semester	Algebra	DSC-IV	CMD 27003	4	0	2	6
5	V Semester	Linear Algebra	DSE-I	CME 27003	5	0	1	6
6	VI Semester	Complex Analysis	DSE-II	CMF 27003	5	0	1	6

7	V Semester/ VI Semester	Vector calculus	SEC	CMF 27203	2	0	0	0
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PROGRAMME: BSc PME, PROGRAMME CODE: BSc-04 (2017-18)

SL No	SEMESTER	Title of the paper	DSC/DSE/SEC	Course code	No. of Credits			Total Credits
					L	T	P	
1	I Semester	Differential Calculus	DSC-I	CMA 27004	4	0	2	6
2	II Semester	Differential Equations	DSC-II	CMB27004	4	0	2	6
3	III Semester	Real Analysis	DSC-III	CMC 27004	4	0	2	6
4	IV Semester	Algebra	DSC-IV	CMD 27004	4	0	2	6
5	V Semester	Linear Algebra	DSE-I	CME 27004	5	0	1	6
6	VI Semester	Complex Analysis	DSE-II	CMF 27004	5	0	1	6
7	V Semester/ VI Semester	Vector calculus	SEC	CMF 27204	2	0	0	0

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
4:0:1	70	-	30	70	-	30	3h	-
2:0:0	70	-	30	50	-	30	2h	-

Note: L-Lecture, T-Tutorial, P-Practical; Th- Theory, Pr-Practical,

I A- Internal Assessment

SEMESTER -I

Course code: CMA27001/ CMA27002/ CMA27003/ CMA27004

Credits: Theory – 04, Practical – 02

Theories: 60 Lectures

COURSE OUTCOME:

After successful completion of the course, the student is able to

- CO1. Learn in details with examples curvature
- CO2. Learn in depth applications of Taylor's theorem
- CO3. Understand the details of mean value theorems
- CO4. Learn the details of linear approximation theorem
- CO5. Understand in details with examples partial derivatives
- CO6. Specify in details with examples asymptotes
- CO7. Identify the classification and characteristics of envelopes
- CO8. Deliberate the details of maxima and minima
- CO9. Understand in details with examples indeterminate forms

DSC I: Differential Calculus

Unit I : Limit and Continuity (ϵ and δ definition), Types of discontinuities, Differentiability of functions, Successive differentiation, Leibnitz's theorem, Partial differentiation, Euler's theorem on homogeneous functions.

Unit II: Linear Approximation theorem, Tangents and normals, Monotone functions, Maxima and Minima, Curvature, Radius of curvature, Centre of curvature, Evolutes

Unit III : Rolle's theorem, Mean Value theorems, Taylor's theorem with Lagrange's and Cauchy's forms of remainder, Taylor's series, Maclaurin's series of $\sin x$, $\cos x$, e^x , $\log(1+x)$, $(1+x)^m$, Maxima and Minima, Indeterminate forms.

Unit IV: Asymptotes, Envelopes, Singular points – Multiple points – Cusp, Node and conjugate points, Orthogonal Trajectories, Tracing of curves,

Reference Books:

1. Frank Ayres and Elliott Mendelson, Schaum's Outline of Calculus, 5th ed. USA: Mc. Graw Hill., 2008.
2. G B Thomas and R L Finney, Calculus and analytical geometry, Addison Wesley, 1995.
3. H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc., 2002
4. J Edwards, An elementary treatise on the differential calculus: with Applications and numerous example, Reprint. Charleston, USA BiblioBazaar, 2010.

5. Lipman Bers – Calculus, Volumes 1 and 2
6. N. Piskunov – Differential and Integral Calculus
7. N P Bali, Differential Calculus, India: Laxmi Publications (P) Ltd., 2010.
8. Serge Lang – First Course in Calculus
9. S Narayanan & T. K. Manicavachogam Pillay, Calculus.:S. Viswanathan Pvt. Ltd., vol. I & II 1996.
10. Shanthi Narayan and P K Mittal, Differential Calculus, Reprint. New Delhi: S Chand and Co. Pvt. Ltd., 2014.

PRACTICAL COMPONENT-1

1. Introduction to Scilab.
2. Operators; trigonometric, inverse trigonometric functions in scilab.
3. Plotting of standard Cartesian curves using Scilab.
4. Plotting of standard polar curves using Scilab.
5. Plotting of standard parametric curves using Scilab.
6. Introduction to Maxima.
7. Creating variables, functions.
8. Creating a Maxima program (simple examples, loops, control sequence).
9. Differentiation and integration using maxima inbuilt functions.
10. Plotting of standard curves- Cartesian, Polar using Maxima.
11. Plotting of standard parametric curves using Maxima.
12. Geometrical meaning of Rolle's theorem of the functions on the given interval.
13. To verify Rolle's theorem , Lagrange's theorem and cauchy's mean value theorem
14. Finding Taylor's theorem for a given function.
15. To illustrate left hand and right hand limits for discontinuous functions.
16. To illustrate continuity of a function.
17. To illustrate differentiability of a function.

SEMESTER-II

Course code: CMB27001/ CMB27002/ CMB27003/ CMB27004

Credits: Theory – 04, Practical – 02

Theories: 60 Lectures

COURSE OUTCOME:

After successful completion of the course, the student is able to

C01. Understand in depth variable separable

C0 2. Specify the characteristics of homogeneous equations

C03. Identify the details of exact equation

C04. Learn in depth simultaneous differential equations

C05. Write down in depth total differential equation

C06. Identify in depth linear non homogeneous equations

C07. Write down in depth linear partial differential equation

C08. Deliberate the characteristics of lagrange's method

DSC II: Differential Equations

Unit I: Linear differential equations of First order, Separation of variables, Equations with homogeneous coefficients, Exact differential equations, Linear differential equations of the form $\frac{dy}{dx} + Py = Q$, Integrating factors, rules to find an integrating factor, Bernoulli's Equations, Equations with coefficients linear in x and y.

Unit II: First order higher degree equations solvable for x, y, p, Clairaut's form. Methods for solving higher-order differential equations. Basic theory of linear differential equations, Wronskian, and its properties. Solving a differential equation by reducing its order, Simultaneous differential equations and Total differential equations.

Unit III: Linear homogenous equations with constant coefficients, Linear non-homogenous equations, The method of variation of parameters, Exact equations, Inverse Differential operators, The Cauchy-Euler equation.

Unit IV: Order and degree of partial differential equations, Concept of linear and non-linear partial differential equations, Formation of first order partial differential equations, Linear partial differential equation of first order, Lagrange's method, Charpit's method.

Reference Books:

1. Daniel A Murray – Introductory Course to Differential equations
Earl David Rainville and Philip Edward Bedient – A short course in Differential equations, Prentice Hall College Div; 6th edition.
2. M D Raisinghania, Advanced Differential Equations, S Chand and Co. Pvt. Ltd., 2013.
F. Ayres, Schaum's outline of theory and problems of Differential Equations, 1st ed. USA McGraw-Hill, 2010
3. S Narayanan and T K Manicavachogam Pillay, Differential Equations .: S V Publishers Private Ltd., 1981.
4. G F Simmons, Differential equation with Applications and historical notes, 2nd ed.: McGraw-Hill Publishing Company, Oct 1991.
5. G. Stephenson – An introduction to Partial Differential Equations.
6. B. S. Grewal – Higher Engineering Mathematics
E. Kreyszig – Advanced Engineering Mathematics
7. E. D. Rainville and P E Bedient – A Short Course in Differential Equations
8. D. A Murray – Introductory Course in Differential Equations.
9. G. P. Simmons – Differential Equations
10. F. Ayres – Differential Equations (Schaum Series)
11. Martin Brown – Application of Differential Equations.
12. Shepley L. Ross, Differential Equations, 3rd Ed, John Wiley and Sons, 1984.

PRACTICAL COMPONENTS-II

1. Obtaining partial derivatives of some standard functions
2. Solution of Differential equation and plotting the solution-I
3. Solution of Differential equation and plotting the solution-II
4. Solution of Differential equation and plotting the solution-III
5. Solution of Differential equation and plotting the solution-IV
6. Finding complementary function and particular integral of constant coefficient second and higher order ordinary differential equations.
7. Solving second order linear partial differential equations in two variables with constant coefficient.

8. Solutions to the problems on total and simultaneous differential equations.
9. Solutions to the problems on different types of partial differential equations.
10. Solution of Cauchy problem for first order partial differential equation.
11. Plotting the characteristics for the first order partial differential equation.
12. Plot the integral surfaces of a given first order partial differential equation with initial data.

SEMESTER III

Course code: CMC27001/ CMC27002/ CMC27003/ CMC27004

Credits: Theory – 04, Practical – 02

Theories: 60 Lectures

COURSE OUTCOMES:

After successful completion of the course, the student is able to

CO1. Deliberate in details with examples finite and infinite sets

CO2. Identify the details of countable and uncountable sets

CO3. Specify the details of sequence

CO4. Learn the characteristics of infinite series

CO5. Deliberate in details with examples comparison test

CO6. Identify the characteristics of sequence and series of function

CO7. Learn the details of uniform convergence

CO8. Understand in details with examples power series and radius of convergence.

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 \mathbb{R} , Archimedean property of \mathbb{R} , intervals. Concept of cluster points and statement of Bolzano-Weierstrass 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 and integrability and differentiability of functions, Power series and radius of convergence.

Reference Books:

1. S.C Malik –Real Analysis
2. Murray R Spiegel – Laplace Transforms
3. S.C.Malik and Savita Arora, *Mathematical Analysis*, 2nd ed. New Delhi, India: New Age international (P) Ltd., 1992
4. Richard R Goldberg, *Methods of Real Analysis*, Indian ed.
5. Asha Rani Singhal and M .K Singhal, *A first course in Real Analysis*
6. E.Kreyszig- *Advanced Engineering Mathematics*, Wiley India Pvt. Ltd.
7. Raisinghania M. D., *Laplace and Fourier Transforms* S. Chand publications.

Practical components-III

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 $(n+1)^{\text{th}}$ terms.
9. Testing the convergence of binomial, exponential and logarithmic series and finding the sum.
10. To find the sum of the series and its radius of convergence.

SEMESTER IV

CMD27001/ CMD27002/ CMD27003/ CMD27004

(Credits: Theory-04, Practicals-02)

Theory: 60

Lectures

COURSE OUTCOMES:

After successful completion of the course, the student is able to

CO1. Understand in details with examples abelian group

CO2. Identify in details with examples permutation group

CO3. Learn the details of subgroups

CO4. Identify the classification and characteristics of cosets

CO5. Specify the details of commutative ring

CO6. Write down in depth ideals

CO7. Deliberate the characteristics of integral domains and fields

CO8. Write down in details with examples homomorphism

DSC IV: Algebra

Unit I: Definition and examples of groups, examples of abelian and non-abelian groups, the group Z_n 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 quaternion'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.

Unit III: Definition and examples of rings, examples of commutative and non-commutative rings: rings from number systems, Z_n 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: Z_p , Q , R , and C . Field of rational functions. Homeomorphisms', Isomorphism'.

Reference Books :

1. Natarajan, Manicavasagam Pillay and Ganapathy – Algebra
2. I. N. Herstein – Topics in Algebra.
3. Joseph Gallian – Contemporary Abstract Algebra, Narosa Publishing House, New Delhi, Fourth Edition.
4. G. D. Birkhoff and S Maclane – A brief Survey of Modern Algebra.
5. J B Fraleigh – A first course in Abstract Algebra.
6. Michael Artin – Algebra, 2nd ed. New Delhi, India: PHI Learning Pvt. Ltd., 2011.
7. Vashista, A First Course in Modern Algebra, 11th ed.: Krishna Prakasan Mandir, 1980.
8. R Balakrishnan and N.Ramabadran, A Textbook of Modern Algebra, 1st ed. New Delhi, India: Vikas publishing house pvt. Ltd., 1991.
9. T. K. Manicavasagam Pillai and K S Narayanan – Modern Algebra Volume 2

Practical component-IV

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 G.C.D of polynomials.
16. Finding units and associates.
17. Test for rational roots.

SEMESTER V

CME 27001/CME27002/CME27003/CME27004

(Credits: Theory-04, Practicals-02)

Theory: 60

Lectures

COURSE OUTCOMES:

After successful completion of the course, the student is able to

CO1. Understand the details of vector space

CO2. Specify the characteristics of dimension of subspaces

CO3. Write down the characteristics of euclidean vectorspace

CO4. Understand the details of orthogonal projection

CO5. Learn in depth linear transformations

CO6. Understand in details with examples rank and nullity

CO7. Learn in details with examples eigen values and eigen vectors

CO8. Write down the characteristics of isomorphism, automorphism theorems

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.

Unit II: Inner Product, Inner Product of any two vectors in $V(\mathbb{R})$, 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 coordinate matrix.

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. Gopalakrishna – University Algebra
6. Saymour Lipschitz – Theory and Problems of Linear Algebra.
7. S.C Mallik –Real Analysis.
8. B.S Grewal – Higher engineering mathematics.

Practical components –V

Credit :2

Hour: 4 Hour per week

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.

JSS MAHAVIDYAPEETA

**J. S. S COLLEGE OF ARTS, COMMERCE AND SCIENCE
(AUTONOMOUS)**

OOTY ROAD, MYSORE –570 025

(Autonomous under University of Mysore *Re-accredited by NAAC with ‘A’Grade)



B. Sc., DEGREE SYLLABUS (SEMESTER SCHEME)

MICROBIOLOGY

(2018-19)

BMF58006

VI SEMESTER

COURSE OUTCOME:

After successful completion of the course students are able to:

- CO1.** Specify the details of Industrial Microbiology
- CO2.** Learn in depth Industrial production
- CO3.** Understand in depth Food Microbiology
- CO4.** Specify the details of Dairy Microbiology

UNIT-I

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.
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)
- D.** Food borne intoxication and infection:
Bacterial intoxication- Staphylococcal intoxication, Botulism,
Bacterial infection- Salmonellosis.
Mycotoxin – Origin, types and importance of toxins with reference to Aflatoxins.
- F.** Food safety and quality control. –A brief account on FPO, HACCP, Food laws and Food standards(in brief)

UNIT-II

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, preparation of cheese.
Preservation of milk and milk products – Pasteurization, Sterilization. Microbiological standard for milk and milk products.

UNIT-III

INDUSTRIAL MICROBIOLOGY

- A.** Introduction, Definition and scope.

B. Microorganisms of industrial importance. Biology of industrial microorganisms:

Isolation, Screening, Improvement and Preservation.

C. A brief account of production medium, inoculum medium, raw materials-Molasses, corn steep liquor, sulphite waste liquor and whey. Buffers, Precursors, Inhibitors and Antifoam agents.

D. Fermenters and fermentation process: Design, types and basic function of fermenters, sterilization, devices for aeration and agitation. Fermentation process – Surface,

Submerged and Solid state fermentation. Types- Batch and Continuous fermentation.

Down stream processing: Steps in recovery and purification of fermented products –

Precipitation, Filtration, Centrifugation, Distillation, Cell disruption, Solvent recovery, chromatography, Drying and crystallization.

E. Bioengineering of Microorganisms for industrial purposes.

UNIT-IV

INDUSTRIAL PRODUCTION

A. a. Organic acids – Citric acid.

b. Antibiotics – Penicillin.

c. Enzymes –Pectinase.

d. Alcohol – Ethanol.

e. Amino acid –Glutamic 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*.

PRACTICALS:

UNIT-I: FOOD MICROBIOLOGY

1. a. Isolation and enumeration of bacteria from utensils

b. Isolation and identification of fungi from food utensils

2. a. Isolation and enumeration of bacteria from spoiled vegetables

b. Isolation and identification fungi from spoiled vegetables.

3. a. Isolation and enumeration of bacteria from spoiled fruits.

b. Isolation and identification of fungi from spoiled fruits.

4. a. Isolation and identification of aspergillus on groundnut by blotters test.

b. Microscopic examination of idli batter.

UNIT-II: DAIRY MICROBIOLOGY

5. a. Estimation of lactose in milk.

b. Estimation of lactic acid in milk.

6. a. Turbidity test to detect boiled and unboiled milk.

7. Methylene blue reductase test and Resazurin test to determine the quality of milk.

UNIT-III & UNIT -IV (INDUSTRIAL MICROBIOLOGY+ INDUSTRIAL PRODUCTION)

8. Preparation of wine from grapes.

9. Preparation of alcohol using jaggery or molasses.

10. Estimation of percentage alcohol in a given sample by specific gravity bottle method.

11. Production of citric acid using *Aspergillus niger*.

12. Visit to food industries or food research laboratories, dairy industries and distilleries. 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. Anathanarayanan C and Paniker, C.K.J. Text Book of Microbiology, 9th ed. Orinet Longman Ltd., Chennai.
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15. R.P. Singh, Immunology and Medical Microbiology
16. Rajan. S. Medical Microbiology. MJP Publishers, Chennai.

VI SEMESTER

IMMUNOLOGY & MEDICAL MICROBIOLOGY

UNIT-II
IMMUNOLOGY

- 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. Immunoprophylaxis – Vaccine – Types – killed, Live and Attenuated (Bacterial and Viral) and Toxoid with an example each.
National Immunization program (Tabular form). 12hrs

UNIT-III AND UNIT- IV
MEDICAL MICROBIOLOGY

- A. Introduction – History and development of medical microbiology. Normal flora of human body.
- B. Infection and disease transmission – Signs, symptoms, syndrome. Types of infection, mode of transmission.
- C. Host pathogen interaction – Pathogenicity, microbial virulence, microbial toxins, opportunists and true pathogens.
- D. Antimicrobial chemotherapy – General characteristics and types of antibiotics. Mode of action of -Penicillin, Aminoglycosides, Erythromycin, Chloramphenicol, Antifungal drugs-Griseofulvin, Nystatin Antiviral drugs-Acyclovir, Multiple Drug Resistance (in brief).

12hrs

PRACTICALS

UNIT-I AND UNIT II : IMMUNOLOGY

1. Determination of blood group and Rh factor.

2. Enumerate RBC in given blood sample

3. Enumerate WBC in given blood sample

UNIT-II

4. Demonstration of precipitation reaction-Double diffusion in two dimensions (Ouchterlony procedure).

5. Antibiotic sensitivity test.

UNIT-III AND UNIT II: MEDICAL MICROBIOLOGY

6. Estimation of urine bacteria by calibrated loop- direct streak method.

7. Microbial flora of oral cavity (tooth and mouth)

8. Isolation of dermatophytes from human skin.

UNIT-IV

9. Detection of typhoid by Widal test

10. Rapid plasma reagin (RPR) card test for syphilis

11-12. Material/ microscopic observation/ display of photographs of human pathogens: *Mycobacterium tuberculosis*, *Vibrio cholerae*, *Trypanosoma pallidum*, *Salmonella typhi*, Hepatitis virus, polio virus, HIV, *Plasmodium*)

Note: Visit to pharmaceuticals and pathological laboratories. Each student shall submit an independent report on the visit along with the practical record for the internal assessment

REFERENCES:

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20. Tizard, I.R. 1998 . Immunology An Introduction, 2nd ed. W.B. Saunders, Philadelphia.
21. Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education

CMF28206

**VI SEMESTER
MEDICAL MICROBIOLOGY AND IMMUNOLOGY**

COURSE OUTCOME:

After successful completion of the course students are able to:

- CO1.** Understand in depth Medical Microbiology
- CO2.** Specify in details with examples Human diseases
- CO3.** Learn the details of Immunology
- CO4.** Specify the classification and characteristics of Antigens and antibodies

UNIT :I

No of Hours: 15

MEDICAL MICROBIOLOGY

A. Introduction – History and development of medical microbiology. Normal microflora of the human body: Importance of normal microflora, 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 – Infection, Invasion, Pathogen, 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, Chloramphenicol, Antifungal drugs-Griseofulvin, Nystatin Antiviral drugs-Acyclovir, Amantadine and Azidothymidine .Multiple Drug Resistance (in brief).

UNIT-IV

No. of Hours:15

IMMUNOLOGY: ANTIGENS AND ANTIBODIES

A. Antigens – Characteristics of an antigen (Foreignness, Molecular size and Heterogeneity); Haptens; Epitopes (T & B cell epitopes), Adjuvants.

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.

Hypersensitivity (Type I to V - in brief).

Immunoprophylaxis – Vaccine – Types – killed, Live and Attenuated (Bacterial and Viral) and Toxoid with an example each.

National Immunization program (Tabular form).

PRACTICALS

1. Determination of blood group and Rh factor.
2. Enumerate RBC in given blood sample
3. Enumerate WBC in given blood sample
4. Demonstration of precipitation reaction-Double diffusion in two dimensions (Ouchterlony procedure).
5. Antibiotic sensitivity test.
6. Estimation of urine bacteria by calibrated loop- direct streak method.
7. Determination of susceptibility to dental carrier-Snydal test
8. Identification of dermatophytes from human skin.
9. Detection of typhoid by Widal test
10. Rapid plasma reagin (RPR) card test for syphilis
11. Identify bacteria on the basis of cultural, morphological and biochemical characteristics: IMViC, TSI, nitrate reduction, urease production and catalase tests
- 12-15. Material/ microscopic observation/ display of photographs of human pathogens as per theory syllabus: Influenza virus, *Corynebacterium diphtheriae*, *Blastomyces dermatitidis*, Human papilloma virus, *Trypanosoma pallidum*, *Sporothrix schenckii*, *Plasmodium*, Dengue viruses (DENV), *Salmonella typhi* and *Entamoeba histolytica*

NOTE: Visit to pharmaceuticals and pathological laboratories. Each student shall submit an independent report on the visit along with the practical record for the internal assessment.

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V SEMESTER
Microbial Diagnosis in Health Clinics

COURSE OUTCOME:

After successful completion of the course students are able to:

- CO1.** Learn the details of Diagnosis of diseases
- CO2.** Learn in details with examples Collection of clinical samples
- CO3.** Understand in depth Microscopic examination of microbes
- CO4.** Specify the details of Testing for antibiotic sensitivity in bacteria

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, throat, skin, Blood, CSF, urine and faeces) and precautions required. Method of transport of clinical samples to laboratory and storage.

UNIT :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 and 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 Microbiology, Prentice Hall Inc, London.
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JSS MAHAVIDYAPEETA

**J. S. S COLLEGE OF ARTS, COMMERCE AND SCIENCE
(AUTONOMOUS)**

OOTY ROAD, MYSORE –570 025

(Autonomous under University of Mysore *Re-accredited by NAAC with ‘A’Grade)



B. Sc., DEGREE SYLLABUS (SEMESTER SCHEME)

MICROBIOLOGY

(2018-19)

BMF58006

VI SEMESTER

COURSE OUTCOME:

After successful completion of the course students are able to:

- CO1.** Specify the details of Industrial Microbiology
- CO2.** Learn in depth Industrial production
- CO3.** Understand in depth Food Microbiology
- CO4.** Specify the details of Dairy Microbiology

UNIT-I

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.
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)
- D.** Food borne intoxication and infection:
Bacterial intoxication- Staphylococcal intoxication, Botulism,
Bacterial infection- Salmonellosis.
Mycotoxin – Origin, types and importance of toxins with reference to Aflatoxins.
- F.** Food safety and quality control. –A brief account on FPO, HACCP, Food laws and Food standards(in brief)

UNIT-II

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, preparation of cheese.
Preservation of milk and milk products – Pasteurization, Sterilization. Microbiological standard for milk and milk products.

UNIT-III

INDUSTRIAL MICROBIOLOGY

- A.** Introduction, Definition and scope.

B. Microorganisms of industrial importance. Biology of industrial microorganisms:

Isolation, Screening, Improvement and Preservation.

C. A brief account of production medium, inoculum medium, raw materials-Molasses, corn steep liquor, sulphite waste liquor and whey. Buffers, Precursors, Inhibitors and Antifoam agents.

D. Fermenters and fermentation process: Design, types and basic function of fermenters, sterilization, devices for aeration and agitation. Fermentation process – Surface,

Submerged and Solid state fermentation. Types- Batch and Continuous fermentation.

Down stream processing: Steps in recovery and purification of fermented products –

Precipitation, Filtration, Centrifugation, Distillation, Cell disruption, Solvent recovery, chromatography, Drying and crystallization.

E. Bioengineering of Microorganisms for industrial purposes.

UNIT-IV

INDUSTRIAL PRODUCTION

A. a. Organic acids – Citric acid.

b. Antibiotics – Penicillin.

c. Enzymes –Pectinase.

d. Alcohol – Ethanol.

e. Amino acid –Glutamic 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*.

PRACTICALS:

UNIT-I: FOOD MICROBIOLOGY

1. a. Isolation and enumeration of bacteria from utensils

b. Isolation and identification of fungi from food utensils

2. a. Isolation and enumeration of bacteria from spoiled vegetables

b. Isolation and identification fungi from spoiled vegetables.

3. a. Isolation and enumeration of bacteria from spoiled fruits.

b. Isolation and identification of fungi from spoiled fruits.

4. a. Isolation and identification of aspergillus on groundnut by blotters test.

b. Microscopic examination of idli batter.

UNIT-II: DAIRY MICROBIOLOGY

5. a. Estimation of lactose in milk.

b. Estimation of lactic acid in milk.

6. a. Turbidity test to detect boiled and unboiled milk.

7. Methylene blue reductase test and Resazurin test to determine the quality of milk.

UNIT-III & UNIT -IV (INDUSTRIAL MICROBIOLOGY+ INDUSTRIAL PRODUCTION)

8. Preparation of wine from grapes.

9. Preparation of alcohol using jaggery or molasses.

10. Estimation of percentage alcohol in a given sample by specific gravity bottle method.

11. Production of citric acid using *Aspergillus niger*.

12. Visit to food industries or food research laboratories, dairy industries and distilleries. Each student shall submit an independent report on the visit along with the practical record for the internal assessment.

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VI SEMESTER

IMMUNOLOGY & MEDICAL MICROBIOLOGY

UNIT-II
IMMUNOLOGY

- 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. Immunoprophylaxis – Vaccine – Types – killed, Live and Attenuated (Bacterial and Viral) and Toxoid with an example each.
National Immunization program (Tabular form). 12hrs

UNIT-III AND UNIT- IV
MEDICAL MICROBIOLOGY

- A. Introduction – History and development of medical microbiology. Normal flora of human body.
- B. Infection and disease transmission – Signs, symptoms, syndrome. Types of infection, mode of transmission.
- C. Host pathogen interaction – Pathogenicity, microbial virulence, microbial toxins, opportunists and true pathogens.
- D. Antimicrobial chemotherapy – General characteristics and types of antibiotics. Mode of action of -Penicillin, Aminoglycosides, Erythromycin, Chloramphenicol, Antifungal drugs-Griseofulvin, Nystatin Antiviral drugs-Acyclovir, Multiple Drug Resistance (in brief).

12hrs

PRACTICALS

UNIT-I AND UNIT II : IMMUNOLOGY

1. Determination of blood group and Rh factor.

2. Enumerate RBC in given blood sample

3. Enumerate WBC in given blood sample

UNIT-II

4. Demonstration of precipitation reaction-Double diffusion in two dimensions (Ouchterlony procedure).

5. Antibiotic sensitivity test.

UNIT-III AND UNIT II: MEDICAL MICROBIOLOGY

6. Estimation of urine bacteria by calibrated loop- direct streak method.

7. Microbial flora of oral cavity (tooth and mouth)

8. Isolation of dermatophytes from human skin.

UNIT-IV

9. Detection of typhoid by Widal test

10. Rapid plasma reagin (RPR) card test for syphilis

11-12. Material/ microscopic observation/ display of photographs of human pathogens: *Mycobacterium tuberculosis*, *Vibrio cholerae*, *Trypanosoma pallidum*, *Salmonella typhi*, Hepatitis virus, polio virus, HIV, *Plasmodium*)

Note: Visit to pharmaceuticals and pathological laboratories. Each student shall submit an independent report on the visit along with the practical record for the internal assessment

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CMF28206

VI SEMESTER MEDICAL MICROBIOLOGY AND IMMUNOLOGY

COURSE OUTCOME:

After successful completion of the course students are able to:

- CO1. Understand in depth Medical Microbiology
- CO2. Specify in details with examples Human diseases
- CO3. Learn the details of Immunology
- CO4. Specify the classification and characteristics of Antigens and antibodies

UNIT :I

No of Hours: 15

MEDICAL MICROBIOLOGY

A. Introduction – History and development of medical microbiology. Normal microflora of the human body: Importance of normal microflora, 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 – Infection, Invasion, Pathogen, 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, Chloramphenicol, Antifungal drugs-Griseofulvin, Nystatin Antiviral drugs-Acyclovir, Amantadine and Azidothymidine .Multiple Drug Resistance (in brief).

UNIT-IV

No. of Hours:15

IMMUNOLOGY: ANTIGENS AND ANTIBODIES

A. Antigens – Characteristics of an antigen (Foreignness, Molecular size and Heterogeneity); Haptens; Epitopes (T & B cell epitopes), Adjuvants.

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.

Hypersensitivity (Type I to V - in brief).

Immunoprophylaxis – Vaccine – Types – killed, Live and Attenuated (Bacterial and Viral) and Toxoid with an example each.

National Immunization program (Tabular form).

PRACTICALS

1. Determination of blood group and Rh factor.
2. Enumerate RBC in given blood sample
3. Enumerate WBC in given blood sample
4. Demonstration of precipitation reaction-Double diffusion in two dimensions (Ouchterlony procedure).
5. Antibiotic sensitivity test.
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10. Rapid plasma reagin (RPR) card test for syphilis
11. Identify bacteria on the basis of cultural, morphological and biochemical characteristics: IMViC, TSI, nitrate reduction, urease production and catalase tests
- 12-15. Material/ microscopic observation/ display of photographs of human pathogens as per theory syllabus: Influenza virus, *Corynebacterium diphtheriae*, *Blastomyces dermatitidis*, Human papilloma virus, *Trypanosoma pallidum*, *Sporothrix schenckii*, *Plasmodium*, Dengue viruses (DENV), *Salmonella typhi* and *Entamoeba histolytica*

NOTE: Visit to pharmaceuticals and pathological laboratories. Each student shall submit an independent report on the visit along with the practical record for the internal assessment.

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42. Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education

V SEMESTER
Microbial Diagnosis in Health Clinics

COURSE OUTCOME:

After successful completion of the course students are able to:

- CO1.** Learn the details of Diagnosis of diseases
- CO2.** Learn in details with examples Collection of clinical samples
- CO3.** Understand in depth Microscopic examination of microbes
- CO4.** Specify the details of Testing for antibiotic sensitivity in bacteria

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, throat, skin, Blood, CSF, urine and faeces) and precautions required. Method of transport of clinical samples to laboratory and storage.

UNIT :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 and 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 Microbiology, Prentice Hall Inc, London.
3. Mackie and Mc catney, Medical Microbiology 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.
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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

Programme: B.Voc. (Software Development)

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



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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	10 th Standard		
Training Outcomes	<p>After completing this programme, participants will be able to:</p> <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> Demonstrate aptitude for analysing information and making logical conclusions. 	SSC/N0506	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
				<ul style="list-style-type: none"> • Demonstrate knowledge of the foundational mathematical concepts in computing. 		
3	Basic Algorithms and Application Development	30:00	60:00	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> • 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	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> • 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	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> • 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 	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
				<p>outside their area of competence or</p> <ul style="list-style-type: none"> • 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 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 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	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> • Comply with organization's current health, safety and security policies and procedures <ul style="list-style-type: none"> • Report any identified breaches in health, safety, and security policies and procedures to the designated person <ul style="list-style-type: none"> • Identify and correct any hazards that can deal with 	SSC/N9003	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
				<p>safely, competently and within the limits of authority</p> <ul style="list-style-type: none"> • 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 		
7	Data and Information Management	15:00	35:00	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> • 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 	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
				<p>data/information to appropriate people</p> <ul style="list-style-type: none"> • Provide complete, accurate and up-to-date data/information to the appropriate people in the required formats on time 		
8	Learning and Self Development	05:00	20:00	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> • 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:	<u>114:00</u>	<u>286:00</u>	<p>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.</p>		



Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
				<p>For Domain NOS, For NOS SSC/N0506 – HTML, C++ / Java, IDE</p> <p>General:</p> <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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: <p>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.</p> • 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 .

ASSESSMENT OUTCOME (NOS CODE AND DESCRIPTION)	Assessment criteria (PC)	Total Marks	Out Of	MARKS ALLOCATION	
				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 people		2.5	0	2.5
	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 customers 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	40	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		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
3.SSC/N9003 (Maintain a healthy, safe and secure working 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 12 th 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



Certificate

CURRICULUM COMPLIANCE TO QUALIFICATION PACE – NATIONAL OCCUPATIONAL STANDARDS

Issued by

SECTOR SKILL COUNCIL, NASSCOM

for

MODEL CURRICULUM

Compliance to the qualification standards of

Software Quality Assurance Technician (Software Development) – SSC/Qual/IT/SC/2015

Head of
Department

Head of
Department

Head of
Department



4E-Vandana Building (4th Floor)

11, Tolstoy Marg

New Delhi-110001

Phone: 91-11- 4151 9230/60

Fax: 91-11- 4151 9240

Email: ssc@nasscom.in

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



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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	<p>After completing this programme, participants will be able to:</p> <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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



Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
				<ul style="list-style-type: none"> 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	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> Establish and agree their work requirements with appropriate people Keep their immediate work area clean and tidy utilize their time effectively 	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
				<ul style="list-style-type: none"> • 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	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> • 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 Health and Safety	05:00	20:00	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> • 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	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> • 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 	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
				<ul style="list-style-type: none"> • 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 		
8	Learning and Self Development	5:00	20:00	Candidates will be able to: <ul style="list-style-type: none"> • 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



Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
				<p>competence and any learning and development needs</p> <ul style="list-style-type: none"> • 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:	<u>109:00</u>	<u>291:00</u>	<p>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.</p> <p>For Domain NOSs:</p> <ul style="list-style-type: none"> • 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 <p>General:</p> <ul style="list-style-type: none"> • 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
				<ol style="list-style-type: none"> 3. White Board, Markers and Eraser 4. Projector with screen 5. Flip chart with markers 6. Faculty's PC/Laptop with latest configuration and internet connection 7. Supporting software / applications for projecting audio, video, recording, 8. Presentation Tools to support learning activities: <ul style="list-style-type: none"> o Intranet o Email o IMs o Learning management system e.g. Moodle, Blackboard to enable blended learning 9. Microphone / voice system for lecture and class activities 10. Handy Camera 11. Stationery kit – Staples, Glue, Chart Paper, Sketch Pens, Paint Box, Scale, A4 Sheets 12. 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 13. Assessment and Test Tools for day to day online Tests and Assessments 14. For team discussions: Adequate seating arrangement in full / half circle format for one or more teams as per planned team composition. 15. 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

- 6 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.
- 7 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,
 - Embed such skills development in the learning pedagogy for each expected outcome
 - Prepare a detailed session plan for training delivery with focus on sequence and duration of training
 - 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 .

ASSESSMENT OUTCOME (NOS CODE AND DESCRIPTION)	ASSESSMENT CRITERIA (PC)	TOTAL MARKS	OUT OF	MARKS ALLOCATION	
				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)	PC1. check their understanding of the Business Requirements Specification (BRS), Software	100	10	10	0



content and graphic designs for software products and Applications)	Requirements Specification (SRS), High Level Design (HLD) and Low Level Design (LLD) with appropriate people				
	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		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	100	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
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 activities in line with their plan		12	0	12
	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



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

Issued by

IT-ITEE SECTION SKILL COUNCIL, BANGALORE

for

MODEL CURRICULUM

Compliance to National Occupational Standards of
Job Role (Occupation) from "Skill Framework" of the "ESQ/Trade/SPQ/Level"

Model Name: _____
Model No: _____
Date of Issue: _____


Director
IT-ITEE SECTION SKILL COUNCIL, BANGALORE



4E-Vandana Building (4th Floor)

11, Tolstoy Marg
New Delhi-110001
Phone: 91-11- 4151 9230/60
Fax: 91-11- 4151 9240
Email: ssc@nasscom.in



Model Curriculum

Software Developer

SECTOR: IT-ITES
SUB-SECTOR: IT SERVICES
OCCUPATION: DATA SCIENTISTS
REF. ID: SSC/Q0501, VERSION 1.0
NSQF LEVEL: 7



Certificate

**CURRICULUM COMPLIANCE TO
QUALIFICATION PACK – NATIONAL OCCUPATIONAL
STANDARDS**

Issued to the
[Name of the Institution]

by
MODE CURRICULUM

Compliance to National Occupational Standards of
[Name of the Qualification Pack] – [Name of the Institution]

Signature: _____
Name: _____
Title: _____

Signature: _____
Name: _____
Title: _____



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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: <ul style="list-style-type: none">• 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: <ul style="list-style-type: none">• 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: <ul style="list-style-type: none">• 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: <ul style="list-style-type: none">• 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
		<ul style="list-style-type: none"> 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	<p>Self and work Management</p> <p>Theory Duration (hh:mm) 12:00</p> <p>Practical Duration (hh:mm) 38:00</p> <p>Corresponding NOS Code SSC/N9001</p>	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> 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	<p>Team Work and Communication</p> <p>Theory Duration (hh:mm) 12:00</p> <p>Practical Duration (hh:mm) 38:00</p> <p>Corresponding NOS Code SSC/N9002</p>	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> 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	<p>Managing Health and Safety</p> <p>Theory Duration (hh:mm) 05:00</p>	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> 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
	<p>Practical Duration (hh:mm) 20:00</p> <p>Corresponding NOS Code SSC/ N 9003</p>	<p>with safely, competently and within the limits of their authority</p> <ul style="list-style-type: none"> • 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	<p>Data and Information Management</p> <p>Theory Duration (hh:mm) 15:00</p> <p>Practical Duration (hh:mm) 35:00</p> <p>Corresponding NOS Code SSC/N9004</p>	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> • 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	<p>Learning and Self Development</p> <p>Theory Duration (hh:mm) 05:00</p> <p>Practical Duration (hh:mm) 20:00</p> <p>Corresponding NOS Code SSC/N9005</p>	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> For NOS SSC/N0501: C/C++, UML tools such as Rational suite For NOS SSC/N0502: JDK / Eclipse General: <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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

- 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.
- 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,

Embed such skills development in the learning pedagogy for each expected outcome

Prepare a detailed session plan for training delivery with focus on sequence and duration of training

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 .



ASSESSMENT OUTCOME (NOS CODE AND DESCRIPTION)	ASSESSMENT CRITERIA (PC)	TOTAL MARKS	OUT OF	MARKS ALLOCATION	
				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



ASSESSMENT OUTCOME (NOS CODE AND DESCRIPTION)	ASSESSMENT CRITERIA (PC)	TOTAL MARKS	OUT OF	MARKS ALLOCATION	
				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	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	100	20
5.SSC/N9003 (MAINTAIN A	PC1. comply with their organization's current health, safety and security policies and procedures	100	20	10	10



ASSESSMENT OUTCOME (NOS CODE AND DESCRIPTION)	ASSESSMENT CRITERIA (PC)	TOTAL MARKS	OUT OF	MARKS ALLOCATION	
				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-to-date 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



ASSESSMENT OUTCOME (NOS CODE AND DESCRIPTION)	ASSESSMENT CRITERIA (PC)	TOTAL MARKS	OUT OF	MARKS ALLOCATION	
				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



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SSC/Q0502 14**

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	<p>After completing this programme, participants will be able to:</p> <ul style="list-style-type: none"> • 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**.

Sr. 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: <ul style="list-style-type: none"> • 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 	SSC/N0501	Refer to Unique Equipment Required



Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
				<ul style="list-style-type: none"> • 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 		
2.	Develop software code to specification	20:00	80:00	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> • 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 	SSC/N0502	

Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
3.	Develop media content and graphic designs for software products and applications	12:00	38:00	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> • 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	
4.	Manage your work to meet requirements	12:00	38:00	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> • 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	



Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
5.	Work effectively with colleagues	10:00	40:00	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> • 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	
6.	Maintain a healthy, safe and secure working environment	7:00	18:00	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> • 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	

Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
				<ul style="list-style-type: none"> complete any health and safety records legibly and accurately 		
7.	Provide data/information in standard formats	12:00	38:00	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> 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 up-to-date data/information to the appropriate people in the required formats on time 	SSC/N9004	
8.	Develop your knowledge, skills and competence	5:00	20:00	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> 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
				<ul style="list-style-type: none"> review your knowledge, skills and competence regularly and take appropriate action 		
Total Duration:		<u>95:00</u>	<u>305:00</u>	<p>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.</p> <p>Domain NOS requirements</p> <ol style="list-style-type: none"> 16. Visio, UML, freeminds, mockingbird 17. HTML 5, CSS, Java Script and SQL 18. IDEs such as Web Builder, Word Press, Joomla 19. Wordpress, psdGraphics etc. 20. HTML, CSS, Flash, Photoshop, Windows media player, Eclipse, XAMPP <p>Common requirements</p> <ol style="list-style-type: none"> 8 Comfortable seats with adequate lighting, controlled temperature and acoustics for training and learning 9 White Board, Markers and Eraser 10 Projector with screen 11 Flip chart with markers 12 Faculty's PC/Laptop with latest configuration and internet connection 13 Supporting software / applications for projecting audio, video, recording, 14 Presentation Tools to support learning activities: <ul style="list-style-type: none"> o Intranet o Email o IMs o Learning management system e.g. Moodle, Blackboard to enable blended learning 15 Microphone / voice system for lecture and class activities 16 Handy Camera 17 Stationery kit – Staples, Glue, Chart Paper, Sketch Pens, Paint Box, Scale, A4 Sheets 18 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. 19 Assessment and Test Tools for day to day online Tests and Assessments 20 For team discussions: Adequate seating arrangement in full / half circle format for one or more teams as per planned team composition. 		

Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
				6 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 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. 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

Model Curriculum for **User Interface (UI) Developer**

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 (Develop media content and graphic designs for software 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
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 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	<p>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.</p> <p>The individual should be result oriented. The individual should also be able to demonstrate skills for communication, creative and logical thinking.</p>
3	Minimum Educational Qualifications	Bachelor's Degree in Science/Technology/Computers or any graduate course
4a	Domain Certification	<p>Minimum accepted score in SSC Assessment is 90% per NOS being taught in SSC/Q0502.</p> <p>Additional certification in computers/technology/ animation/graphics</p>
4b	Platform Certification	<p>Recommended that the Trainer is certified for the Job Role: "Trainer" mapped to the Qualification Pack: "SSC/Q1402".</p> <p>Minimum accepted score is 70% per NOS.</p>
5	Experience	<p>Field experience: Minimum 2 years' experience in the same domain</p> <p>Training experience: 1 year preferred</p>



IT-ITeS Sector Skills Council NASSCOM 4E-Vandana Building (4th Floor), 11, Tolstoy
Marg, New Delhi-110001 T +91 11 41519230/60 | F +91 11 41519240
www.sscnasscom.com | www.nasscom.in

Model Curriculum

Fruit Pulp Processing Technician

SECTOR: FOOD PROCESSING
SUB-SECTOR: FRUITS & VEGETABLES
OCCUPATION: PROCESSING
REF ID: FIC/Q0106, V1.0
NSQF LEVEL: 4





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Fruit Pulp Processing Technician

CURRICULUM / SYLLABUS

This program is aimed at training candidates for the job of a “Fruit Pulp Processing Technician”, in the “Food Processing” Sector/Industry and aims at building the following key competencies amongst the learner

Program Name	Fruit Pulp Processing Technician		
Qualification Pack Name & Reference ID. ID	FIC/Q0106, v1.0		
Version No.	1.0	Version Update Date	12/01/2016
Pre-requisites to Training	Preferably Class 8 and 2-3 years' experience in a food processing unit		
Training Outcomes	<p>The programme will help in building the following key competencies amongst the learner:</p> <ul style="list-style-type: none"> Process fruits to produce fruit pulps manually or through machine operation; Plan, organize, prioritize, inspect, and calculate production requirements; Maintain process parameters to achieve the desired quality and quantity; Follow and maintain food safety and hygiene in the work environment 		

This course encompasses 5 out of 5 National Occupational Standards (NOS) of “Fruit Pulp Processing Technician” Qualification Pack FIC/Q0106, Version 1.0 issued by Food Industry Capacity and Skill Initiative”.

Sr. No.	Module	Key Learning Outcomes	Equipment Required
1	<p>Introduction to the training program</p> <p>Theory Duration (hh:mm) 00:30</p> <p>Practical Duration (hh:mm) 00:00</p> <p>Corresponding NOS Code Bridge Module</p>	Introduce each other and build rapport with fellow participants and the trainer.	White board/Chart papers, marker
2	<p>Overview of the “Fruit Pulp processing technician” Role</p> <p>Theory Duration (hh:mm) 01:00</p> <p>Practical Duration (hh:mm) 00:00</p> <p>Corresponding NOS Code</p>	<p>Understanding the roles and responsibilities of fruit pulp processing technician</p> <p>Awareness of the nature and availability of job opportunities</p>	Laptop/computer white board, marker, projector, chart papers
3	<p>Introduction to the Food Processing Industry</p> <p>Theory Duration (hh:mm) 01:30</p> <p>Practical Duration (hh:mm) 00:00</p> <p>Corresponding NOS Code</p>	<p>Define food processing</p> <p>List the various sub sectors of food processing industry</p>	Laptop, white/black board, marker, chart papers, projector, Trainer’s guide, Student manual
4	<p>Introduction to Fruit & Vegetable Processing</p> <p>Theory Duration (hh:mm)</p>	<p>State the need for fruit and vegetable processing</p> <p>State the common methods of fruit and vegetable processing</p>	Laptop, white/black board, marker, chart papers, projector, trainer’s guide, student handbook, pictures/charts of

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	02:00 Practical Duration (hh:mm) 01:00 Corresponding NOS Code		different subsectors in fruit and vegetable processing e.g. pickle, jam and jelly, ketchup, juices, squashes, fruit pulp etc.
5.	Overview of Fruit Pulp Processing Theory Duration (hh:mm) 03:00 Practical Duration (hh:mm) 01:00 Corresponding NOS Code FIC/N0120 FIC/N0121 FIC/N0122 FIC/N0123	Define fruit pulping List the various fruits used for pulping Describe the pulping process	Laptop/computer white board, marker, projector, chart papers, Trainer's guide , student handbook
6.	Organizational standards and norms Theory Duration (hh:mm) 05:00 Practical Duration (hh:mm) 01:00 Corresponding NOS Code FIC/N0120 FIC/N0121 FIC/N0122 FIC/N0123 FIC/N9001	State the roles and responsibilities of a jam, jelly and ketchup processing technician State how to conduct yourself at the workplace State the personal hygiene and sanitation guidelines State the food safety and hygiene standards to follow in an organization	Laptop, white board, marker, chart papers, projector, trainer's guide and student handbook, protective gloves, head caps, aprons, safety goggles, safety boots, mouth masks, sanitizer, safety manual
7.	Prepare and Maintain Work Area and Process Machineries for pulp processing Theory Duration (hh:mm)	<ul style="list-style-type: none"> Identify different equipments used in fruit pulp processing State the materials and equipments used in cleaning and maintenance of the work area and machineries State the cleaning processes used to clean the work area 	Laptop, white board, marker, chart papers, projector, trainer's guide and student handbook, authorized sanitizers, cleansers, all equipments for demonstration

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	08:00 Practical Duration (hh:mm) 15:00 Corresponding NOS Code FIC/N0120 FIC/N0121 FIC/N0122 FIC/N0123 FIC/N9001	<ul style="list-style-type: none"> • Demonstrate the use of different tools and machineries used for squash and juice • Demonstrate the appropriate method for cleaning and maintain a work area Ensure the work area is safe and hygienic for food processing • Identify and set the machines and tools required for production in working condition • Maintain cleanliness of the process machineries required for production using recommended sanitizers 	
8.	Food Microbiology Theory Duration (hh:mm) 06:00 Practical Duration (hh:mm) 02:00 Corresponding NOS Code	State the types of food microbes State the causes of food spoilage State the process of food spoilage state the criteria to check food spoilage State the need for food preservation State different types of food preservation processes Explain the method of assessing the quality of produce based on physical parameters	Laptop, white board, marker, chart papers, projector, trainer's guide and student handbook, samples of fresh and spoiled food
9..	Prepare for production of fruit pulp Theory Duration (hh:mm) 06:00 Practical Duration (hh:mm) 12:00 Corresponding NOS Code FIC/N0121 FIC/N0122	Use basic mathematics for various calculations in day-to-day processes Plan the production schedule as per organizational standards and instructions Organize for raw materials, packaging materials, manpower, equipment and machineries for the scheduled production Identify the raw materials required for production as per production schedule and formation State the methods for storing raw materials for later use Plan the production sequence to maximize capacity, utilization of resources, manpower and machinery Calculate batch size and prioritize urgent orders based on the production schedule and machine capacity	SOP; pH meter(Digital); Thermometer (Digital); Beakers; Measuring Cylinder; Measuring flask; Brinometer; Salinometer, Hydrometer; Weighing Balance (Digital); Brix Meter/ Refractometer; Deep fridge; refrigerator; Gas burner with cylinder; Fruit tray; Stainless steel mug; Pilfer proof capping machine; Cutting knives; mixer/electric mixer; water tank; fruit slicing machine; sealing machine; Vacuum gauge; pressure gauge; seam checking gauge or screw gauge; pressure cooker; coring Knives; Pitting knives;

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<ul style="list-style-type: none"> • Check the conformance of raw material quality to company standards • Organize quality raw material as per production process and company standards • Check the raw material quality and grade • Prepare the raw material for production • List the effect on pulp of manhandling fruits 	Juice extractor, crown corking machine; pulper; fruit mill; vacuum pan; mechanical peeler/ batch type of fruit and vegetable peeling; steam jacket kettle; baby boiler/ exhausting box; shredder for slicing of fruit and vegetable; liquid filling machine; Autoclaves S.S vessels with lids; micrometer; seam checking gauge; bottle brush washer;
10.	<p>Produce fruit pulp from various fruits</p> <p>Theory Duration (hh:mm) 15:00</p> <p>Practical Duration (hh:mm) 20:00</p> <p>Corresponding NOS Code FIC/N0122</p>	<ul style="list-style-type: none"> • Explain the process of pulping fruit • Define ripening • Explain fruit ripening process • Demonstrate the process of ripening, sorting, and deseeding fruit • State the procedures used to create the fruit pulp • Demonstrate the process of fruit pulping • State the methods of sterilizing fruit pulp • List the quality control parameters for checking fruit pulp • State the basic categories of packing • State the various types of packaging materials used for packing fruit pulp • State the factors for selecting packaging materials • Explain aseptic packaging in fruit processing industry • Define canning and its purpose • State the process of canning • Demonstrate the canning process of fruit pulp • State the methods for storing raw materials for later use • Explain the process of storing packaged fruit pulp • State the process of maintaining storage conditions • Demonstrate the process of cleaning the work area and machineries after production organizational standards 	SOP; pH meter(Digital); Thermometer (Digital); Beakers; Measuring Cylinder; Measuring flask; Brinometer; Salinometer, Hydrometer; Weighing Balance (Digital); Brix Meter/ Refractometer; Deep fridge; refrigerator; Gas burner with cylinder; Fruit tray; Stainless steel mug; Pilfer proof capping machine; Cutting knives; mixer/electric mixer; water tank; fruit slicing machine; sealing machine; Vacuum gauge; pressure gauge; seam checking gauge or screw gauge; pressure cooker; coring Knives; Pitting knives; Juice extractor, crown corking machine; pulper; fruit mill; vacuum pan; mechanical peeler/ batch type of fruit and vegetable peeling; steam jacket kettle; baby boiler/ exhausting box; shredder for slicing of fruit and

Sr. No.	Module	Key Learning Outcomes	Equipment Required
			vegetable; liquid filling machine; Autoclaves S.S vessels with lids; micrometer seam checking gauge; bottle brush washer; protective gloves, head caps, aprons, safety goggles, safety boots, mouth masks, sanitizer, safety manual
11.	<p>Complete documentation and record keeping</p> <p>Theory Duration (hh:mm) 03:00</p> <p>Practical Duration (hh:mm) 01:00</p> <p>Corresponding NOS Code FIC/N0123</p>	<ul style="list-style-type: none"> • State the need for documenting and maintaining records of raw materials, processes and finished products • State the method of documenting and recording the details of raw material to final finished product • Document daily records in the ERP system effectively 	Laptop, white board, marker, chart papers, projector, trainer's guide and student handbook, logbooks, internal audit register, food safety manual, quality policy etc.
12.	<p>Food Safety, Hygiene and Sanitation</p> <p>Theory Duration (hh:mm) 04:00</p> <p>Practical Duration (hh:mm) 04:00</p> <p>Corresponding NOS Code FIC/N9001</p>	<p>State the importance of safety, hygiene and sanitation in the baking industry</p> <p>Follow the industry standards to maintain a safe and hygiene workplace</p> <p>Follow HACCP principles to eliminate food safety hazards in the process and products</p> <p>Follow safety practices in the work area</p>	Laptop, white board, marker, chart papers, projector ,trainer's guide and student handbook, protective gloves, head caps, aprons, safety goggles, safety boots, mouth covers, sanitizer, safety manual ,logbooks etc.
13.	<p>Professional and Core Skills</p> <p>Theory Duration (hh:mm) 04:00</p> <p>Practical Duration (hh:mm) 00:00</p>	<p>Undertake a self-assessment test</p> <p>Identify personal strengths and weaknesses</p> <p>Plan and schedule the work order and manage time effectively to complete the tasks assigned</p> <p>Prevent potential problems from occurring</p> <p>Resolve issues and problems using acquired knowledge and realize the importance of decision making</p>	Laptop, white/black board, marker, chart papers, projector ,Trainer's guide, Student manual

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	Corresponding NOS Code	Identify potential problems and make sound and timely decision Improve your reading skills State the importance of listening	
14.	IT Skills Theory Duration (hh:mm) 05:00 Practical Duration (hh:mm) 08:00 Corresponding NOS Code	Identify parts of the computer Use the computer keyboard effectively to type Use computer applications effectively to record day-to-day activities Use the word processor effectively Use the spreadsheet application effectively Use the computer to document day-to-day activities	Laptop, white/black board, marker, chart papers, projector, Trainer's guide, Student manual
15.	Field Visits Theory Duration (hh:mm) 05:00 Practical Duration (hh:mm) 19:00 Corresponding NOS Code	Observe the factory location, layout and safety aspects of food processing Observe the storage facilities for raw materials and finished products Observe the various machineries used in pickle processing Observe the various machineries used in pickle processing Observe the cleaning methods and processes followed to maintain the process machineries and tools Observe the raw materials used and their storage procedures Observe the packaging and storage processes of raw material and finished product Observe the post-production cleaning and maintenance process followed in the industry	All the tools and equipment listed above must be available at the site of field visit
16.	Revision Theory Duration (hh:mm) 05:00 Practical Duration (hh:mm) 01:00 Corresponding NOS Code	Revised the knowledge gained so far	All the tools and equipment listed above must be available at the time of revision
17.	Evaluation Theory Duration (hh:mm) 08:00	Assess the knowledge and skills acquired by the participants	All the tools and equipment listed above must be available for evaluation

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	Practical Duration (hh:mm) 10:00 Corresponding NOS Code		
18.	On-the-job Training Theory Duration (hh:mm) 14:00 Practical Duration (hh:mm) 50:00 Corresponding NOS Code	Apply the skills and knowledge acquired in the training program in the field	All the tools and equipment listed above must be available on the site at the time of OJT
	Total Duration 240:00 Theory Duration 95:00 Practical Duration 145:00	Unique Equipment Required: SOP; pH meter(Digital); Thermometer (Digital); Beakers; Measuring Cylinder; Measuring flask; Brinometer; Salinometer, Hydrometer; Weighing Balance (Digital); Brix Meter/ Refractometer; Deep fridge; refrigerator; Gas burner with cylinder; Fruit tray; Stainless steel mug; Pilfer proof capping machine; Cutting knives; mixer/electric mixer; water tank; fruit slicing machine; sealing machine; Vacuum gauge; pressure gauge; seam checking gauge or screw gauge; pressure cooker; coring Knives; Pitting knives; Juice extractor, crown corking machine; pulper; fruit mill; vacuum pan; mechanical peeler/ batch type of fruit and vegetable peeling; steam jacket kettle; baby boiler/ exhausting box; shredder for slicing of fruit and vegetable; liquid filling machine; Autoclaves S.S vessels with lids; micrometer seam checking gauge; bottle brush washer	

Grand Total Course Duration: **240Hours, 0 Minutes**

(This syllabus/ curriculum has been approved by [SSC: Food Industry Capacity and Skill Initiative](#))

Trainer Prerequisites for Job role: “Fruit Pulp Processing Technician” mapped to Qualification Pack: “FIC/Q0106, v1.0”

Sr. No.	Area	Details
1	Description	To deliver accredited training service, mapping to the curriculum detailed above, in accordance with the Qualification Pack “FIC/Q0106”, Version 1.0
2	Personal Attributes	An aptitude for conducting training, and pre/ post work to ensure competent, employable candidates at the end of the training, and pre/post work to ensure competent, employable candidates at the end of the training. Strong communication skills, ability to work as part of a team; a passion for quality and for developing others; well-organized and focused, eager to learn and keep oneself updated with the latest in the mentioned fields.
3	Minimum Educational Qualifications	<ul style="list-style-type: none"> B.Sc/B.Tech/BE in Food Technology or Food Engineering with 2-3 years of hand on experience in a Pulping Unit or Fruits/Vegetables Processing Unit.
4a	Domain Certification	Certified for Job Role: “Fruit Pulp Processing Technician” mapped to QP: “FIC/Q0106, v1.0”. Minimum accepted score is 80%
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 80 % as per FICSI guidelines.
5	Experience	<ul style="list-style-type: none"> B.Sc/B.Tech/BE in Food Technology or Food Engineering with 2-3 years of hand on experience in a Pulping Unit or Fruits/Vegetables Processing Unit.

Annexure: Assessment Criteria

Assessment Criteria	
Job Role	Fruit Pulp Processing Technician
Qualification Pack	FIC/Q0106, v1.0
Sector Skill Council	Food Processing

Sr. No.	Guidelines for Assessment
1	Criteria for assessment for each Qualification Pack will be created by the Sector Skill Council. Each Performance Criteria (PC) will be assigned marks proportional to its importance in NOS. SSC will also lay down proportion of marks for Theory and Skills Practical for each PC.
2	The assessment for the theory part will be based on knowledge bank of questions created by the SSC.
3	Individual assessment agencies will create unique question papers for theory part for each candidate at each examination/training centre(as per assessment criteria below)
4	Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/training center based on this criteria
5	To pass the Qualification Pack, every trainee should score a minimum of 70% (overall) in every QP
6	The marks are allocated PC wise; however, every NOS will carry a weight age in the total marks allocated to the specific QP

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
1. FIC/Q0120: Prepare and maintain work area and process machineries for pulp processing	PC.1 Prepare, clean and maintain the cleanliness of the work area using approved sanitizers and keep it free from dust, waste, flies and pests	100	25	10	15
	PC2. Ensure that the work area is safe and hygienic for food		10	3	7
	PC3. Dispose waste materials as per defined SOPs and industry requirements		15	5	10
	PC4. Check the working and performance of all machineries and tools used for the pickle making process such as washer, peeler, vegetable cutter/slicer, blender, packaging machines etc.		15	5	10
	PC5. Clean the machineries and tools used with approved sanitizers following SOP		15	5	10
	PC6. Place the necessary tools required for process		5	2	3
	PC7. Attend the minor repairs/ faults of all machines, if required		15	5	10
	Total		100	35	65
2. FIC/Q0121: Prepare for production of fruit pulp	PC1. Read and understand the production order from supervisor	100	10	4	6
	PC2. Check the availability of raw materials, packaging materials, equipment availability and manpower		5	2	3
	PC3. Support in planning production sequence		15	5	10
	PC4. Calculate the batch size based on the production order and machine capacity		5	2	3
	PC5. Calculate the raw material requirement (considering the process loss) to produce the required quantity of finished		5	2	3
	PC6. Calculate the raw materials, packaging materials and manpower requirement for completing the order.		5	2	3
	PC7. Ensure the working and performance of each equipment required for the process		7	2	5
	PC8. Calculate the process time for effective utilization of machineries		7	2	5
	PC9. Plan batch size considering full capacity utilization of machineries		3	1	2
	PC10. Plan to utilize machineries for multiple products without affecting the quality of		3	1	2

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	the finished products, and to optimize production and save energy				
	PC11. Allot responsibilities and help to assistants and workers		5	1.5	3.5
	PC12. Refer the process chart for products produced		3	1	2
	PC13. Weigh the raw materials required for the batch		3	1	2
	PC14. Check the conformance of raw material quality to organization standards, through physical analysis and by referring the quality analysis report from the supplier/ internal lab analysis report		10	4	6
	PC15. Sharpen cutter blades and change the cutter/slicer blades		2	0.5	1.5
	PC16. Fix, change, clean filters and sieves of processing machinery		5	2	3
	PC17. Ensure working and performance of required machines and tools.		5	1	4
	PC18. Keep the tools assessable to repair in case of faults/ breakdown		2	0.5	1.5
	Total		100	35	65
3. FIC/Q0122: Produce fruit pulp from various fruits	PC1. Receive fruits from the supplier/vendor and check weight	100	1	0.5	0.5
	PC2. Check quality through physical parameters such as appearance, color, texture, maturity		1	0.5	0.5
	PC3. Load fruits in fruit ripening chamber, adjust controls to set required temperature, time, relative humidity to pre-cool the fruit, monitor temperature to ensure the fruit is cooled to required temperature		3	1	2
	PC4. Open and control the regulator of the ethylene generator or use PLC to introduce ethylene into the chamber to initiate ripening of fruit, monitor air circulation system for uniform ethylene flow for specified period, adjust controlling system to maintain required temperature, relative humidity, etc. for specified period, adjust ventilation system at periodic interval by controlling the speed of exhaust fan to remove carbon-di-oxide		3	1	2

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	PC5. Open ripening chamber after specified period, start fan to ventilate ethylene gas, stop fan after ventilation, unload the ripened fruit from the ripening chamber, check the quality of ripened fruit and transfer to processing area		2	0.5	1.5
	PC6. Open valves or start pump to fill water in washing tank and control water level, dump fruits into the washing tank for washing		2	0.5	1.5
	PC7. Switch on agitator of revolving screens/blades to immerse each fruit into water to remove dirt, soil, etc		2	0.5	1.5
	PC8. Start the ladder conveyor to lift fruits from the washing tank and transfer to the washing line conveyor		2	0.5	1.5
	PC9. Open valves of the high pressure spraying system for fresh water and adjust pressure to spray water on fruits for rinsing		2	0.5	1.5
	PC10. Adjust controls to transfer washed fruit to sorting/inspecting line, start and adjust speed of sorting/inspecting line conveyor to visually inspect and manually remove damaged, blemished and rotten fruits		2	0.5	1.5
	PC11. Dump sorted fruits in the peeler or corer (depending on the type of fruits), start machine, adjust speed to remove the peel or core of fruits (or) turn valves to introduce steam and adjust controls to maintain pressure for steam peeling		3	1	2
	PC12. Open valve or pump water or open spraying system to wash peeled fruits, observe fruits emerging from peeling/coring machine to ensure removal of peel/core		2	0.5	1.5
	PC13. Cut fruits manually (or) load the fruits in the chopper/cutter/slicer machine, adjust controls to cut fruits to required size, start machine, collect sliced fruits from the discharge chute		2	0.5	1.5
	PC14. In case of mangoes, start conveyor and control speed to allow washed mangoes to pass through mango tip cutting line, cut the mango tip manually, control conveyor speed to dump the tip cut mangoes into		2	0.5	1.5

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	destoner machine to remove seed and peel				
	PC15. Control speed of waste disposal conveyor to dispose waste following sop		1	0.5	0.5
	PC16. Adjust and maintain speed of pulper conveyor to allow fruits to pass through the pulper cum finisher/ pulper refiner machine for pulping fruits and sieving pulp to required fineness, adjust position of discharge outlet to collect refined pulp in collection tank, check collected pulp to ensure it is free from seeds and fiber		8	3	5
	PC17. Replace damaged or clogged filter screen of pulper cum finisher/ pulper refiner machine		2	0.5	1.5
	PC18. Start pump to transfer measured quantity of pulp from collection tank to steam jacketed kettle/ pre-cooking tank for cooking pulp, check pumped quantity through the level indicator and glass windows of the pre-cooking tank, adjust controls to set pressure, temperature, cooking time, stirrer speed, etc., open valve to allow steam to pass through kettle for pre-cooking/ pre-heating pulp to required temperature, examine pre-cooked fruits through feel/texture		8	3	5
	PC19. Open valves to allow pre-cooked pulp to pass through de-canter machine to remove black specks, set control of the machine such as speed of screw conveyor in machine and speed/ rotation and start machine to remove black specks (in case of mango)		5	2	3
	PC20. Collect the pre-cooked pulp in the collection tank/ holding tank, sample pulp and transfer to quality lab for analysis and conformance to organisation standards		2	0.5	1.5
	PC21. Set controls of de-aerator machine to remove air from pulp for extended shelf-life, start machine, open valves/ start pump to transfer measured quantity of pre-cooked pulp into de-aeration tank to de-aerate pulp		5	2	3

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	PC22. Set controls of evaporator like flow rate of pulp, temperature, residence time etc to concentrate pulp (for processing concentrated pulp), switch on machine to transfer measured quantity of de-aerated pulp into continuous evaporator for concentrating pulp		5	2	3
	PC23. Open valves/start pump to transfer measured quantity of precooked(or)de-aerated and concentrated pulp into sterilization tank to sterilize pulp before aseptic packing, adjust controls to set temperature, pressure, time, etc. and open valves to allow steam to pass through sterilization tank, switch on machine to start sterilization, observe through glass windows of the sterilization tank, monitor and maintain steam pressure by adjusting gauges to sterilize fruit pulp to organisation standards		4	1	3
	PC24. Set controls to allow the sterilized pulp to pass to the aseptic surge tank for filling, maintain temperature of product surge tank until filling, set controls of the product filler of aseptic filling machine for filling volume, pressure, temperature, etc		4	1	3
	PC25. Place plastic liners in the container (drums, cartons etc), date code aseptic bags with details like date of manufacture, date of expiry etc and place inside the liner for filling pulp, start conveyor and control speed to move the drum with aseptic bags under the aseptic (product) filling machine		2	1	1
	PC26. Fix the spout of the aseptic bag to the filling nozzle of the machine, set controls like pressure, temperature, filling volume etc and start machine to fill hot sterile product and automatically seal/ close with sterile closures		2	0.5	1.5
	PC27. Start conveyor to move the container with filled aseptic bags to the weighing area, check the weight of the container, label the container with details like batch number, date of manufacture, date of expiry, volume/weight etc		2	0.5	1.5
	PC28. Cover the aseptic bags with liner, place lid on drums, close and seal lid,		1	0.5	0.5

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	transfer to the storage area and store by maintaining storage conditions and following SOP				
	PC29. Operate can reformer, flanger, seamer, can body beader and embossing machines to form cans		1	0.5	0.5
	PC30. Press button to activate machine-lift that raises stacked cans and transfers them onto mechanical conveyor (in mechanical units), observe passing cans and remove defective/ damaged cans from conveyor and discard following SOP		1	0.5	0.5
	PC31. Start machine that automatically feeds empty cans onto conveyors leading to washing, filling and sealing machines (or) set controls like temperature, pressure, conveyor speed of empty can machine, place empty cans in the conveyor and start machine to sterilize cans, collect sterilized cans from other end of the conveyor and transfer to the filling machine		1	0.5	0.5
	PC32. Start conveyor to allow sterilized cans to pass through the filling line (or) place sterilized cans manually in the filling line conveyor		1	0.5	0.5
	PC33. Start pump to fill pre-cooked/preheated pulp into the filling tank, set temperature, volume etc and start machine to fill pulp in cans, control speed of conveyor to transfer filled cans to the can seaming machine (or) manually place lid over the filled cans and seal in cans in can seamer machine		2	0.5	1.5
	PC34. Load the canned product manually in metal baskets, start motor to lower the basket with cans in lager tank with hot water, allow steam to pass through tank to heat continuously to sterilize can to specified temperature and time, mechanically lift basket with sterilised cans from hot water tank and place in cold water tank, open valves to circulate cold water in tanks to cool cans, dry cans manually		2	1	1

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	PC35. Load the canned product into the retort manually or mechanically through push trucks, close retort door or lid, and turn wheels or moves levers to seal chamber, adjust controls to set pressure, temperature and time of the retort chamber to sterilize canned product following sop		2	0.5	1.5
	PC36. Set process parameters like pressure, temperature, sterilization time etc in the retort following SOP, turns valves to admit steam to retort, observe dials and gauges and adjust controls to maintain process parameters, turn valves to release steam and allow cool water into chamber to prevent overcooking		1	0.5	0.5
	PC37. Open retort and move the canned product to the cooling line conveyor, open valves of the water spraying system and adjust pressure to spray cold water on cans passing though cooling line conveyor, transfer cooled cans to drying line conveyor and start conveyor, set and control temperature and air flow to dry adhering water from the cooled cans		2	1	1
	PC38. Load labels in the packaging machine and set date coding machine for batch number, date of manufacture, date of expiry etc, start labeling machine and date coding machine to label and date code cans, sample canned product and transfer to quality lab for analysis, pack labeled cans into cartons and transfer to storage area and store maintaining storage conditions following SOP		1	0.5	0.5
	PC39. Report discrepancies/concerns to department supervisor for immediate action		1	0.5	0.5
	PC40. Clean the work area, machineries, equipment and tools using recommended cleaning agents and sanitizers		2	0.5	1.5
	PC4. Attend minor repairs/faults of all machines (if any)		1	0.5	0.5
	PC42. Ensure periodic (daily/weekly/monthly/quarterly/half yearly/annual) maintenance of all machines		1	0.5	0.5

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	and equipment following the SOP or following suppliers instructions/manuals				
	Total		100	35	65
4. FIC/Q0123: Complete documentation and record keeping related to production of fruit pulp	PC1. Document and maintain records of details of raw materials and packaging materials as per organizational standards	100	10	6	4
	PC2. Document and maintain record on observations (if any) related to raw materials and packaging materials		5	3	2
	PC3. Load the raw material details in ERP for future reference		5	3	2
	PC4. Verify the documents and track from finished products to raw materials, in case of quality concerns and during quality management system audits		5	3	2
	PC5. Document and maintain records of production plan with details		10	6	4
	PC6. Document and maintain records of process details for entire production in process chart or production log for all products produced		15	9	6
	PC7. Document and maintain records of batch size, production yield, wastage of raw materials, energy utilization and final product produced		10	6	4
	PC8. Document and maintain record of observations or deviations		5	3	2
	PC9. Load the production plan and process details in ERP for future reference		5	3	2
	PC10. Verify documents and track from finished product to ingredients, in case of quality concerns and for quality management system audit		5	3	2
	PC11. Document and maintain records of finished products		3	2	1
	PC12. Document and maintain records of the finished product details as per organizational standards		7	4	3
	PC13. Document and maintain record on observations or deviations related to finished products		5	3	2
	PC14. Load the finished product details in ERP for future reference		5	3	2
	PC15. Verify the documents and track from finished product to ingredients, in case of quality concerns and for quality management system audits		5	3	2

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	Total		100	60	40
5. FIC/N9001: Food Safety, hygiene and sanitation for processing food products	PC1. Comply with food safety and hygiene procedures followed in the organization	100	5	2	3
	PC2. Ensure personal hygiene by use of gloves, masks ,hair net, ear plugs, boots etc.		6	1	5
	PC3. Ensure hygienic production of food by inspecting raw materials, ingredients, finished products etc for compliance to physical, chemical and microbiological procedures		5	2	3
	PC4. Pack products in appropriate packaging material, label and store them in designated area free from pests, flies etc.		10	4	6
	PC5. Clean, maintain and monitor food processing equipments periodically, using it only for the specified purpose		5	2	3
	PC6. Use safety equipment such as fire extinguisher, eye wash unit, first aid kit when required		10	4	6
	PC7. Follow housekeeping practices by having designated area for machines/tools		5	2	3
	PC8. Follow industry standards like GMP, HACCP and product recall		10	4	6
	PC9. Attend training on hazard management to understand type of physical, chemical and microbiological hazards		5	1	4
	PC10. Identify, document and report problems such as rodents and pests to management		5	1	4
	PC11. Conduct workplace checklist audit before and after work to ensure safety and hygiene		5	1	4
	PC12. Document and maintain raw material, process, packaging material to maintain the effectiveness of quality system		4	1	3
	PC13. Determine the quality of food using criteria such as odor, color, taste and best before date and take immediate measures to prevent spoilage		5	2	3
	PC14. Store raw materials, finished products and allergens separately to prevent cross contamination		5	2	3

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	PC15. Label raw materials and finished products and store them in different storage areas according to safe food practices	5	2	3	
	PC16. Follow stock rotation based on FEFO/FIFO		10	4	6
	Total		100	35	65
	Grand Total	500	500	300	200
	Percentage Weightage		100	60%	40%
	Minimum Pass% to qualify (aggregate):			70%	



Model Curriculum

Supervisor-Fruits and Vegetables Processing

SECTOR: FOOD PROCESSING
SUB-SECTOR: FRUITS & VEGETABLES
OCCUPATION: PROCESSING
REF ID: FIC/Q0109, V1.0
NSQF LEVEL: 5





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Supervisor-Fruits and Vegetables Processing

CURRICULUM / SYLLABUS

This program is aimed at training candidates for the job of a “Supervisor-Fruits and Vegetables processing”, in the “Food Processing” Sector/Industry and aims at building the following key competencies amongst the learner

Program Name	Supervisor-Fruits and Vegetables Processing		
Qualification Pack Name & Reference ID. ID	FIC/Q0109, v1.0		
Version No.	1.0	Version Update Date	01/08/2018
Pre-requisites to Training	Preferably Class 12 and 2 years’ experience in fruit and vegetable processing unit		
Training Outcomes	After completing this programme, participants will be able to: <ul style="list-style-type: none">• ensure preparation of work area and process machineries for fruit & vegetable processing,• execute production planning of fruits & vegetable processing,• supervise and coordinate activities of workers engaged in production of fruits & vegetable products,• perform documentation and record keeping of raw material, ingredients and the finished good,• apply sanitation and hygiene practices in the work environment,• manage and lead the team.		

This course encompasses 6 out of 6 National Occupational Standards (NOS) of “Supervisor-Fruits and Vegetables Processing” Qualification Pack issued by “Food Industry Capacity and Skill Initiative”.

Sr. No.	Module	Key Learning Outcomes	Equipment Required
1	<p>Introduction to Training Program and Overview of Food Processing Industry</p> <p>Theory Duration (hh:mm) 07:00</p> <p>Practical Duration (hh:mm) 00:00</p> <p>Corresponding NOS Code Bridge Module</p>	<ul style="list-style-type: none"> Define food processing List the various sub sectors of food processing industry Define fruits and vegetables Processing List the various units within a fruits and vegetables processing industry State the roles and responsibilities of supervisor-fruits and vegetables processing 	
2	<p>Organizational Standards and Norms</p> <p>Theory Duration (hh:mm) 05:00</p> <p>Practical Duration (hh:mm) 10:00</p> <p>Corresponding NOS Code Bridge Module</p>	<ul style="list-style-type: none"> State the roles and responsibilities of a Supervisor-fruits and vegetables processing State how to conduct yourself at the workplace State the personal hygiene and sanitation guidelines State the food safety hygiene standards to follow in a work environment 	Protective Gloves, Head Caps, Lab Coat, Safety Goggles, Safety Boots, Mouth Masks, Sanitizer, Food Safety Manual
3	<p>Ensure Preparation and Maintenance of Work Area and Process Machineries for Production of Fruit and Vegetable Products</p> <p>Theory Duration (hh:mm) 10:00</p> <p>Practical Duration (hh:mm) 20:00</p>	<ul style="list-style-type: none"> Check if the work area is cleaned using approved sanitizers Describe the importance of cleanliness of the work area Check if the work area is safe and hygienic for food production Check the working and performance of all machineries and tools used for fruits and vegetables processing Check if the equipment are washed with approved sanitizers Check if the disposal of waste material is as per SOP 	Fruit Washer, Peeler, Fruit Pulper , Juice Extractor, Clarifier, Filter, Pasteurizer, Steam Jacketed Kettles, Packaging Machines, Protective Gloves, Head Caps, Lab Coat, Safety Goggles, Safety Boots, Mouth Masks, Sanitizer, Food Safety Manual

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	Corresponding NOS Code FIC/N0131		
4.	Execute production planning of Fruit and Vegetable Products Theory Duration (hh:mm) 10:00 Practical Duration (hh:mm) 20:00 Corresponding NOS Code FIC/N0132	<ul style="list-style-type: none"> • Perform the grouping of ingredients for same type of products • Plan production sequence • Demonstrate the allotting of responsibilities • Perform calculation for raw material requirement • Perform a check on the availability of raw material, ingredients and packaging materials 	Fruit Washer, Peeler, Fruit Pulper , Juice Extractor, Clarifier, Filter, Pasteurizer, Steam Jacketed Kettles, Packaging Machines, Protective Gloves, Head Caps, Lab Coat, Safety Goggles, Safety Boots, Mouth Masks, Sanitizer, Food Safety Manual
5.	Supervise Production of Fruit and Vegetable Products Theory Duration (hh:mm) 15:00 Practical Duration (hh:mm) 40:00 Corresponding NOS Code FIC/N0133	<ul style="list-style-type: none"> • Perform a check if all the machineries are clean and in good working conditions • Demonstrate assembling of all components of machines • Perform a pre check on all machineries • Review of the production order • Check if the production area is clean for processing of fruits and vegetables • Check the quality report of fruits and vegetables to ensure conformance to the industry standards • Demonstrate the monitoring of control panel of each fruits and vegetables processing machinery • Co-ordinate with the maintenance team and ensure machine breakdowns are attended • Check for timely production of the food product • Complete all the documents related to production and pass them on to manager • Demonstrate cleaning the machineries used with recommended sanitizers following CIP (clean-in-place) procedure • Demonstrate cleaning the equipment and tools used using recommended cleaning agents and sanitizers 	Fruit Washer, Peeler, Fruit Pulper , Juice Extractor, Clarifier, Filter, Pasteurizer, Steam Jacketed Kettles, Packaging Machines, Protective Gloves, Head Caps, Lab Coat, Safety Goggles, Safety Boots, Mouth Masks, Sanitizer, Food Safety Manual
6.	Complete Documentation and Record Keeping	<ul style="list-style-type: none"> • State the need for documenting and maintaining records of raw materials, processes and finished products • State the method of documenting and 	Food Safety Manual, Log Books.

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	<p>Related to Packaging Food Products</p> <p>Theory Duration (hh:mm) 06:00</p> <p>Practical Duration (hh:mm) 05:00</p> <p>Corresponding NOS Code FIC/N0134</p>	<p>recording the details of raw material to final finished product</p> <ul style="list-style-type: none"> • Demonstrate the process of documenting records of production plan, process parameters, and finished products 	
7.	<p>Food Safety, Hygiene and Sanitation for Packaging Food Products</p> <p>Theory Duration (hh:mm) 10:00</p> <p>Practical Duration (hh:mm) 35:00</p> <p>Corresponding NOS Code FIC/N9001</p>	<ul style="list-style-type: none"> • State the importance of safety, hygiene and sanitation in the baking industry • Apply the industry standards to maintain a safe and hygiene workplace • Apply HACCP principles to eliminate food safety hazards in the process and products • Apply safety practices in the work area 	<p>Protective Gloves, Head Caps, Aprons, Safety Goggles, Safety Boots, Mouth Covers, Sanitizer, Food Safety Manual ,Log Books etc.</p>
8.	<p>Leadership Skills</p> <p>Theory Duration (hh:mm) 04:00</p> <p>Practical Duration (hh:mm) 10:00</p> <p>Corresponding NOS Code FIC/N9004</p>	<ul style="list-style-type: none"> • Perform a check if the team is aware about the schedule and expectations from them • Conduct regular meetings with the team members • Tell the team member to participate in various activities organized by the organization • Demonstrate counselling of team members • Conduct training of team members • Provide feedback to the team members 	<p>Computer/Laptop, Log Books</p>
9.	<p>Professional and Core Skills</p> <p>Theory Duration (hh:mm) 04:00</p>	<ul style="list-style-type: none"> • Plan a general aptitude self-assessment test • Identify personal strengths and weaknesses • Plan and schedule the work order 	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	Practical Duration (hh:mm) 10:00 Corresponding NOS Code Bridge Module	<ul style="list-style-type: none"> • Manage time effectively to complete the tasks assigned • Identify and resolve potential problems and take preventive measure to prevent it • State the importance of decision making • State the importance of listening 	
10.	IT Skills Theory Duration (hh:mm) 04:00 Practical Duration (hh:mm) 15:00 Corresponding NOS Code Bridge Module	<ul style="list-style-type: none"> • Identify parts of the computer • Use the computer keyboard effectively to type • Use computer applications effectively to record day-to-day activities • Use the word processor effectively • Use the spreadsheet application effectively • Use the computer to document day-to-day activities 	Computer/Laptop
	Total Duration 240:00 Theory Duration 75:00 Practical Duration 165:00	Unique Equipment Required: Fruit Washer, Peeler, Fruit Pulper , Juice Extractor, Clarifier, Filter, Pasteurizer, Steam Jacketed Kettles, Packaging Machines, Protective Gloves, Head Caps, Lab Coat, Safety Goggles, Safety Boots, Mouth Masks, Sanitizer, Food Safety Manual, Log Books, Computer/Laptop	

Grand Total Course Duration: **240Hours, 0 Minutes**
 Recommend OJT Hours: **60Hours, 0 Minutes**

(This syllabus/ curriculum has been approved by SSC: Food Industry Capacity and Skill Initiative)

Trainer Prerequisites for Job role: “Supervisor- Fruits and Vegetables Processing” mapped to Qualification Pack: “FIC/Q0109, v1.0”

Sr. No.	Area	Details
1	Description	To deliver accredited training service, mapping to the curriculum detailed above, in accordance with the Qualification Pack “FIC/Q0109”, Version 1.0
2	Personal Attributes	An aptitude for conducting training, and pre/ post work to ensure competent, employable candidates at the end of the training, and pre/post work to ensure competent, employable candidates at the end of the training. Strong communication skills, ability to work as part of a team; a passion for quality and for developing others; well-organized and focused, eager to learn and keep oneself updated with the latest in the mentioned fields.
3	Minimum Educational Qualifications	<ul style="list-style-type: none"> • B.Sc/B.Tech/BE in Food Technology or Food Engineering with 2-3 years of hands on experience in a Fruits/Vegetables Unit • M.Sc/M.Tech/ME in Food Technology or Food Engineering with 1-2 years of hands on experience in a Fruits/Vegetables Unit
4a	Domain Certification	Certified for Job Role: “Supervisor-Fruits & Vegetables Processing” mapped to QP: “FIC/Q0109, v1.0”. Minimum accepted score is 80%
4b	Platform Certification	Recommended that the Trainer is certified for the Job Role: “Trainer”, mapped to the Qualification Pack: “MEP/Q0102”. Minimum accepted score is 80 % as per FICSI guidelines.
5	Experience	<ul style="list-style-type: none"> • B.Sc/B.Tech/BE in Food Technology or Food Engineering with 2-3 years of hands on experience in a Fruits/Vegetables Unit • M.Sc/M.Tech/ME in Food Technology or Food Engineering with 1-2 years of hands on experience in a Fruits/Vegetables Unit



Annexure: Assessment Criteria

Assessment Criteria	
Job Role	Supervisor-Fruits and Vegetables Processing
Qualification Pack	FIC/Q0109, v1.0
Sector Skill Council	Food Processing

Guidelines for Assessment

1. Criteria for assessment for each Qualification Pack will be created by the Sector Skill Council. Each Performance Criteria (PC) will be assigned marks proportional to its importance in NOS. SSC will also lay down proportion of marks for Theory and Skills Practical for each PC
2. The assessment for the theory part will be based on knowledge bank of questions created by the SSC.
3. Assessment will be conducted for all compulsory NOS, as well as the selected elective NOS/set of NOS.
OR
4. Assessment will be conducted for all compulsory NOS, as well as the selected optional NOS/set of NOS.
5. Individual assessment agencies will create unique question papers for theory part for each candidate at each examination/training center (as per assessment criteria below)
6. Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/training center based on this criteria
7. To pass the Qualification Pack, every trainee should score a minimum of 70% of aggregate marks to successfully clear the assessment.
8. In case of unsuccessful completion, the trainee may seek reassessment on the Qualification Pack

Total Marks: 600	Compulsory NOS				
Assessable outcomes	Assessment criteria for outcomes	Total Marks	Out Of	Theory	Skills Practical
1. FIC/N0131: Prepare and maintain work area and process machineries for production of fruits & vegetables	PC.1 ensure work area is cleaned using approved sanitizers and cleanliness is maintained to keep it free from dust, waste, flies and pests	100	15	5	10
	PC2. Ensure that the work area is safe and hygienic for food processing		20	8	12
	PC3. ensure disposal of waste materials as per defined SOPs and industry requirements		15	6	9
	PC4. ensure the working and performance of all machineries and tools used for production of fruits and vegetable products like washer, peeler, slicer, pulper, pasteurizer, drier, refractometer, salinometer, double jacketed kettle, juice extractor, clarifier, evaporator, retort, packaging machines etc.		20	8	12
	PC5. ensure machineries and tools are cleaned using recommended sanitizers following the SOP		10	4	6
	PC6. ensure tools required for process are placed accessible, to use when necessary		5	1	4
	PC7. ensure minor repairs/ faults of all machines are attended		15	3	12
			100	35	65
2. FIC/N0132: execute production planning of fruits & vegetable products	PC1. plan production sequence by <ul style="list-style-type: none"> grouping products of same type (varieties of juices, pulps, jams, pickles etc) using same equipment and machinery for various products such that one product does not impact the quality of the other planning maximum capacity utilization of machineries considering the process time for each product planning efficient utilization of resources/manpower prioritizing urgent orders 		27	10	17
	PC2. calculate the batch size based on the production order and machine capacity		7	2	5
	PC3. calculate lead time for production of various products planned		11	3	8
	PC4. prepare shift schedule for assistants/technicians		5	2	3
	PC5. allot responsibilities work to the assistants/technicians and helpers		5	2	3
	PC6. calculate the raw material requirement		5	2	3

Total Marks: 600	Compulsory NOS				
Assessable outcomes	Assessment criteria for outcomes	Total Marks	Out Of	Theory	Skills Practical
	(considering the process loss) to produce finished product(s) as per production order				
	PC7. calculate the raw materials, packaging materials and manpower requirement for completing the order		5	2	3
	PC8. check the availability of raw materials, packaging materials, equipment and manpower		9	3	6
	PC9. prepare indent for issue of raw materials and packaging materials from store		3	1	2
	PC10. ensure transfer of raw materials and packaging materials from store production and packaging area through helpers		2	0.5	1.5
	PC11. ensure checking the weight of raw materials and packaging materials received from store and check its conformance of quality to organisation standards through physical parameters like appearance, colour, texture etc		8	2.5	5.5
	PC12. verify quality documents from supplier and internal lab to ensure its conformance to standards		9	4	5
	PC13. ensure raw materials (including ingredients, additives, preservatives etc) for the batch are weighed accurately following the formulations		4	2	2
			100	35	65
3. FIC/N0133: Supervise production of fruit and vegetable products	PC1. check and ensure cleanliness and sterilization of all fruit and vegetable processing machineries like washer, peeler, slicer, pulper, drier, juice extractor, juice clarifier, evaporator, retort, pasteurizer, steam jacketed kettle, packaging machines etc	100	2	0.5	1.5
	PC2. check and ensure maintenance has been carried out on all fruit and vegetable processing machineries and equipments		2	0.5	1.5
	PC3. check and ensure all process machineries are clean and in good mechanical condition		2	0.5	1.5
	PC4. check assembling of fittings like stirrer, blades, pipes and other parts to equipment and ensure all machineries are ready for production		5	0.5	4.5
	PC5. start each process machineries and ensure its working and performance and check if required tools are kept accessible to attend repairs/faults in case of breakdown		2	0.5	1.5

Total Marks: 600		Compulsory NOS			
Assessable outcomes	Assessment criteria for outcomes	Total Marks	Out Of	Theory	Skills Practical
	PC6. review production orders or schedules to ascertain product details such as type of products to be produced, quantities, specifications of products and scheduled delivery dates in order to plan production operation		2	1	1
	PC7. check and ensure production area is safe and clean		2	0	2
	PC8. verify the quality report on raw materials to ensure its conformance to quality standards		2	1	1
	PC9. monitor control panel of each fruit and vegetable processing machinery and ensure applicable process parameters like temperature, pressure, time etc (as applicable) are set in accordance with standards for production of various fruit and vegetable products		3	1	2
	PC10. observe control points and equipments at regular intervals to ensure operational performance and optimum utilization		3	1	2
	PC11. stop production following stop procedure, in case of machine breakdowns during production		3	1	2
	PC12. co-ordinate with maintenance team and ensure machine breakdowns are attended to immediately in order to prevent operational delays		3	1	2
	PC13. suggest control measures and corrective actions for any problems related to production, process and products, if required consult with manager and resolve problems		4	1.5	2.5
	PC14. ensure product quality by establishing and enforcing organization standards in each stage of production process		3	1	2
	PC15. monitor packaging of finished products, perform random check on weight of packed products, check label details like date of manufacture, batch number, expiry date etc and ensure products are packed as per organisation and regulatory standards		4	1.5	2.5
	PC16. monitor production activities, coordinate with cross function team and ensure production is started and completed as scheduled		4	1.5	2.5
	PC17. ensure timely production with minimum or no wastage, and quality of products		4	1.5	2.5

Total Marks: 600	Compulsory NOS				
Assessable outcomes	Assessment criteria for outcomes	Total Marks	Out Of	Theory	Skills Practical
	produced meets organisation and regulatory standards				
	PC18. analyze production performance records and data, investigate issues related to fruit and vegetable products processing, discuss with manger and identify solutions to prevent/correct problems, and ensure to implement suggested corrective action		4	1.5	2.5
	PC19. evaluate new equipment and techniques while producing new products and on installation of new machineries		4	2	2
	PC20. maintain safe and clean work environment by educating team on procedures to maintain compliance		3	1.5	1.5
	PC21. monitor activities and performance of assistants, technicians, operators and helpers		7	3	4
	PC22. provide production information to the manager by compiling, sorting, and analysing production performance records of all shifts		4	1.5	2.5
	PC23. update manager on day-to-day activities, discuss problem, suggest or understand suggested preventive and corrective action, and implement corrective actions immediately		4	1	3
	PC24. update manager on day-to-day activities, discuss problem, suggest or understand suggested preventive and corrective action, and implement corrective actions immediately		6	2	4
	PC25. monitor cleaning of work area, equipments and tools using recommended cleaning agents and sanitizers		8	3	5
	PC26. ensure minor repairs/faults (if any) of all components and machines are attended to before the start of next production		4	1	3
	PC27. ensure periodic (daily/weekly/monthly/quarterly/half yearly/annual) maintenance of all machines and equipment following the sop or following suppliers instructions/manuals		6	3	3
			100	35	65
4. FIC/N0134: Complete documentation	PC1. Document and maintain records of details of raw materials type and variety, grown area, grown season, quantity,	100	10	6	4

Total Marks: 600	Compulsory NOS				
Assessable outcomes	Assessment criteria for outcomes	Total Marks	Out Of	Theory	Skills Practical
and record keeping related to production of fruit and vegetable products	vendor/supplier details, date of manufacture, expiry date, quality report from supplier and internal lab etc. as per organisation standards				
	PC2. Document and maintain record on observations (if any) related to raw materials and packaging materials		5	3	2
	PC3. Load the raw material details in ERP for future reference		5	3	2
	PC4. Verify the documents and track from finished products to raw materials, in case of quality concerns and during quality management system audits		5	3	2
	PC5. Document and maintain records of production plan with details such as product details, production sequence, equipments and machinery details, efficiency and capacity utilization of equipment		10	6	4
	PC6. Document and maintain records of process details for entire production in process chart or production log for all products produced		15	9	6
	PC7. Document and maintain records of batch size, production yield, wastage of raw materials, energy utilization and final product produced		10	6	4
	PC8. Document and maintain record of observations or deviations (if any) or deviations related to process and production		5	3	2
	PC9. Load the production plan and process details in ERP for future reference		5	3	2
	PC10. Verify documents and track from finished product to ingredients, in case of quality concerns and for quality management system audit		5	3	2
	PC11. Document and maintain records of finished products		3	2	1
	PC12. Document and maintain records of the finished product details as per organizational standards		7	4	3
	PC13. Document and maintain record on observations or deviations related to finished products		5	3	2
	PC14. Load the finished product details in ERP for future reference		5	3	2

Total Marks: 600	Compulsory NOS				
Assessable outcomes	Assessment criteria for outcomes	Total Marks	Out Of	Theory	Skills Practical
	PC15. Verify the documents and track from finished product to ingredients, in case of quality concerns and for quality management system audits		5	3	2
			100	60	40
5. FIC/N9001: Food Safety, hygiene and sanitation for processing food products	PC1. Comply with food safety and hygiene procedures followed in the organization	100	5	2	3
	PC2. Ensure personal hygiene by use of gloves, masks, hair net, ear plugs, boots etc.		6	1	5
	PC3. Ensure hygienic production of food by inspecting raw materials, ingredients, finished products etc for compliance to physical, chemical and microbiological procedures		5	2	3
	PC4. Pack products in appropriate packaging material, label and store them in designated area free from pests, flies etc.		10	4	6
	PC5. Clean, maintain and monitor food processing equipments periodically, using it only for the specified purpose		5	2	3
	PC6. Use safety equipment such as fire extinguisher, eye wash unit, first aid kit when required		10	4	6
	PC7. Follow housekeeping practices by having designated area for machines/tools		5	2	3
	PC8. Follow industry standards like GMP, HACCP and product recall		10	4	6
	PC9. Attend training on hazard management to understand type of physical, chemical and microbiological hazards		5	1	4
	PC10. Identify, document and report problems such as rodents and pests to management		5	1	4
	PC11. Conduct workplace checklist audit before and after work to ensure safety and hygiene		5	1	4
	PC12. Document and maintain raw material, process, packaging material to maintain the effectiveness of quality system		4	1	3
	PC13. Determine the quality of food using criteria such as odor, color, taste and best before date and take immediate measures to prevent spoilage		5	2	3
	PC14. Store raw materials, finished products and allergens separately to prevent cross contamination		5	2	3
	PC15. Label raw materials and finished products and store them in different storage areas according to safe food practices		5	2	3

Total Marks: 600	Compulsory NOS				
Assessable outcomes	Assessment criteria for outcomes	Total Marks	Out Of	Theory	Skills Practical
	PC16. Follow stock rotation based on FEFO/FIFO		10	4	6
			100	35	65
6. FIC/N9004 (Manage and lead a team)	PC1. ensure that the team is aware of the schedule and job expectations on a daily basis		12	4	8
	PC2. involve the team in regular meetings to communicate information intended for them		12	4	8
	PC3. ensure communication to the team on any changes in policies/ processes by the organization through required verbal/ written mechanisms		12	4	8
	PC4. ensure participation of the team in various engagement initiatives organized by the organization		8	2	6
	PC5. counsel and address issues among the team for any work related issues		12	4	8
	PC6. support the manager in deployment of the team as per production schedule and the organizational norms and guidelines		6	2	4
	PC7. ensure periodic training of the team and support the team by delivering trainings		6	3	3
	PC8. share knowledge of processes, techniques and products with the team to enhance their skill levels		6	3	4
	PC9. provide feedback to the manager pertaining to performance of the team		6	3	3
		PC10. motivate workers, initiate and develop cooperation within and between departments, develop personal growth opportunities		4	1
	PC11. maintain effective supervisor-worker relations, create safe work environment, establish effective communication methods, identify and solve employee problems, manage conflict, respond to grievances		4	2	2
	PC12. manage employees and team performance, provide new employee orientation, educate team on procedures to maintain compliance, train or provide adequate training and motivate employees		4	1	3
	PC13. coach, counsel and discipline employees, initiate, coordinate and enforce systems, policies and procedures through team		4	2	2
	PC14. evaluate, investigate complaints or performance concerns, implement		4	2	2

Total Marks: 600	Compulsory NOS				
Assessable outcomes	Assessment criteria for outcomes	Total Mark s	Out Of	Theory	Skills Practical
	disciplinary action as needed in consultation with proper authorities				
			100	35	65



Model Curriculum

Food Regulatory Affairs Manager

SECTOR: FOOD PROCESSING

SUB-SECTOR: FRUIT & VEGETABLE, FOOD GRAIN MILLING (INCLUDING OILSEEDS), DAIRY PRODUCTS, MEAT & POULTRY, FISH & SEAFOOD, BREAD & BAKERY, ALCOHOLIC BEVERAGES, AERATED WATER/ SOFT DRINKS, SOYA FOOD, PACKAGED FOOD

OCCUPATION: QUALITY ASSURANCE

REF ID: FIC/Q9002, V1.0

NSQF LEVEL: 6



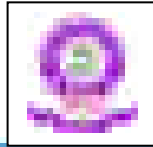


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Food Regulatory Affairs Manager

CURRICULUM / SYLLABUS

This program is aimed at training candidates for the job of a “Food Regulatory Affairs Manager”, in the “Food Processing” Sector/Industry and aims at building the following key competencies amongst the learner

Program Name	Food Regulatory Affairs Manager		
Qualification Pack Name & Reference ID. ID	FIC/Q9002, v1.0		
Version No.	1.0	Version Update Date	23/02/2016
Pre-requisites to Training	Master’s degree in food science with 8-10 years’ experience in food processing unit or food regulatory matters		
Training Outcomes	<p>After completing this programme, participants will be able to:</p> <ul style="list-style-type: none"> Designing, developing, implementing and changing food regulatory systems in the organisation. Act as a liaison between organisation and government regulatory agencies Ensure that the products produced and distributed comply with regulatory standards. 		



This course encompasses 3 out of 3 National Occupational Standards (NOS) of “Food Regulatory Affairs Manager” Qualification Pack issued by “Food Industry Capacity and Skill Initiative”.

Sr. No.	Module	Key Learning Outcomes	Equipment Required
1	<p>Introduction to the training program</p> <p>Theory Duration (hh:mm) 01:30</p> <p>Practical Duration (hh:mm) 00:00</p> <p>Corresponding NOS Code Bridge Module</p>	<p>Introduce each other and build rapport with fellow participants and the trainer.</p>	<p>White board/Chart papers, marker</p>
2	<p>Overview of the “Food Regulatory Affairs Manager” Role</p> <p>Theory Duration (hh:mm) 01:00</p> <p>Practical Duration (hh:mm) 00:00</p> <p>Corresponding NOS Code</p>	<p>Understanding the roles and responsibilities of food regulatory affairs manager</p> <p>Awareness of the nature and availability of job opportunities</p>	<p>Laptop/computer white board, marker, projector, chart papers</p>
3	<p>Introduction to the Food Processing Industry</p> <p>Theory Duration (hh:mm) 01:00</p> <p>Practical Duration (hh:mm) 00:00</p> <p>Corresponding NOS Code</p>	<p>Define food processing</p> <p>List the various sub-sectors of food processing industry</p>	<p>Laptop, white/black board, marker, chart papers, projector, Trainer’s guide, Student manual</p>
4	<p>Introduction to the food regulations and affairs</p> <p>Theory Duration (hh:mm) 05:00</p> <p>Practical Duration</p>	<p>List the terminology used in the food regulation process</p> <p>State various methods to ensure food regulation</p> <p>State the processes to oversee for ensuring that the food regulations are in compliance</p>	<p>Laptop, white/black board, marker, chart papers, projector, trainer’s guide, student handbook</p>

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	(hh:mm) 30:00 Corresponding NOS Code	Understand what are regulatory policies of an organization and follow them	
5	Design, develop and implement regulatory system Theory Duration (hh:mm) 13:00 Practical Duration (hh:mm) 21:00 Corresponding NOS Code FIC/N9011	Understand food safety regulations and develop regulatory policies for the organisation with clear definitions to increase consistency, legal security and to provide high level of food safety Design regulatory system with focus on risk reduction, risk-based priorities, reflect integrated and economically feasible initiatives, and ensure high quality and transparency Design and develop regulatory system with intuitive approach to food safety such that problem are recognized, understood, dealt, and checked to ensure problem has been dealt efficiently and effectively Design regulatory system with contingency planning like product traceability and product recall in case of problems, procedures for handling containment, with clear attribution of roles like lines of authority and co-ordination mechanism across food chain (from procuring raw materials, production until product reaching consumers) Design regulatory system with improved communication on food safety information in marketing materials, product labels etc, providing science based information to clear up the unjustified fear among consumers Set food safety system involving food producers, processors, distributors, retailers and consumers to recognize their primary responsibility and to share a common goal of ensuring food safety at all stages Design food regulatory system involving GMP, GHP, and monitoring systems like HACCP Design regulatory system that improve efficiency and compliance, build consumer confidence in the safety and quality of food products	Laptop, white/black board, marker, chart papers, projector, trainer's guide, student handbook, quality manual, quality policy



Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>produced, processed, marketed, distributed and sold</p> <p>Design and develop regulatory system ensuring food and health standards are followed in each stage of production and produce food products that meet national and international regulatory standards and protect the health of consumers</p> <p>Design regulatory system including provisions for the right of consumers to have access to accurate and sufficient information and make adequate choices</p> <p>Provide strategic advice and cost effective strategies on regulatory aspects/requirements to senior management and project managing teams throughout the development of a new product</p> <p>Interpret regulatory standards and develop organisation standards meeting national and international food safety regulations like FSSAI, FDA, EU food safety regulations, codex alimentarius etc for products produced, exported and imported, and labels of products packed by the organisation</p> <p>Develop and review standard operating procedures (SOPs) and ensure that they are in compliance with current regulatory requirements and provide regulatory support for corporate quality assurance efforts</p> <p>Develop organisation standards for labels of food products produced and packed, promotional marketing materials, products imported and exported by the organisation to meet national and international food regulatory</p> <p>Evaluate labels of packed food products to ensure it meets national and international food regulatory standards and provide approval or recommend changes</p> <p>Evaluate promotional and materials for regulatory impact and provide approval</p> <p>Provide support for review of essential documents, development and review of consent forms for submission to regulatory authorities for clearance</p>	



Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>Initiate and contribute to process improvements which have an impact on regulatory affairs, quality assurance and other departments</p> <p>Conduct audits on food processing unit for compliance with regulatory, safety and hygiene standards implemented and followed in the organisation</p> <p>Conduct periodic audits to evaluate haccp plans and their implementation in the organisation and ensure it meets the regulatory standards</p> <p>Review internal and external audit reports to check the effectiveness of the present regulatory system and recommend necessary changes in the policies and procedures to reduce failures in the future</p> <p>Identify reason for consumer cases in court related to non-compliance of food products to regulatory standards, collect relevant information's and documents transmitting evidence to produce in court to assist prosecution</p> <p>Monitor company progress toward fulfillment of regulatory commitments</p> <p>Provide training to department managers on organisation policies on food and safety regulations, national and international food laws and regulations, methods and procedures for implementing regulations for procuring raw materials, producing food products, marketing and selling quality products to the consumers</p> <p>Provide training to all department managers on the importance of food regulatory standards and need for its compliance, statutory and regulatory requirements for the products produced, labels of packed products and promotional materials, and the consequences for not following the regulatory requirements</p> <p>Provide training on procedures for collecting evidence in case of problems/consumer complaints/consumer cases in court</p>	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>and handling them with technical and scientific approach</p> <p>Provide training to all department managers on methods to implement and monitor regulatory system in their area of function, writing reports with relevant information and data to present to local food regulatory authorities for any concerns raised / clarification required, methods to approach and maintain relationship with food regulatory authorities</p> <p>Provide training on upgradation and changes in the food regulatory system and methods to implement, monitor and achieve them</p>	
6	<p>Manage change in food regulatory system</p> <p>Theory Duration (hh:mm) 14:00</p> <p>Practical Duration (hh:mm) 20:00</p> <p>Corresponding NOS Code FIC/N9012</p>	<ul style="list-style-type: none"> • Identify procedures, systems, structures that need to be changed for effective implementation of food regulatory system • Assess gaps in the current policies and procedures and analyze the future requirements • Identify and assess barriers to change in regulatory system, develop strategies and plans to overcome those barriers • Assess risks and benefits associated with the strategies and plans, and develop contingency arrangements design new work processes, procedures, systems, structures and roles to achieve planned changes in regulatory system • Ensure plan for change in regulatory system include short-term as well as longer-term deliverables • Develop system for monitoring and assessing regulatory system to assess progress in changes implemented • Develop reporting and communicating system to review the effectiveness of the changes in regulatory system and to obtain feedback • Provide training and support to implement changes planned in regulatory system • Communicate reasons, importance and benefits of implementing change in regulatory system, future that can be achieved through 	Laptop, white/black board, marker, chart papers, projector, trainer's guide, student handbook, quality manual, quality policy, regulatory policies



Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>implementing and following the change, to management and concerned employees</p> <ul style="list-style-type: none">• Make the management and employees welcome change in regulatory system as an opportunity to deliver products of national and international quality• Make the management and employees understand the need and importance for change in regulatory system, result expected out of change and its effect on the organisation• Implement the strategies and plans for change in regulatory system with available resources• Make the managers responsible for implementing change in regulatory system understand their responsibilities and commitment, and use their influence and power over employees to implement change• Set and prioritize objectives for the change in regulatory system, identify and deal with obstacles to change, and support employees through the change process• Communicate progress achieved through change in regulatory system to everyone involved, and make them understand and enjoy achievement• Review reports on total quality management system to evaluate effectiveness of changes implemented in regulatory system of the organisation• Organize internal and external audit on total quality management system to evaluate effectiveness of the changes implemented in regulatory system• Monitor changes implemented in regulatory system, document and communicate the outcome of implemented change to the management• Recognize and reward employees and teams for implementing regulatory system and achieving results through new policies and procedures	



Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<ul style="list-style-type: none"> Monitor and ensure changes implemented in regulatory system are effective and meet the requirements of the organisation and regulatory system laid by national and international regulatory bodies 	
7	<p>Prepare representations to regulatory authorities and for new product registrations</p> <p>Theory Duration (hh:mm) 09:00</p> <p>Practical Duration (hh:mm) 14:00</p> <p>Corresponding NOS Code FIC/N9013</p>	<p>Prepare simple and complex regulatory documents in accordance with applicable FSSAI regulations by collecting, collating and evaluating scientific data that has been well researched on relevant aspects</p> <p>Review regulatory guidance and requirements pertaining to products produced in the organisation and prepare documents providing thoughtful and accurate comments</p> <p>Prepare regulatory documents to authorities that translate regulatory requirements into practical, workable plans with timelines for development and implementation</p> <p>Coordinate with food regulatory authorities to review disputed matters, negotiation and finalization on products and projects, and for comments and formal approvals</p> <p>Prepare documents that include check lists created and maintained to implement regulatory requirements, technical data, and declarations of conformity</p> <p>Interface with consultants, research organizations, partners, co-manufacturers etc. for preparation, review, compilation, finalization and submission of documents for regulatory approvals</p> <p>Prepare responses to communications and other requests from government food regulatory authorities</p> <p>Prepare safety reports and documents on raw materials, ingredients, additives, flavours etc used in the products produced and marketed by the organisation, for regulatory submissions and clearance</p> <p>Identify reasons related to non-compliance of food products to regulatory standards, collect relevant information's and data,</p>	<p>Laptop, white/black board, marker, chart papers, projector, trainer's guide, student handbook, quality manual, quality policy, audit documents, regulatory policies</p>



Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>prepare technical documents with scientific facts and supporting evidence, and submit to relevant authorities, respond to communications from government authorities, and follow up regularly to revoke product ban</p> <p>Interact with various regulatory authorities during concept, development and industrialization stages of projects for clarification and approvals</p> <p>Interact with the notified bodies and competent authorities for developing and reviewing regulatory standards</p> <p>Coordinate with regulatory authorities for reporting, to comment on proposed regulations, and to represent company's interest in the development of standards and guidelines</p> <p>Discuss on the differences that exist in the regulations laid down by different governments and their interpretation by the regulatory agencies and ensure that efficient and economical regulatory standards are planned</p> <p>Identify possible threats or opportunities from upcoming regulations under FSSAI, consumer affairs, other government food policies and regulations and liaise with industry associations to tackle/manage them effectively</p> <p>Participate in seminar, workshops, conferences and meetings organised by FSSAI and other industry association, representing the organisation to maintain, strengthen and expand contacts</p> <p>Work closely with regulatory and trade associations like CII (confederation of indian industries), FICCI (federation of indian chambers of commerce and industries), CIFTI (confederation of indian food trade and industry), AIFPA (all india food processors association), ASSOCHAM(the associated chambers of commerce of india) etc on national and international regulatory changes and challenges that have impact on food products produced in the</p>	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>organisation and to manage them proactively</p> <p>Develop and write clear arguments and explanations for new product license</p> <p>Prepare and present registration documents to regulatory authorities and notified bodies for new product approvals</p> <p>Present written representation for new products and carry out negotiations with regulatory authorities to obtain necessary approvals for new product production and marketing</p> <p>Evaluate, prepare and submit new product registration applications and follow through the application during the evaluation phase to achieve favorable outcome</p> <p>Prepare responses to letter/e-mail communications and other requests from government food regulatory bodies on new product approval</p> <p>Provide regulatory and product compliance report in the area of advertising and label claims for new products</p>	
8	<p>Field Visits</p> <p>Theory Duration (hh:mm) 04:00</p> <p>Practical Duration (hh:mm) 20:00</p> <p>Corresponding NOS Code</p>	<p>Observe the location, layout and safety aspects of food processing</p> <p>Observe the storage facilities for raw materials and finished products</p> <p>Observe the various machineries used in process</p> <p>Observe the various machineries used in process</p> <p>Observe the cleaning methods and processes followed to maintain the process machineries and tools</p> <p>Observe the raw materials used and their storage procedures</p> <p>Observe the packaging and storage processes of raw material and finished product</p> <p>Observe the post-production cleaning and maintenance process followed in the industry</p>	All the tools and equipment listed above must be available at the site of field visit
9	<p>Revision</p> <p>Theory Duration (hh:mm) 01:00</p>	Revised the knowledge gained so far	All the tools and equipment listed above must be available at the time of revision



Sr. No.	Module	Key Learning Outcomes	Equipment Required
	Practical Duration (hh:mm) 01:00 Corresponding NOS Code		
10	Evaluation Theory Duration (hh:mm) 06:00 Practical Duration (hh:mm) 28:00 Corresponding NOS Code	Assess the knowledge and skills acquired by the participants	All the tools and equipment listed above must be available for evaluation
11	On-the-job Training Theory Duration (hh:mm) 08:00 Practical Duration (hh:mm) 24:00 Corresponding NOS Code	Apply the skills and knowledge acquired in the training program in the field	All the tools and equipment listed above must be available on the site at the time of OJT
	Total Duration 240:00 Theory Duration 79:00 Practical Duration 161:00	Unique Equipment Required: Laptop, white/black board, marker, chart papers, projector, trainer's guide, student handbook, quality manual, quality policy, audit documents, regulatory policies	

Grand Total Course Duration: **240 Hours, 0 Minutes**

(This syllabus/ curriculum has been approved by [SSC: Food Industry Capacity and Skill Initiative](#))

Trainer Prerequisites for Job role: “Food Regulatory Affairs Manager” mapped to Qualification Pack: “FIC/Q9002, v1.0”

Sr. No.	Area	Details
1	Description	To deliver accredited training service, mapping to the curriculum detailed above, in accordance with the Qualification Pack “FIC/Q9002”, Version 1.0
2	Personal Attributes	An aptitude for conducting training, and pre/ post work to ensure competent, employable candidates at the end of the training, and pre/post work to ensure competent, employable candidates at the end of the training. Strong communication skills, ability to work as part of a team; a passion for quality and for developing others; well-organized and focused, eager to learn and keep oneself updated with the latest in the mentioned fields.
3	Minimum Educational Qualifications	B.Sc/B.Tech/BE in Food Process Engineering/ Food Safety and Quality Management in Food Process Engineering with 5-6 years of hand on experience in QA/regulations of a food Processing Industry or M.Sc/M.Tech/ME or in Food Process Engineering/ Food Safety and Quality Management in Food Safety/Food Process Engineering with 3-4- years of hand on experience in QA/regulations of a food Processing Industry
4a	Domain Certification	Certified for Job Role: “ <u>Food regulatory affairs Manager</u> ” mapped to QP: “ <u>FIC/Q9002, v1.0</u> ”. Minimum accepted score is 80%
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 80 % as per FICSI guidelines.
5	Experience	B.Sc/B.Tech/BE in Food Process Engineering/ Food Safety and Quality Management in Food Process Engineering with 5-6 years of hand on experience in QA/regulations of a food Processing Industry or M.Sc/M.Tech/ME or in Food Process Engineering/ Food Safety and Quality Management in Food Safety/Food Process Engineering with 3-4- years of hand on experience in QA/regulations of a food Processing Industry



Annexure: Assessment Criteria

Assessment Criteria	
Job Role	Food regulatory affairs manager
Qualification Pack	FIC/Q9002 v1.0
Sector Skill Council	Food Processing

Sr. No.	Guidelines for Assessment
1	Criteria for assessment for each Qualification Pack will be created by the Sector Skill Council. Each Performance Criteria (PC) will be assigned marks proportional to its importance in NOS. SSC will also lay down proportion of marks for Theory and Skills Practical for each PC.
2	The assessment for the theory part will be based on knowledge bank of questions created by the SSC.
3	Individual assessment agencies will create unique question papers for theory part for each candidate at each examination/training centre(as per assessment criteria below)
4	Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/training center based on this criteria
5	To pass the Qualification Pack, every trainee should score a minimum of 70% (overall) in every QP
6	The marks are allocated PC wise; however, every NOS will carry a weight age in the total marks allocated to the specific QP

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
1. FIC/N9011: Design, develop and implement regulatory system	PC.1 understand food safety regulations and develop regulatory policies for the organisation with clear definitions to increase consistency, legal security and to provide high level of food safety	100	4	1.5	2.5
	PC2. design regulatory system with focus on risk reduction, risk-based priorities, reflect integrated and economically feasible initiatives, and ensure high quality and transparency		4	1.5	2.5
	PC3. design and develop regulatory system with intuitive approach to food safety such that problem are recognized, understood, dealt, and checked to ensure problem has been dealt efficiently and effectively		4	1.5	2.5
	PC4. design regulatory system with contingency planning like product traceability and product recall in case of problems, procedures for handling containment, with clear attribution of roles like lines of authority and co-ordination mechanism across food chain (from procuring raw materials, production until product reaching consumers		4	1.5	2.5
	PC5. design regulatory system with improved communication on food safety information in marketing materials, product labels etc, providing science based information to clear up the unjustified fear among consumers		4	1.5	2.5
	PC6. set food safety system involving food producers, processors, distributors, retailers and consumers to recognize their primary responsibility and to share a common goal of ensuring food safety at all stages		4	1.5	2.5
	PC7. design food regulatory system involving gmp, ghp, and monitoring systems like haccp		4	1.5	2.5
	PC8. design regulatory system that improve efficiency and compliance, build consumer confidence in the safety and quality of food products produced, processed, marketed, distributed and sold		4	1.5	2.5
	PC9. design and develop regulatory system ensuring food and health standards are followed in each stage of production and		4	1.5	2.5

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	produce food products that meet national and international regulatory standards and protect the health of consumers				
	PC10. design regulatory system including provisions for the right of consumers to have access to accurate and sufficient information and make adequate choices		4	1.5	2.5
	PC11. provide strategic advice and cost effective strategies on regulatory aspects/requirements to senior management and project managing teams throughout the development of a new product		4	1.5	2.5
	PC12. interpret regulatory standards and develop organisation standards meeting national and international food safety regulations like fssai, fda, eu food safety regulations, codex alimentarius etc for products produced, exported and imported, and labels of products packed by the organisation		4	1.5	2.5
	PC13. develop and review standard operating procedures (sops) and ensure sops are in compliance with current regulatory requirements and provide regulatory support for corporate quality assurance efforts		4	1.5	2.5
	PC14. develop organisation standards for labels of food products produced and packed, promotional marketing materials, products imported and exported by the organisation to meet national and international food regulatory		4	1.5	2.5
	PC15. evaluate labels of packed food products to ensure it meets national and international food regulatory standards and provide approval or recommend changes		4	1	3
	PC16. evaluate promotional and materials for regulatory impact and provide approval		4	1	3
	PC17. provide support for review of essential documents, development and review of consent forms for submission to regulatory authorities for clearance		3	1	2
	PC18. initiate and contribute to process improvements which have an impact on		3	1	2

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	regulatory affairs, quality assurance and other departments				
	PC19. conduct audits on food processing unit for compliance with regulatory, safety and hygiene standards implemented and followed in the organisation		3	1	2
	PC20. conduct periodic audits to evaluate haccp plans and their implementation in the organisation and ensure it meets the regulatory standards		3	1	2
	PC21. review internal and external audit reports to check the effectiveness of the present regulatory system and recommend necessary changes in the policies and procedures to reduce failures in the future		3	1	2
	PC22. identify reason for consumer cases in court related to non-compliance of food products to regulatory standards, collect relevant information's and documents transmitting evidence to produce in court to assist prosecution		3	1	2
	PC23. monitor company progress toward fulfillment of regulatory commitments		3	1	2
	PC24. provide training to department managers on organisation policies on food and safety regulations, national and international food laws and regulations, methods and procedures for implementing regulations for procuring raw materials, producing food products, marketing and selling quality products to the consumers		3	1	2
	PC25. provide training to all department managers on the importance of food regulatory standards and need for its compliance, statutory and regulatory requirements for the products produced, labels of packed products and promotional materials, and the consequences for not following the regulatory requirements		3	1	2
	PC26. provide training on procedures for collecting evidence in case of problems/consumer complaints/consumer cases in court and handling them with technical and scientific approach		3	1	2

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	PC27. provide training to all department managers on methods to implement and monitor regulatory system in their area of function, writing reports with relevant information and data to present to local food regulatory authorities for any concerns raised / clarification required, methods to approach and maintain relationship with food regulatory authorities		3	1	2
	PC28. provide training on upgradation and changes in the food regulatory system and methods to implement, monitor and achieve them		3	1	2
			100	35	65
2. FIC/N9012: Manage change in food regulatory system	PC1. identify procedures, systems, structures that need to be changed for effective implementation of food regulatory system	100	5	1	4
	PC2. assess gaps in the current policies and procedures and analyze the future requirements		5	1	4
	PC3. identify and assess barriers to change in regulatory system, develop strategies and plans to overcome those barriers		5	1	4
	PC4. assess risks and benefits associated with the strategies and plans, and develop contingency arrangements		5	1	4
	PC5. design new work processes, procedures, systems, structures and roles to achieve planned changes in regulatory system		5	1	4
	PC6. ensure plan for change in regulatory system include shortterm as well as longer-term deliverables.		4	1.5	2.5
	PC7. develop system for monitoring and assessing regulatory system to assess progress in changes implemented		5	2	3
	PC8. develop reporting and communicating system to review the effectiveness of the changes in regulatory system and to obtain feedback		5	2	3
	PC9. provide training and support to implement changes planned in regulatory system		4	2	2
	PC10. communicate reasons, importance and benefits of implementing change in regulatory system, future that can be achieved through implementing and		5	2	3



Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	following the change, to management and concerned employees				
	PC11. make the management and employees welcome change in regulatory system as an opportunity to deliver products of national and international quality		4	1.5	2.5
	PC12. make the management and employees understand the need and importance for change in regulatory system, result expected out of change and its effect on the organisation		5	2	3
	PC13. implement the strategies and plans for change in regulatory system with available resources		5	2	3
	PC14. make the managers responsible for implementing change in regulatory system understand their responsibilities and commitment, and use their influence and power over employees to implement change		5	2	3
	PC15. set and prioritize objectives for the change in regulatory system, identify and deal with obstacles to change, and support employees through the change process		5	2	3
	PC16. communicate progress achieved through change in regulatory system to everyone involved, and make them understand and enjoy achievement		4	1.5	2.5
	PC17. review reports on total quality management system to evaluate effectiveness of changes implemented in regulatory system of the organisation		5	2	3
	PC18. organize internal and external audit on total quality management system to evaluate effectiveness of the changes implemented in regulatory system		5	2	3
	PC19. monitor changes implemented in regulatory system , document and communicate the outcome of implemented change to the management		5	2	3
	PC20. recognize and reward employees and teams for implementing regulatory system and achieving results thorough new policies and procedures		4	1.5	2.5
	PC21. monitor and ensure changes implemented in regulatory system are		5	2	3

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	effective and meet the requirements of the organisation and regulatory system laid by national and international regulatory bodies		100	35	65
3. FIC/N9013: Prepare representations to regulatory authorities and for new product registrations	PC1. prepare simple and complex regulatory documents in accordance with applicable FSSAI regulations by collecting, collating and evaluating scientific data that has been well researched on relevant aspects	100	5	1	4
	PC2. review regulatory guidance and requirements pertaining to products produced in the organisation and prepare documents providing thoughtful and accurate comments		5	1	4
	PC3. prepare regulatory documents to authorities that translate regulatory requirements into practical, workable plans with timelines for development and implementation		5	1	4
	PC4. coordinate with food regulatory authorities to review disputed matters, negotiation and finalization on products and projects, and for comments and formal approvals		5	1	4
	PC5. prepare documents that include check lists created and maintained to implement regulatory requirements, technical data, and declarations of conformity		4	1.5	2.5
	PC6. interface with consultants, research organizations, partners, co-manufacturers etc for preparation, review, compilation, finalization and submission of documents for regulatory approvals		4	1.5	2.5
	PC7. prepare responses to communications and other requests from government food regulatory authorities		4	1.5	2.5
	PC8. prepare safety reports and documents on raw materials, ingredients, additives, flavours etc used in the products produced and marketed by the organisation, for regulatory submissions and clearance		4	1.5	2.5

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	PC9. Identify reasons related to noncompliance of food products to regulatory standards, collect relevant information's and data, prepare technical documents with scientific facts and supporting evidence, and submit to relevant authorities, respond to communications from government authorities, and follow up regularly to revoke product ban		4	1.5	2.5
	PC10. prepare simple and complex regulatory documents in accordance with applicable fssai regulations by collecting, collating and evaluating scientific data that has been well researched on relevant aspects		5	2	3
	PC11. review regulatory guidance and requirements pertaining to products produced in the organisation and prepare documents providing thoughtful and accurate comments		5	2	3
	PC12. prepare regulatory documents to authorities that translate regulatory requirements into practical, workable plans with timelines for development and implementation		5	2	3
	PC13. coordinate with food regulatory authorities to review disputed matters, negotiation and finalization on products and projects, and for comments and formal approvals		5	2	3
	PC14. prepare documents that include check lists created and maintained to implement regulatory requirements, technical data, and declarations of conformity		4	1.5	2.5
	PC15. interface with consultants, research organizations, partners, co-manufacturers etc for preparation, review, compilation, finalization and submission of documents for regulatory approvals		4	1.5	2.5
	PC16. prepare responses to communications and other requests from government food regulatory authorities		5	2	3
	PC17. develop and write clear arguments and explanations for new product license		5	2	3



Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	PC18. prepare and present registration documents to regulatory authorities and notified bodies for new product approvals		5	2	3
	PC19. present written representation for new products and carry out negotiations with regulatory authorities to obtain necessary approvals for new product production and marketing		5	2	3
	PC20. evaluate, prepare and submit new product registration applications and follow through the application during the evaluation phase to achieve favorable outcome		4	1.5	2.5
	PC21. prepare responses to letter/e-mail communications and other requests from government food regulatory bodies on new product approval		4	1.5	2.5
	PC22. Provide regulatory and product compliance report in the area of advertising and label claims for new products		4	1.5	2.5
	Total		100	35	65
	Grand Total	300	300	200	100
	Percentage Weightage		100	60%	40%
	Minimum Pass% to qualify (aggregate):			70%	



Model Curriculum

Production Manager

SECTOR: FOOD PROCESSING

**SUB-SECTOR: FRUIT & VEGETABLE, FOOD GRAIN
OCCUPATION: MILLING (INCLUDING OILSEEDS), DAIRY
PRODUCTS, MEAT & POULTRY, FISH & SEAFOOD,
BREAD & BAKERY, ALCOHOLIC BEVERAGES,
AERATED WATER/ SOFT DRINKS, SOYA FOOD,**

**PACKAGED FOOD
PROCESSING**

**REF ID: FIC/Q9003, V1.0
NSQF LEVEL: 7**





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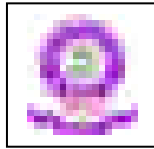
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Production Manager

CURRICULUM / SYLLABUS

This program is aimed at training candidates for the job of a “Production Manager”, in the “Food Processing” Sector/Industry and aims at building the following key competencies amongst the learner

Program Name	Production Manager		
Qualification Pack Name & Reference ID. ID	FIC/Q9003, v1.0		
Version No.	1.0	Version Update Date	30/03/2016
Pre-requisites to Training	Preferably Class 12 and 2-3 years' experience in a food processing unit		
Training Outcomes	<p>After completing this programme, participants will be able to:</p> <ul style="list-style-type: none"> Production of food products through the process of production planning, coordinating and controlling production process to achieve quantity and quality product Reviewing production process to minimize production cost and optimizing production. 		



This course encompasses 3 out of 3 National Occupational Standards (NOS) of “Production Manager” Qualification Pack issued by “Food Industry Capacity and Skill Initiative”.

Sr. No.	Module	Key Learning Outcomes	Equipment Required
1	<p>Introduction to the training program</p> <p>Theory Duration (hh:mm) 00:30</p> <p>Practical Duration (hh:mm) 00:00</p> <p>Corresponding NOS Code Bridge Module</p>	<p>Introduce each other and build rapport with fellow participants and the trainer.</p>	<p>White board/Chart papers, marker</p>
2	<p>Overview of the “Production Manager” Role</p> <p>Theory Duration (hh:mm) 01:00</p> <p>Practical Duration (hh:mm) 00:00</p> <p>Corresponding NOS Code</p>	<p>Understanding the roles and responsibilities of production manager</p> <p>Awareness of the nature and availability of job opportunities</p>	<p>Laptop/computer white board, marker, projector, chart papers</p>
3	<p>Introduction to the Food Processing Industry</p> <p>Theory Duration (hh:mm) 01:30</p> <p>Practical Duration (hh:mm) 00:00</p> <p>Corresponding NOS Code</p>	<p>Define food processing</p> <p>List the various sub sectors of food processing industry</p>	<p>Laptop, white/black board, marker, chart papers, projector, Trainer’s guide, Student manual</p>
4	<p>Introduction to food processing process</p> <p>Theory Duration (hh:mm) 02:00</p> <p>Practical Duration (hh:mm)</p>	<p>List the common machineries used in food processing</p> <p>Explain the process of testing food for accepted quality standards</p> <p>Demonstrate the test for checking the quality of food</p> <p>Describe the procedure for processing various food</p>	<p>Laptop, white board, marker, chart papers, projector, trainer’s guide and student handbook</p>

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	04:00 Corresponding NOS Code	Identify different equipment used in food industry	
5	Organizational standards and norms Theory Duration (hh:mm) 04:00 Practical Duration (hh:mm) 02:00 Corresponding NOS Code	State the roles and responsibilities of a production manager State how to conduct yourself at the workplace State the personal hygiene and sanitation guidelines State the food safety hygiene standards to follow in a work environment	Laptop, white board, marker, chart papers, projector, trainer's guide and student handbook, protective gloves, head caps, aprons, safety goggles, safety boots, mouth masks, sanitizer, safety manual
6	Manage production process in food processing unit Theory Duration (hh:mm) 15:00 Practical Duration (hh:mm) 11:40 Corresponding NOS Code FIC/N9014	<ul style="list-style-type: none"> Communicate the organisation policies and goals clearly to the employees of production team, make them understand and commit their energy and expertise to achieve organisation goals Achieve department targets and organisation goals by understanding the organisation and employees, developing a leadership style and applying them appropriately Communicate with employees regularly and effectively, help them identify their strengths, provide support to overcome their weakness, listen to their grievances and provide appropriate solutions, and win their trust and support Motivate and support employees to achieve their work and development objectives, and provide recognition when they are successful Encourage employees to take responsibilities, to take own decisions within agreed boundaries, to take lead in their own areas of expertise for their development Initiate personnel actions, such as promotions, transfers, discharges or disciplinary measures Lead production department and team successfully through difficulties and challenges Review the sales forecast for the week/month (or) monthly production 	Laptop, white board, marker, chart papers, projector, trainer's guide and student handbook



Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>plan discussed with plant manager (or) customer requirement (as applicable) and identify production priorities to meet market requirement</p> <ul style="list-style-type: none">• Identify and confirm resource availability such as raw materials, packing materials, equipment availability and capacity, production capacity, manpower requirement and availability, stock level, storage capacity, transport capacity etc• Plan details of production in terms of output quantity and quality, cost, time and manpower requirements• Analyze the consequences of failing to meet production/delivery timelines to meet the schedule, notify relevant authorities of any possibility that demand cannot be met within required timeframe• Develop production schedule to meet market demands/priorities and delivery timelines within budget and with available resources, consult production plan with inter department heads and production supervisor, instruct supervisor to allocate work to production team• Communicate the production schedule to cross function heads through communication system followed by the organisation such as e-mail or upload in the ERP system• Identify and confirm equipment requirements to meet production target, share production schedule with equipment requirement to maintenance manager/supervisor for maintenance plan that aligns with production plan• Co-ordinate with maintenance manager/supervisor to understand materials, consumables and manpower requirement and availability for maintenance activities, for uninterrupted production• Understand equipment maintenance process and procedure and co-ordinate for maintenance activities during breakdown, emergency response, routine cleaning and servicing, etc.• Analyze equipment maintenance data to interpret equipment	



Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>performance and arrive at production capability of each process equipment</p> <ul style="list-style-type: none">• Co-ordinate with maintenance team to ensure reliable equipment performance with minimal disruption to production, to minimize down time during equipment breakdowns, and to optimize equipment efficiency to achieve production target• Lead and build team spirit between production and maintenance personnel through effective communication to enhance equipment performance and to identify production improvement opportunities• Ensure maintenance procedures are followed meet food safety and environmental requirements• Monitor production process for usage of raw materials, packaging materials, manpower, wastage against production plan and identify reason for variances against plan• Address the reason for variation in achieving production schedule, production target within allocated budget• Adjust production schedule in response to variables affecting achievement of production target• Monitor production output and cost, adjust processes and resources to minimize cost and to achieve quantity and quality product• Reschedule production plan in case of urgent requirement or any unforeseen event, to minimize wastage and to utilize materials/utilities and resources efficiently, discuss and negotiate changes with inter department team on time for their support and team work• Review production schedule and process, consult /discuss with supervisor, team and cross function teams identify opportunities for improvement and develop recommendations for improvement on production process• Set polices, plans and procedures, and take initiative to implement the identified improvement opportunities	



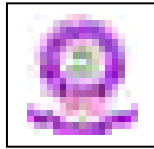
Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>to control cost and to achieve better yield and quality</p> <ul style="list-style-type: none">• Monitor, review and ensure production details are documented to meet the documentation requirements of the organisation, and to meet audit requirements like ISO, HACCP, etc• Understand objective of trial production, trial product processing method and specification, select production team for trial, discuss with cross function team like planning, QA, maintenance etc, clarify roles and responsibilities and level of authority to the team and cross function• Prepare technical production procedures considering all engineering and process parameters for new product trial, educate and train supervisors and operators on trial procedure• Identify and consider all possible hazards, prepare plan and procedures to prevent and control hazards, provide training to trial team to handle hazards• Prepare detailed trial production schedule to manage production process without overlapping/affecting with regular production, and considering availability of raw materials and packaging materials, machine availability and capability, man power availability and competency etc• Monitor trial production against plan to identify variances and factors that need to be adjusted to achieve product of required specification within the planned time• Document and evaluate trial production data and identify process/parameters to be modified/changed to achieve product of required specification• Prepare trial production report with recommendations on improvement opportunities, and share with cross function heads and relevant authorities for suggestion and consideration	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
7	<p>Manage production optimization and cost efficiency</p> <p>Theory Duration (hh:mm) 08:00</p> <p>Practical Duration (hh:mm) 12:00</p> <p>Corresponding NOS Code FIC/N9015</p>	<p>Review production reports and analyze equipment performance, process capability, change over time, maintenance, consumables, power etc, to identify factors that affect performance of production and recommend improvement opportunities</p> <p>Compile performance data on process and equipment to identify cause for lack of performance, evaluate opportunities to improve, identify cost saving options, propose changes in process, and implement proposal with proper approvals</p> <p>Review production process with supervisor and machine operators to identify reasons for slowdown or stop of production process, provide recommendations to overcome efficiency issues, take feedback, develop plans for implementing recommended changes, monitor changes implemented, and review changes and improvement</p> <p>Calculate utilities and energy usage in production area and for production process, identify methods to minimize usage</p> <p>Develop plans and procedures to minimize use of utilities and energy without affecting the production efficiency</p> <p>Identify energy and utility losses or sources of waste, analyze reason, recommend methods to improve efficient energy/utility application, ensure recommendations are implemented, and monitor improvement</p> <p>Identify areas where utilities and energy can be saved, and Identify methods to save energy like recycling energy and utilities such as steam, heat and water, following proper maintenance methods to avoid leaks and losses etc, and prepare efficient production schedule such that target is met with efficient utilization of energy and utility</p> <p>Analyze usage pattern of energy and other utilities in production area and process against budget allocation, identify cost effective options for</p>	<p>Laptop, white board, marker, chart papers, projector, trainer's guide and student handbook ,</p>



Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>minimizing wastage, and implement changes</p> <p>Identify system, production process that need to be changed, identify opportunities for implementing change in production process, analyze impact of change on product quality, impact on the team and present production process</p> <p>Communicate with relevant authorities/superiors the need for change, results and benefits expected out of change</p> <p>Design new processes, procedures, systems, structures with roles and responsibilities, key performance indicators, training needs, safety system, contingency plans, monitoring and reporting system to implement planned changes in production process</p> <p>Provide training and support to implement changes, develop a strategy to help teams implement change</p> <p>Monitor changes implemented in production process and ensure changes are effective and meet the organisation and regulatory requirements</p> <p>Document and communicate the progress achieved through implemented change to the management and everyone involved, and make them understand and enjoy achievement</p> <p>Recognize and reward employees and teams for implementing change in production system and achieving better efficiency</p> <p>Manage budget efficiently by managing production with available resource, by avoiding overtime and too many casual workers/helpers</p> <p>Plan effectively to secure, confirm and allocate required manpower to meet production target within budget, monitor resource utilization, to achieve production target within existing resource</p> <p>Identify situations where actual budget exceeds the approved budget, investigate reason for variance and take appropriate</p>	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>corrective action to keep budget under control</p> <p>Identify the impact on budget of production-related decisions like scheduling holidays, adjusting production volume, scheduling equipment maintenance etc, before scheduling production, and identify opportunities to improve performance against budget</p> <p>Identify the causes for any significant variances in budget control, discuss with team and ensure prompt corrective action is taken to keep expenditure under control</p> <p>Encourage team to think and identify ways of reducing expenditure, analyse and pursue the suggested ideas</p>	
8	<p>Manage documentation system and implement safety and environmental policies</p> <p>Theory Duration (hh:mm) 07:00</p> <p>Practical Duration (hh:mm) 09:00</p> <p>Corresponding NOS Code FIC/N9016</p>	<ul style="list-style-type: none"> • Establish to production team the importance of documentation, provide training on documentation system, and ensure all documents are maintained systematically • Ensure all relevant records and documents are complete, up-to-date and accessible for audits on production process • During audit provide the auditor with access to all relevant information, records and documents • Ensure corrective actions recommended and implemented are documented to assure production process is carried in accordance with organisation and regulatory standards • Establish methods to track production information from documented and maintained records • Establish to production team importance of safety and environment requirements related to food processing unit, communicate information about safety and environmental policies and related procedures to the team • Co-ordinate with quality team to prepare policies and sops on safety and environment requirements related to production function, and ensure those procedure are followed in production area and during production process 	Laptop, white board, marker, chart papers, projector, trainer's guide and student handbook, logbooks, internal audit register, food safety manual, quality policy etc.



Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<ul style="list-style-type: none">• Ensure safe work procedures are followed in production area and during production process• Ensure policies and standard operating procedures on safety and environment requirements are accessible to all employees of production team, and are followed to meet the regulatory requirements• Identify safety and environmental hazards relevant to production processes, implement system to handle risks• Provide or organize training through relevant authorities on safety and environmental management system, to understand methods to control and prevent hazards• Conduct inspections in work place on use of protective clothing and accessories, and to ensure safety system is followed during production process• Conduct audits and review records on safety and environmental system to monitor if control systems are followed by production team, and address non-compliance following organisation standards• Implement system on waste management in production area and process, monitor and confirm waste collection, treatment, recycling or disposal is carried out meeting industry requirements and environmental regulations• Respond to environmental management hazard identification and incidents in an appropriate and timely way• Review practice and procedures followed on safety, conduct risk assessments, identify non-compliance, and provide recommendations to address gaps and non-conformances• Review environmental records documents maintained, analyze data to evaluate effectiveness of the environmental management system and identify areas for improvement, plan and implement improvements to meet regulatory requirements	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
9	Professional and Core Skills Theory Duration (hh:mm) 03:00 Practical Duration (hh:mm) 05:00 Corresponding NOS Code	Undertake a self-assessment test Identify personal strengths and weaknesses Plan and schedule the work order and manage time effectively to complete the tasks assigned Prevent potential problems from occurring Resolve issues and problems using acquired knowledge and realize the importance of decision making Identify potential problems and make sound and timely decision Improve your reading skills State the importance of listening	Laptop, white/black board, marker, chart papers, projector, Trainer's guide, Student manual
10	IT Skills Theory Duration (hh:mm) 05:00 Practical Duration (hh:mm) 07:00 Corresponding NOS Code	Identify parts of the computer Use the computer keyboard effectively to type Use computer applications effectively to record day-to-day activities Use the word processor effectively Use the spreadsheet application effectively Use the computer to document day-to-day activities	Laptop, white/black board, marker, chart papers, projector, Trainer's guide, Student manual
11	Field Visits Theory Duration (hh:mm) 04:00 Practical Duration (hh:mm) 30:00 Corresponding NOS Code	Observe the factory location, layout and safety aspects of food processing Observe the storage facilities for raw materials and finished products Observe the various machineries used in process Observe the various machineries used in process Observe the cleaning methods and processes followed to maintain the process machineries and tools Observe the raw materials used and their storage procedures Observe the packaging and storage processes of raw material and finished product Observe the post-production cleaning and maintenance process followed in the industry	All the tools and equipment listed above must be available at the site of field visit
12	Revision Theory Duration (hh:mm) 02:00	Revised the knowledge gained so far	All the tools and equipment listed above must be available at the time of revision

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	Practical Duration (hh:mm) 02:00 Corresponding NOS Code		
13	Evaluation Theory Duration (hh:mm) 08:00 Practical Duration (hh:mm) 20:00 Corresponding NOS Code	Assess the knowledge and skills acquired by the participants	All the tools and equipment listed above must be available for evaluation
14	On-the-job Training Theory Duration (hh:mm) 30:00 Practical Duration (hh:mm) 65:00 Corresponding NOS Code	Apply the skills and knowledge acquired in the training program in the field	All the tools and equipment listed above must be available on the site at the time of OJT
	Total Duration 240:00 Theory Duration 88:00 Practical Duration 152:00	Unique Equipment Required: Laptop, white board, marker, chart papers, projector, trainer's guide and student handbook, cleaning machines, destoner, pulverizer, kneader, mixer, roaster, dryer, oven, extruder, packaging machines flaker, machineries blender, Measurement Cane; Weighing balance, Timer, Gas with Burner; Knives, spatulas, packing wrap rolls, measuring cup and spoons, utensils, ladle, ladle with holes, digital hygrometer, Muslin Cloth; Weighing Machine; Milk Stirrer; Thermometer; Test Tube (Glass); Test Tube Holder; Gas with Burner,	

Grand Total Course Duration: **240Hours, 0 Minutes**

*(This syllabus/ curriculum has been approved by **SSC: Food Industry Capacity and Skill Initiative**)*



Trainer Prerequisites for Job role: “Production Manager” mapped to Qualification Pack: “FIC/Q9003, v1.0”

Sr. No.	Area	Details
1	Description	To deliver accredited training service, mapping to the curriculum detailed above, in accordance with the Qualification Pack “FIC/Q9003”, Version 1.0
2	Personal Attributes	An aptitude for conducting training, and pre/ post work to ensure competent, employable candidates at the end of the training, and pre/post work to ensure competent, employable candidates at the end of the training. Strong communication skills, ability to work as part of a team; a passion for quality and for developing others; well-organized and focused, eager to learn and keep oneself updated with the latest in the mentioned fields.
3	Minimum Educational Qualifications	M.Sc/M.Tech/ME in Food Technology or Food Engineering with 5-6 years of hands on experience in a food industry B.Sc (home Sc) /B.Tech/BE in Food Technology or Food Engineering with 7-8 years of hands on experience in a food industry
4a	Domain Certification	Certified for Job Role: “Production Manager” mapped to QP: “FIC/Q9003, v1.0”. Minimum accepted score is 80%
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 80 % as per FICSI guidelines.
5	Experience	M.Sc/M.Tech/ME in Food Technology or Food Engineering with 5-6 years of hands on experience in a food industry B.Sc (home Sc) /B.Tech/BE in Food Technology or Food Engineering with 7-8 years of hands on experience in a food industry



Annexure: Assessment Criteria

Assessment Criteria	
Job Role	Production Manager
Qualification Pack	FIC/Q9003, v1.0
Sector Skill Council	Food Processing

Sr. No.	Guidelines for Assessment
1	Criteria for assessment for each Qualification Pack will be created by the Sector Skill Council. Each Performance Criteria (PC) will be assigned marks proportional to its importance in NOS. SSC will also lay down proportion of marks for Theory and Skills Practical for each PC.
2	The assessment for the theory part will be based on knowledge bank of questions created by the SSC.
3	Individual assessment agencies will create unique question papers for theory part for each candidate at each examination/training centre(as per assessment criteria below)
4	Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/training center based on this criteria
5	To pass the Qualification Pack, every trainee should score a minimum of 70% (overall) in every QP
6	The marks are allocated PC wise; however, every NOS will carry a weight age in the total marks allocated to the specific QP

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
1. FIC/N9014: Manage production process in food processing unit	PC1. Communicate clearly the organisation policies and goals to the employees of production team, make them understand and commit their energy and expertise to achieve organisation goals	100	2.5	1	1.5
	PC2. Achieve department targets and organisation goals by understanding the organisation and employees, developing a leadership style and applying them appropriately		2.5	1	1.5
	PC3. Communicate with employees regularly and effectively, help them identify their strengths, provide support to overcome their weakness, listen to their grievances and provide appropriate solutions, and win their support		3	1	2
	PC4. Motivate and support employees to achieve their work and development objectives, and provide recognition when they are successful		2.5	1	1.5

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	PC5. Encourage employees to take responsibilities, to take own decisions within agreed boundaries, to take lead in their own areas of expertise for their development		2.5	1	1.5
	PC6. Initiate personnel actions, such as promotions, transfers, discharges or disciplinary measures		3	1	2
	PC7. Lead production department and team successfully through difficulties and challenges		3	1	2
	PC8. Review the sales forecast for the week/month (or) monthly production plan discussed with plant manager (or) customer requirement (as applicable) and identify production priorities to meet market requirement		3	1	2
	PC9. Identify and confirm resource availability like raw materials, packing materials, equipment availability and capacity, production capacity, manpower requirement and availability, stock level, storage capacity, transport capacity etc		3	1	2
	PC10. Plan details of production in terms of output quantity and quality, cost, time and manpower requirements		3	1	2
	PC11. Analyze the consequences of failing to meet production/delivery timelines to meet the schedule, notifying relevant authorities of any possibility that demand cannot be met within required timeframe		3	1	2
	PC12. Develop production schedule to meet market demands/priorities and delivery timelines within budget and with available resources, consult production plan with inter department heads and production supervisor, instruct supervisor to allocate work to production team		3	1	2
	PC13. Communicate the production schedule to cross function heads through communication system followed by the organisation like e-mail or upload in the erp system		2.5	1	1.5
	PC14. Identify and confirm equipment requirements to meet production target, share production schedule with equipment requirement to maintenance manager/supervisor for		2.5	1	1.5

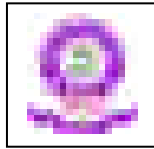
Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	maintenance plan that aligns with production plan				
	PC15. Co-ordinate with maintenance manager/supervisor to understand materials, consumables and manpower requirement and availability for maintenance activities, for uninterrupted production		3	1	2
	PC16. Understand equipment maintenance process and procedure and co-ordinate for maintenance activities during breakdown, emergency response, routine cleaning and servicing etc		2.5	1	1.5
	PC17. Analyze equipment maintenance data to interpret equipment performance and arrive at production capability of each process equipment		3	1	2
	PC18. Co-ordinate with maintenance team to ensure reliable equipment performance with minimal disruption to production, to minimize down time during equipment breakdowns, and to optimize equipment efficiency to achieve production target		3	1	2
	PC19. Lead and build team spirit between production and maintenance personnel through effective communication to enhance equipment performance and to identify production improvement opportunities		2.5	1	1.5
	PC20. Ensure maintenance procedures followed meet food safety and environmental requirements		2.5	1	1.5
	PC21. Monitor production process for usage of raw materials, packaging materials, manpower, wastage against production plan and identify reason for variances against plan		3	1	2
	PC22. Address the reason for variation in achieving production schedule, production target within allocated budget		3	1	2
	PC23. Adjust production schedule in response to variables affecting achievement of production target		3	1	2
	PC24. Monitor production output and cost, adjust processes and resources to minimize cost and to achieve quantity and quality product		3	1	2

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	PC25. Reschedule production plan in case of urgent requirement or any unforeseen event, to minimize wastage and to utilize materials/utilities and resources efficiently, discuss and negotiate changes with inter department team on time for their support and team work		3	1	2
	PC26. Review production schedule and process, consult /discuss with supervisor, team and cross function teams identify opportunities for improvement and develop recommendations for improvement on production process		3	1	2
	PC27. Set policies, plans and procedures, and take initiative to implement the identified improvement opportunities to control cost and to achieve better yield and quality		3	1	2
	PC28. Monitor, review and ensure production details are documented to meet the documentation requirements of the organisation, and to meet audit requirements like iso, haccp etc		3	1	2
	PC29. Understand objective of trial production, trial product processing method and specification, select production team for trial, discuss with cross function team like planning, qa, maintenance etc, clarify roles and responsibilities and level of authority to the team and cross function		3	1	2
	PC30. Prepare technical production procedures considering all engineering and process parameters for new product trial, educate and train supervisors and operators on trial procedure		3	1	2
	PC31. Identify and consider all possible hazards, prepare plan and procedures to prevent and control hazards, provide training to trial team to handle hazards		2.5	1	1.5
	PC32. Prepare detailed trial production schedule to manage production process without overlapping/affecting with regular production, and considering availability of raw materials and packaging materials,		3	1	2



Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	machine availability and capability, man power availability and competency etc				
	PC33. Monitor trial production against plan to identify variances and factors that need to be adjusted to achieve product of required specification within the planned time		3	1	2
	PC34. Document and evaluate trial production data and identify process/parameters to be modified/changed to achieve product of required specification		3	1	2
	PC35. Prepare trial production report with recommendations on improvement opportunities, and share with cross function heads and relevant authorities for suggestion and consideration		3	1	2
2. FIC/N9015: Manage production optimization and cost efficiency in food processing unit	PC1. Review production reports and analyze equipment performance, process capability, change over time, maintenance, consumables, power etc, to identify factors that affect performance of production and recommend improvement opportunities	100	2	0.5	1.5
	PC2. Compile performance data on process and equipment to identify cause for lack of performance, evaluate opportunities to improve, identify cost saving options, propose changes in process, and implement proposal with proper approvals		3	0.5	2.5
	PC3. Review production process with supervisor and machine operators to identify reasons for slowdown or stop of production process, provide recommendations to overcome efficiency issues, take feedback, develop plans for implementing recommended changes, monitor changes implemented, and review changes and improvement		3	1	2
	PC4. Calculate utilities and energy usage in production area and for production process, identify methods to minimize usage		2	0.5	1.5
	PC5. Develop plans and procedures to minimize use of utilities and energy		2	0.5	1.5

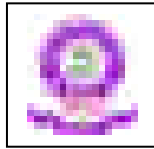
Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	without affecting the production efficiency				
	PC6. Identify energy and utility losses or sources of waste, analyze reason, recommend methods to improve efficient energy/utility application, ensure recommendations are implemented, and monitor improvement		2	0.5	1.5
	PC7. Identify areas where utilities and energy can be saved, and identify methods to save energy like recycling energy and utilities such as steam, heat and water, following proper maintenance methods to avoid leaks and losses etc, and prepare efficient production schedule such that target is met with efficient utilization of energy and utility		3	1	2
	PC8. Analyze usage pattern of energy and other utilities in production area and process against budget allocation, identify cost effective options for minimizing wastage, and implement changes		3	1	2
	PC9. Identify system, production process that need to be changed, identify opportunities for implementing change in production process, analyze impact of change on product quality, impact on the team and present production process		3	1	2
	PC10. Communicate with relevant authorities/superiors the need for change, results and benefits expected out of change		1	0.5	0.5
	PC11. Design new processes, procedures, systems, structures with roles and responsibilities, key performance indicators, training needs, safety system, contingency plans, monitoring and reporting system to implement planned changes in production process		1	0.5	0.5
	PC12. Provide training and support to implement changes, develop a strategy to help teams implement change		2	0.5	1.5
	PC13. Monitor changes implemented in production process and ensure		4	1.5	2.5



Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	changes are effective and meet the organisation and regulatory requirements				
	PC14. Document and communicate the progress achieved through implemented change to the management and everyone involved, and make them understand and enjoy achievement		4	1.5	2.5
	PC15. Recognize and reward employees and teams for implementing change in production system and achieving better efficiency		5	2	3
	PC16. Manage budget efficiently by managing production with available resource, by avoiding overtime and too many casual workers/helpers		4	1.5	2.5
	PC17. Plan effectively to secure, confirm and allocate required manpower to meet production target within budget, monitor resource utilization, to achieve production target within existing resource		4	1.5	2.5
	PC18. Identify situations where actual budget exceeds the approved budget, investigate reason for variance and take appropriate corrective action to keep budget under control		1	0.5	0.5
	PC19. Identify the impact on budget of production-related decisions like scheduling holidays, adjusting production volume, scheduling equipment maintenance etc, before scheduling production, and identify opportunities to improve performance against budget		1	0.5	0.5
	PC20. Identify the causes for any significant variances in budget control, discuss with team and ensure prompt corrective action is taken to keep expenditure under control		3	1	2
	PC21. Encourage team to think and identify ways of reducing expenditure, analyze and pursue the suggested ideas		4	1	3
			100	35	65
3. FIC/N9016: Manage documentation system and implement	PC1. Establish to production team the importance of documentation, provide training on documentation system, and ensure all documents are maintained systematically	100	6	2	4

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
safety and environmental policies in food processing unit	PC2. Ensure all relevant records and documents are complete, up-to-date and accessible for audits on production process		6	2	4
	PC3. During audit provide the auditor with access to all relevant information, records and documents		6	3	3
	PC4. Ensure corrective actions recommended and implemented are documented to assure production process is carried in accordance with organisation and regulatory standards		6	2	4
	PC5. Establish methods to track production information from documented and maintained records		5	2	3
	PC6. Establish to production team importance of safety and environment requirements related to food processing unit, communicate information about safety and environmental policies and related procedures to the team		6	2	4
	PC7. Co-ordinate with quality team to prepare policies and sops on safety and environment requirements related to production function, and ensure those procedure are followed in production area and during production process		6	2	4
	PC8. Ensure safe work procedures are followed in production area and during production process		6	2	4
	PC9. Ensure policies and standard operating procedures on safety and environment requirements are accessible to all employees of production team, and are followed to meet the regulatory requirements		5	2	3
	PC10. Identify safety and environmental hazards relevant to production processes, implement system to handle risks		6	2	4
	PC11. Provide or organize training through relevant authorities on safety and environmental management system, to understand methods to control and prevent hazards		6	2	4
	PC12. Conduct inspections in work place on use of protective clothing and accessories, and to ensure safety		6	2	4

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	system is followed during production process				
	PC13. Conduct audits and review records on safety and environmental system to monitor if control systems are followed by production team, and address non-compliance following organisation standards		6	2	4
	PC14. Implement system on waste management in production area and process, monitor and confirm waste collection, treatment, recycling or disposal is carried out meeting industry requirements and environmental regulations		6	2	4
	PC15. Respond to environmental management hazard identification and incidents in an appropriate and timely way		6	2	4
	PC16. Review practice and procedures followed on safety, conduct risk assessments, identify non-compliance, and provide recommendations to address gaps and non-conformances		6	2	4
	PC17. Review environmental records documents maintained, analyze data to evaluate effectiveness of the environmental management system and identify areas for improvement, plan and implement improvements to meet regulatory requirements		6	2	4
	Total		100	35	65
	Grand Total	400	400	300	100
	Percentage Weightage		100	60%	40%
	Minimum Pass% to qualify (aggregate):			70%	





**JSS COLLEGE OF ARTS, COMMERCE & SCIENCE
(AUTONOMOUS)**

OOTY ROAD, MYSURU-570 025

(Autonomous under University of Mysore: Re-accredited by NAAC with 'A' Grade)

MASTERS OF VOCATIONAL COURSE

M.Voc (Software Development)

Department of M.Voc

JSS College of Arts, Commerce and Science

Ooty Road, Mysore-25

2018-19

NOS Code : SSC/N0502

Develop Software code to specification

C, Java

Course Outcomes: At the end of the course students will be able to:

- CO1. 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.
- CO2. Convert technical specifications into code to meet the requirements, leveraging reusable components, where available
- CO3. Create appropriate Unit test cases (UTCs)
- CO4. Review codes and UTCs with appropriate people
- CO5. Analyze inputs from appropriate people to inform future designs
- CO6. Submit tested code for approval by appropriate people

Mango DB on AWS

Hr:-15

- Introduction
- Creating, reading and updating data
- Schema design
- Performance
- Aggregation framework
- Application engineering
- Case studies

Model Curriculum

Plant Manager

SECTOR: FOOD PROCESSING

SUB-SECTOR: FRUIT & VEGETABLE, FOOD GRAIN MILLING (INCLUDING OILSEEDS), DAIRY PRODUCTS, MEAT & POULTRY, FISH & SEAFOOD, BREAD & BAKERY, ALCOHOLIC BEVERAGES, AERATED WATER/ SOFT DRINKS, SOYA FOOD, PACKAGED FOOD

OCCUPATION: PROCESSING
REF ID: FIC/Q9004, V1.0
NSQF LEVEL: 9

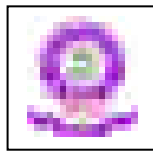




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Plant Manager

CURRICULUM / SYLLABUS

This program is aimed at training candidates for the job of a “Plant Manager”, in the “Food Processing” Sector/Industry and aims at building the following key competencies amongst the learner

Program Name	Plant Manager		
Qualification Pack Name & Reference ID. ID	FIC/Q9004, v1.0		
Version No.	1.0	Version Update Date	30/03/2016
Pre-requisites to Training	Preferably Class 12 and 6-7 years' experience in a food processing unit		
Training Outcomes	After completing this programme, participants will be able to: Daily management of food processing unit Coordination of food processing unit operations including production planning, managing human resources, supply chain, production operation, maintenance, quality assurance, storage and distribution of finished products.		



This course encompasses 3 out of 3 National Occupational Standards (NOS) of “Plant Manager” Qualification Pack issued by “Food Industry Capacity and Skill Initiative”.

Sr. No.	Module	Key Learning Outcomes	Equipment Required
1	<p>Introduction to the training program</p> <p>Theory Duration (hh:mm) 00:30</p> <p>Practical Duration (hh:mm) 00:00</p> <p>Corresponding NOS Code Bridge Module</p>	Introduce each other and build rapport with fellow participants and the trainer.	White board/Chart papers, marker
2	<p>Overview of the “Plant Manager” Role</p> <p>Theory Duration (hh:mm) 01:00</p> <p>Practical Duration (hh:mm) 00:00</p> <p>Corresponding NOS Code</p>	<p>Understanding the roles and responsibilities of plant manager</p> <p>Awareness of the nature and availability of job opportunities</p>	Laptop/computer white board, marker, projector, chart papers
3	<p>Introduction to the Food Processing Industry</p> <p>Theory Duration (hh:mm) 01:30</p> <p>Practical Duration (hh:mm) 00:00</p> <p>Corresponding NOS Code</p>	<p>Define food processing</p> <p>List the various sub sectors of food processing industry</p>	Laptop, white/black board, marker, chart papers, projector, Trainer’s guide, Student manual
4	<p>Introduction to food processing process</p> <p>Theory Duration (hh:mm) 02:00</p> <p>Practical Duration (hh:mm)</p>	<p>List the common machineries used in food processing</p> <p>Explain the process of testing food for accepted quality standards</p> <p>Demonstrate the test for checking the quality of food</p> <p>Describe the procedure for processing various food</p>	Laptop, white board, marker, chart papers, projector, trainer’s guide and student handbook

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	04:00 Corresponding NOS Code	Identify different equipment used in food industry	
5	Organizational standards and norms Theory Duration (hh:mm) 04:00 Practical Duration (hh:mm) 02:00 Corresponding NOS Code	State the roles and responsibilities of a plant manager State how to conduct yourself at the workplace State the personal hygiene and sanitation guidelines State the food safety hygiene standards to follow in a work environment	Laptop, white board, marker, chart papers, projector, trainer's guide and student handbook, protective gloves, head caps, aprons, safety goggles, safety boots, mouth masks, sanitizer, safety manual
6	Lead operations of a food processing unit Theory Duration (hh:mm) 15:00 Practical Duration (hh:mm) 11:40 Corresponding NOS Code FIC/N9017	<ul style="list-style-type: none"> • Develop operational plans for the operation of food processing unit that is consistent with the objectives and goals of organisation, and to produce quantity and quality products • Develop operational plan that is flexible and complements supply chain, inventory, human resource, production, maintenance, quality and logistics management of production unit • Develop operational plan to improve output in all areas of functions with the objective to reduce overall cost, and to produce quantity and quality products • Develop operational plan considering national and international regulatory requirements, health and safety, food safety and hygiene requirements on process and product(s), and to maintain safe and environmental compliant workplace • Develop objectives and set demanding but achievable targets for operation function managers, and assign clear responsibilities with expected targets/performance • Provide direction and professional expertise to all function managers to achieve organisation goals • Monitor and control the operational plan to achieve its overall objectives 	Laptop, white board, marker, chart papers, projector, trainer's guide and student handbook

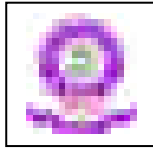


Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<ul style="list-style-type: none">• Evaluate the implemented operational plan periodically, analyze performance data, identify areas for improvement and recommend changes• Monitor performance of managers and employees to ensure that departmental and individual objectives are achieved within scheduled timelines and budget• Design new work processes, procedures, systems, structures and roles for any changes implemented in the organisation to achieve organizational goal and regulatory requirements• Review and ensure implemented changes are effective and meet the requirements of the organization• Maintain professionalism, tact, diplomacy, sensitivity, diversity and equality, and lead food processing unit to achieve organisation objectives and goals• Ensure that work arrangements, resources and business processes respond to different needs, abilities and values• Develop and implement new business strategies for improving processes and procedures to improve performance• Develop a leadership style and apply them appropriately for managers to follow the lead willingly to achieve organisation targets and goals• Communicate clearly the organisation vision, values and goals to employees, make managers understand and commit their expertise to achieve organisation goals• Lead managers of all operation functions, link operational plans and drive managers towards achieving organisation vision, objectives and goals• Lead managers through difficulties, challenges and conflicts• Conduct meetings with managers regularly and effectively, encourage them to share their views, provide guidance and support to overcome process issues and lead to achieve organisation goal	



Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<ul style="list-style-type: none">• Encourage managers to take lead in their own areas of expertise, take own decisions in their area of function, and provide recognitions when they are successful• Lead the managers and organisation successfully through difficulties and challenges• Design processes with achievable targets and realistic timeline, proper resource allocation, with defined process responsibilities to manage food processing operation based on organizational goals• Develop processes that are effective and sustainable, implement and ensure it is followed, review its effectiveness and make necessary changes if required• Develop process measures that are affordable, and provide enough information and required training for managers and employees to manage the process• Review and understand resource requirements for process and allocate necessary resources to all functional areas• Develop systems to link all function processes, and encourage function heads and employees to interact across the organisation to form a complete system• Establish effective methods to review the quality of work and product, and improve the process• Focus attention on issues that are critical to achieve results, provide solutions and guidance to overcome the issues that affect the process• Identify issues and trends and recognize their impact upon current and future work, work out solutions and implementation plan to overcome and utilize latest trends to achieve long term goals of the organisation• Develop policies and procedures for any change in organisation goal, organisation structure PC31. set responsibilities for managers, set and prioritize objectives for change, clearly communicate change and make the managers understand their responsibilities and commitment	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<ul style="list-style-type: none"> • Implement change, identify and deal with obstacles to change, and support managers and employees through the change process • Brief managers on their responsibilities and make them understand their role, objectives for their area and the overall organisation, and expected performance • Monitor progress and performance quality of the managers on regular basis against the level of expected performance and provide prompt and constructive feedback PC35. support managers in identifying and dealing with problems and unforeseen events • Identify gaps and performance issues, discuss the causes and recommend solutions to improve performance of managers and their team • Monitor performance, analyze employee strength and weakness, and make changes in their tasks/responsibilities • Review performance and update work plans in their area, monitor and conduct review meetings on regular basis, recognize successful completion of work or work activities by function manager(s) and their teams • Motivate managers to complete expected target and any additional work allocated and provide additional support and resources to complete work 	
7	<p>Ensure proper production and operation management</p> <p>Theory Duration (hh:mm) 08:00</p> <p>Practical Duration (hh:mm) 12:00</p> <p>Corresponding NOS Code FIC/N9018</p>	<p>Update self with an understanding of the goals of the organisation and forecast/requirements of the sales and marketing manager, with the knowledge of production method and process, plant capacity, resource availability, plan products and quantity to be produced</p> <p>Monitor and regulate supply chain management which includes sourcing and procurement, conversion of raw materials to finished products, all logistics activities, coordination and collaboration with suppliers,</p>	Laptop, white board, marker, chart papers, projector, trainer's guide and student handbook ,



Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>intermediaries, third party service providers, and customers, to integrate supply and demand management within and across companies</p> <p>Monitor and regulate inventory process to meet the production requirement of the organisation, review current procurement procedures, analyze benefits and risks that may impact the procurement of supplies, implement plans and methods to improve and provide solutions to resolve any immediate problems</p> <p>Evaluate current storage methods and identify ways of improving the storage of supplies to provide better fit with supply chain strategy</p> <p>During production process, coordinate production activities with procurement, maintenance, and quality control function to obtain optimum production and efficient utilization of human resources, machines and equipment</p> <p>Make adjustments/revise/reschedule production schedules and priorities in case of breakdown down of equipment/issues with physical or human resource/ urgent orders/unforeseen issues or any operational problems</p> <p>Direct production activities and establish production priorities to produce quantity and quality products within the operation budget</p> <p>Review and analyze human resource, production, quality control, maintenance, and operational reports to identify reason for nonconformance/ non-compliance to organisation and regulatory standards for product and process, develop and implement operating methods and procedures to eliminate problems and improve product and process quality</p> <p>Monitor storage and distribution of products to and from the plant/processing unit warehouse, ensure storage and distribution norms and procedures like palletizing, stacking height, labeling, fefo etc are followed</p>	



Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>Establish systems to collect and assess information on performance of all functions, analyze data and evaluate performance of departments and organisation, through knowledge and understanding identify reasons for problems and low performance</p> <p>Establish and implement methods and procedures for improvement, ensure implemented methods deliver expected result, and identify opportunities to improve organization performance</p> <p>Read financial responsibilities, compile available financial information, evaluate the cost, benefits and risks of the current budget, and estimate financial requirements for operation of food processing unit</p> <p>Consult with department managers the objectives and associated plans, discuss and identify priorities and develop a realistic master budget for food processing operation, communicate the final proposed budget with all managers</p> <p>Submit the proposed master budget with clear proposals to the management for approval, assist them to evaluate the budget, negotiate with clarity and strong reasoning and get the budget approved</p> <p>Evaluate, analyze and allocate budget to departments of food processing operation, allocate budget to each department managers with expectations and targets, provide required ongoing support and resources</p> <p>Establish systems to monitor and evaluate performance against delegated budgets and the master budget and put contingency plans in place</p> <p>Identify reason for significant variances between budget and actual expenditure, discuss with managers, provide solutions and ensure immediate corrective action is taken</p> <p>In case of unforeseen situation/emergency/shortage,</p>	



Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>identify any additional financial needs, prepare provisional budget, negotiate and get it approved by the management, delegate provisional budget to respective managers, monitor and control expenditure</p> <p>Encourage managers to identify ways of reducing expenditure, analyze and pursue potential ideas, implement those in all areas of function</p> <p>Review the financial performance of managers regularly, and identify improvement opportunities and ensure it is implemented, provide information to the management on the financial performance of the operation management</p> <p>Determine human resource requirement including contingencies to achieve organisation goal, organize interview, hiring and training of new employees through human resources manager</p> <p>Ensure that all employees receive appropriate training on job duties, corporate policies and applicable regulations</p> <p>Oversee and direct the activities of subordinate managers, provide coaching and mentoring, and conduct evaluations of all</p> <p>Discuss with managers of operation function and identify resource requirement for their area, analyze, estimate and approve resources, monitor effective use of those resources</p> <p>Ensure compliance of all employees with organization policy, procedures and applicable regulations</p> <p>Conduct meetings to address grievances, to resolve or effect settlements within the scope of authority, and refer unresolved grievances for management-union negotiations</p> <p>Take personnel actions, such as promotions, transfers, discharges or disciplinary measures, within the scope of authority</p> <p>Update self with knowledge of quality management system, legal and regulatory requirements, environmental issues related to the</p>	



Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>organisation, process and products produced</p> <p>Ensure system, plan and resources are in place to assure food products produced in the organisation meet the organisation standards, national and international regulations</p> <p>Implement procedure, standards and specifications to meet quality goals of the organisation, co-ordinate departments and provide support to implement food safety system like HACCP in the organisation</p> <p>Evaluate records of quality of product and process to assess the effectiveness of quality system followed in the organisation, review and revise the quality system through quality assurance manager and implement changes</p> <p>Organize training for employees to update on latest developments/systems/ tools and techniques in quality management system and evaluate their competency to fulfill organisation goals</p> <p>Encourage employees of all functions to take personal responsibility for achieving quality standards of product and process and address or report/address any non-conformance</p> <p>Monitor process and product quality against target and plan, identify and assess risks of shortfalls in the quality of processes and products/services and take immediate corrective action to address risks</p> <p>Direct and coordinate implementation of quality system such as ISO, HACCP, etc. in the organisation through quality manager</p> <p>Ensure managers responsible for organizational processes understand the requirements of quality system, establish their roles in implementation of quality system in their functional areas, enhance their confidence and commitment to quality by providing continuous support</p> <p>Encourage and support department heads and employees for quality</p>	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>audit process to obtain accreditation, certifications to a standard or a mark of quality, monitor quality audit process, review results and take immediate corrective action through concerned managers</p> <p>Identify the environmental impact related to the resources, process and products produced in the organisation such as air/water/noise pollution, effluent treatment, waste disposal etc, identify risks to the environment, consult with experts and identify opportunities to improve environmental performance</p> <p>Set and implement policies and procedures through managers, monitor to ensure its efficiency and effectiveness and make changes as required to meet the regulatory requirements</p>	
8	<p>Manage new projects and ensure compliance to regulatory requirements</p> <p>Theory Duration (hh:mm) 07:00</p> <p>Practical Duration (hh:mm) 09:00</p> <p>Corresponding NOS Code FIC/N9019</p>	<p>Implement new project/business plans of the organisation for introducing new products or for improving processes, procedures and performance</p> <p>Map or perform comparative study of the project with the current project/product to understand the ways proposed project fits with the overall vision, objectives and plans of the organization</p> <p>Read the key objectives and scope of the proposed project, prepare resource requirement for implementation of new project, negotiate with clarity and strong reasoning and get approval from superiors/management</p> <p>Consult with experts and managers and prepare realistic and thorough plan to implement the project successfully, prepare project report considering all possibilities</p> <p>Submit the project report to the superiors/management, discuss plan, consider suggestions and recommendations and make necessary changes where necessary, take approval of final plan</p> <p>brief project team managers on the project plan and their roles and responsibilities, start implementation of project and provide ongoing</p>	<p>Laptop, white board, marker, chart papers, projector, trainer's guide and student handbook, logbooks, internal audit register, food safety manual, quality policy etc.</p>



Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>support, encouragement and information for successful completion</p> <p>Monitor, control and review project plan during each stage of implementation</p> <p>Provide sufficient resources to deal with contingencies and to manage any potential risks</p> <p>Inform the management/superiors of the developments in the project on regular basis, discuss progress and problems, take approval for any changes in project plan</p> <p>Complete project within agreed level of resources, meeting all legal and regulatory requirements, share the success with the project team members, recognize and reward their contribution</p> <p>Update self with understanding of national and international food safety regulations and standards related to the food processing units, process and products produced in the organisation</p> <p>Ensure effective policies and procedures are in place in the organization to meet to legal and regulatory requirements</p> <p>Ensure regulatory standards set by the organisation for products are stringent in context of the national and international legal requirements</p> <p>Ensure managers of all functional area have a clear understanding of the policies and procedures on food regulatory standards</p> <p>Organize training for all employees on policies and procedures on food regulatory standards and the importance of following regulations</p> <p>Monitor and ensure relevant legal and regulatory requirements pertaining to food processing units and products produced in the organisation are followed and met</p> <p>Identify reasons for non-compliance, review and revise the policies and procedures in consultation with quality and regulatory affairs manager to correct and overcome failures, provide support to all managers to implement corrective actions for the organisation and</p>	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>products to comply with regulatory standards</p> <p>Update self with understanding of health and safety requirements, and food safety, hygiene and sanitation requirements for the organisation and products produced</p> <p>Ensure that the organisation has written policy and procedures on health and safety, food safety, hygiene and sanitation, and those are clearly communicated to all employees of the organisation, and are put into practice and followed</p> <p>Implement a system for identifying hazards and assessing risk in food processing and products and set procedures to control and prevent them</p> <p>Implement system for GMP, HACCP, FIFO/FEFO, product recall, etc., organize training to the employees on health and safety, food safety, hygiene and sanitation for effective implementation of the systems, allocate required resources for implementation, and ensure those are followed by all employees</p> <p>Ensure systems are in place for effective monitoring, measuring and reporting on the performance of health and safety system</p> <p>Evaluate the existing systems and procedures, consult with managers and experts and identify methods to reduce risks/improve control measure</p> <p>Ensure health and safety policies are practiced across the organisation, effectively monitored, reviewed and revised at regular intervals to meet the changes in national and international regulations</p>	
9	<p>Professional and Core Skills</p> <p>Theory Duration (hh:mm) 03:00</p> <p>Practical Duration (hh:mm) 05:00</p>	<p>Undertake a self-assessment test</p> <p>Identify personal strengths and weaknesses</p> <p>Plan and schedule the work order and manage time effectively to complete the tasks assigned</p> <p>Prevent potential problems from occurring</p>	<p>Laptop, white/black board, marker, chart papers, projector ,Trainer's guide, Student manual</p>

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	Corresponding NOS Code	Resolve issues and problems using acquired knowledge and realize the importance of decision making Identify potential problems and make sound and timely decision Improve your reading skills State the importance of listening	
10	IT Skills Theory Duration (hh:mm) 05:00 Practical Duration (hh:mm) 07:00 Corresponding NOS Code	Identify parts of the computer Use the computer keyboard effectively to type Use computer applications effectively to record day-to-day activities Use the word processor effectively Use the spreadsheet application effectively Use the computer to document day-to-day activities	Laptop, white/black board, marker, chart papers, projector, Trainer's guide, Student manual
11	Field Visits Theory Duration (hh:mm) 04:00 Practical Duration (hh:mm) 30:00 Corresponding NOS Code	Observe the factory location, layout and safety aspects of food processing Observe the storage facilities for raw materials and finished products Observe the various machineries used in process Observe the various machineries used in process Observe the cleaning methods and processes followed to maintain the process machineries and tools Observe the raw materials used and their storage procedures Observe the packaging and storage processes of raw material and finished product Observe the post-production cleaning and maintenance process followed in the industry	All the tools and equipment listed above must be available at the site of field visit
12	Revision Theory Duration (hh:mm) 02:00 Practical Duration (hh:mm) 02:00 Corresponding NOS Code	Revised the knowledge gained so far	All the tools and equipment listed above must be available at the time of revision
13	Evaluation	Assess the knowledge and skills acquired by the participants	All the tools and equipment listed above



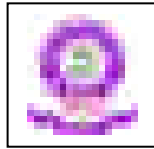
Sr. No.	Module	Key Learning Outcomes	Equipment Required
	Theory Duration (hh:mm) 08:00 Practical Duration (hh:mm) 20:00 Corresponding NOS Code		must be available for evaluation
14	On-the-job Training Theory Duration (hh:mm) 30:00 Practical Duration (hh:mm) 65:00 Corresponding NOS Code	Apply the skills and knowledge acquired in the training program in the field	All the tools and equipment listed above must be available on the site at the time of OJT
	Total Duration 240:00 Theory Duration 88:00 Practical Duration 152:00	Unique Equipment Required: Laptop, white board, marker, chart papers, projector, trainer's guide and student handbook, protective gloves, head caps, aprons, safety goggles, safety boots, mouth masks, sanitizer, safety manual	

Grand Total Course Duration: **240Hours, 0 Minutes**

(This syllabus/ curriculum has been approved by SSC: Food Industry Capacity and Skill Initiative)

Trainer Prerequisites for Job role: “Plant Manager” mapped to Qualification Pack: “FIC/Q9004, v1.0”

Sr. No.	Area	Details
1	Description	To deliver accredited training service, mapping to the curriculum detailed above, in accordance with the Qualification Pack “FIC/Q9004”, Version 1.0
2	Personal Attributes	An aptitude for conducting training, and pre/ post work to ensure competent, employable candidates at the end of the training, and pre/post work to ensure competent, employable candidates at the end of the training. Strong communication skills, ability to work as part of a team; a passion for quality and for developing others; well-organized and focused, eager to learn and keep oneself updated with the latest in the mentioned fields.
3	Minimum Educational Qualifications	M.Sc/M.Tech/ME in Food Technology or Food Engineering with 7-8 years of hands on experience in a food industry B.Sc (home Sc) /B.Tech/BE in Food Technology or Food Engineering with 9-10 years of hands on experience in a food industry
4a	Domain Certification	Certified for Job Role: “Plant Manager” mapped to QP: “FIC/Q9004, v1.0”. Minimum accepted score is 80%
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 80 % as per FICSI guidelines.
5	Experience	M.Sc/M.Tech/ME in Food Technology or Food Engineering with 7-8 years of hands on experience in a food industry B.Sc (home Sc) /B.Tech/BE in Food Technology or Food Engineering with 9-10 years of hands on experience in a food industry



Annexure: Assessment Criteria

Assessment Criteria	
Job Role	Plant Manager
Qualification Pack	FIC/Q9004, v1.0
Sector Skill Council	Food Processing

Sr. No.	Guidelines for Assessment
1	Criteria for assessment for each Qualification Pack will be created by the Sector Skill Council. Each Performance Criteria (PC) will be assigned marks proportional to its importance in NOS. SSC will also lay down proportion of marks for Theory and Skills Practical for each PC.
2	The assessment for the theory part will be based on knowledge bank of questions created by the SSC.
3	Individual assessment agencies will create unique question papers for theory part for each candidate at each examination/training centre(as per assessment criteria below)
4	Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/training center based on this criteria
5	To pass the Qualification Pack, every trainee should score a minimum of 70% (overall) in every QP
6	The marks are allocated PC wise; however, every NOS will carry a weight age in the total marks allocated to the specific QP

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
1. FIC/N9017: Lead Operations of a food processing unit	PC1. Develop operational plans for the operation of food processing unit that is consistent with the objectives and goals of organisation, and to produce quantity and quality products	100	3	1	2
	PC2. Develop operational plan that is flexible and complements supply chain, inventory, human resource, production, maintenance, quality and logistics management of production unit		2.5	1	1.5
	PC3. Develop operational plan to improve output in all areas of functions with the objective to reduce overall cost, and to produce quantity and quality products		2.5	0.5	2
	PC4. Develop operational plan considering national and international regulatory requirements, health and safety, food safety and hygiene requirements on process and product(s), and to maintain safe and environmental compliant workplace		2.5	1	1.5

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	PC5. Develop objectives and set demanding but achievable targets for operation function managers, and assign clear responsibilities with expected targets/performance		3	1	2
	PC6. Provide direction and professional expertise to all function managers to achieve organisation goal		2.5	1	1.5
	PC7. Monitor and control the operational plan to achieve its overall objectives		2.5	0.5	2
	PC8. Evaluate the implemented operational plan periodically, analyze performance data, identify areas for improvement and recommend changes		2.5	1	1.5
	PC9. Monitor performance of managers and employees to ensure that departmental and individual objectives are achieved within scheduled timelines and budget		3	1	2
	PC10. Design new work processes, procedures, systems, structures and roles for any changes implemented in the organisation to achieve organizational goal and regulatory requirements		2.5	1	1.5
	PC11. Review and ensure implemented changes are effective and meets the requirements of the organisation		2.5	1	1.5
	PC12. Maintain professionalism, tact, diplomacy, sensitivity, diversity and equality, and lead food processing unit to achieve organisation objectives and goals		2.5	1	1.5
	PC13. Ensure that work arrangements, resources and business processes respond to different needs, abilities and values		2.5	0.5	2
	PC14. Develop and implement new business strategies for improving processes and procedures to improve performance		2.5	1	1.5
	PC15. Develop a leadership style and apply them appropriately for managers to follow the lead willingly to achieve organisation targets and goals		2.5	1	1.5
	PC16. Communicate clearly the organisation vision, values and goals to employees, make managers understand and commit their expertise to achieve organisation goals		2.5	0.5	2

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	PC17. Lead managers of all operation functions, link operational plans and drive managers towards achieving organisation vision, objectives and goals		3	1	2
	PC18. Lead managers through difficulties, challenges and conflicts		2.5	1	1.5
	PC19. Conduct meetings with managers regularly and effectively, encourage them to share their views, provide guidance and support to overcome process issues and lead to achieve organisation goal		2.5	0.5	2
	PC20. Encourage managers to take lead in their own areas of expertise, take own decisions in their area of function, and provide recognitions when they are successful		2.5	1	1.5
	PC21. Lead the managers and organisation successfully through difficulties and challenges		3	1	2
	PC22. Design processes with achievable targets and realistic timeline, proper resource allocation, with defined process responsibilities to manage food processing operation based on organizational goals		2.5	1	1.5
	PC23. Develop processes that are effective and sustainable, implement and ensure it is followed, review its effectiveness and make necessary changes if required		2.5	1	1.5
	PC24. Develop process measures that are affordable, and provide enough information and required training for managers and employees to manage the process		2.5	0.5	2
	PC25. Review and understand resource requirements for process and allocate necessary resources to all functional areas		2.5	1	1.5
	PC26. Develop systems to link all function processes, and encourage function heads and employees to interact across the organisation to form a complete system		2.5	0.5	2
	PC27. Establish effective methods to review the quality of work and product, and improve the process		2.5	0.5	2



Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	PC28. Focus attention on issues that are critical to achieve results, provide solutions and guidance to overcome the issues that affect the process		2.5	1	1.5
	PC29. Identify issues and trends and recognize their impact upon current and future work, work out solutions and implementation plan to overcome and utilize latest trends to achieve long term goals of the organisation		3	1	2
	PC30. Develop policies and procedures for any change in organisation goal, organisation structure		2.5	1	1.5
	PC31. Set responsibilities for managers, set and prioritize objectives for change, clearly communicate change and make the managers understand their responsibilities and commitment		2.5	1	1.5
	PC32. Implement change, identify and deal with obstacles to change, and support managers and employees through the change process		2.5	1	1.5
	PC33. Brief managers on their responsibilities and make them understand their role, objectives for their area and the overall organisation, and expected performance		2	1	1
	PC34. Monitor progress and performance quality of the managers on regular basis against the level of expected performance and provide prompt and constructive feedback		3	1	2
	PC35. Support managers in identifying and dealing with problems and unforeseen events		2.5	1	1.5
	PC36. Identify gaps and performance issues, discuss the causes and recommend solutions to improve performance of managers and their team		3	1	2
	PC37. Monitor performance, analyze employee strength and weakness, and make changes in their tasks/responsibilities		2.5	1	1.5
	PC38. Review performance and update work plans in their area, monitor and conduct review meetings on regular basis, recognize successful completion of work or work activities by function manager(s) and their teams		2.5	1	1.5

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	PC39. Motivate managers to complete expected target and any additional work allocated and provide additional support and resources to complete work		2	1	1
			100	35	65
2. FIC/N9018: Ensure proper production and proper management	PC1. Update self with an understanding of the goals of the organisation and forecast/requirements of the sales & marketing manager, with the knowledge on production method and process, plant capacity, resource availability, plan products and quantity to be produced	100	2	1	1
	PC2. Monitor and regulate supply chain management which include sourcing and procurement, conversion of raw materials to finished products, all logistics activities, coordination and collaboration with suppliers, intermediaries, third-party service providers, and customers, to integrates supply and demand management within and across companies		3	0.5	2.5
	PC3. Monitor and regulate inventory process to meet the production requirement of the organisation, review current procurement procedures, analyze benefits and risks that may impact the procurement of supplies, implement plans and methods to improve, provide solutions to resolve any immediate problems		3	1	2
	PC4. Evaluate current storage methods, identifying ways of improving the storage of supplies to provide better fit with supply chain strategy		3	1	2
	PC5. During production process, coordinate production activities with procurement, maintenance, and quality control function to obtain optimum production and efficient utilization of human resources, machines and equipment		1.5	0.5	1
	PC6. Make adjustments/revise/reschedule production schedules and priorities in case of breakdown down of equipment/issues with physical or human resource/ urgent		1.5	0.5	1

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	orders/unforeseen issues or any operational problems				
	PC7. Direct production activities and establish production priorities to produce quantity and quality products within the operation budget		3	1	2
	PC8. Review and analyze human resource, production, quality control, maintenance, and operational reports to identify reason for non-conformance/ noncompliance to organisation and regulatory standards for product and process, develop and implement operating methods and procedures to eliminate problems and improve product and process quality		3	1	2
	PC9. Monitor storage and distribution of products to and from the plant/processing unit warehouse, ensure storage and distribution norms and procedures like palletizing, stacking height, labeling, FEFO etc are followed		3	0.5	2.5
	PC10. Establish systems to collect and assess information on performance of all functions, analyze data and evaluate performance of departments and organisation, through knowledge and understanding identify reasons for problems and low performance		1.5	1	0.5
	PC11. Establish and implement methods and procedures for improvement, ensure implemented methods deliver expected result, and identify opportunities to improve organization performance		1.5	1	0.5
	PC12. Read financial responsibilities, compile available financial information, evaluate the cost, benefits and risks of the current budget, and estimate financial requirements for operation of food processing unit		3	1.5	1.5
	PC13. Consult with department managers the objectives and associated plans, discuss and identify priorities and develop a realistic master budget for food processing operation, communicate the final proposed budget with all managers		3	1	2



Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	PC14. Submit the proposed master budget with clear proposals to the management for approval, assist them to evaluate the budget, negotiate with clarity and strong reasoning and get the budget approved		2.5	1	1.5
	PC15. Evaluate, analyze and allocate budget to departments of food processing operation, allocate budget to each department managers with expectations and targets, provide required ongoing support and resources		3	1	2
	PC16. Establish systems to monitor and evaluate performance against delegated budgets and the master budget and put contingency plans in place		2.5	1	1.5
	PC17. Identify reason for significant variances between budget and actual expenditure, discuss with managers, provide solutions and ensure immediate corrective action is taken		2.5	1	1.5
	PC18. In case of unforeseen situation/emergency/shortage, identify any additional financial needs, prepare provisional budget, negotiate and get it approved by the management, delegate provisional budget to respective managers, monitor and control expenditure		3	1	2
	PC19. Encourage managers to identify ways of reducing expenditure, analyze and pursue potential ideas, implement those in all areas of function		2.5	1	1.5
	PC20. Review the financial performance of managers regularly, and identify improvement opportunities and ensure it is implemented, provide information to the management on the financial performance of the operation management		2.5	1	1.5
	PC21. Determine human resource requirement including contingencies to achieve organisation goal, organize interview, hiring and training of new employees through human resources manager		3	1	2
	PC22. Ensure that all employees receives appropriate training on job duties,		2.5	1	1.5



Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	corporate policies and applicable regulations				
	PC23 Oversee and direct the activities of subordinate managers, provide coaching and mentoring, and conduct evaluations of all		2.5	1	1.5
	PC24 Discuss with managers of operation function and identify resource requirement for their area, analyze, estimate and approve resources, monitor effective use of those resources		3	1	2
	PC25 Ensure compliance of all employees with organization policy, procedures and applicable regulations		2.5	1	1.5
	PC26 Conduct meetings to address grievances, to resolve or effect settlements within the scope of authority, and refer unresolved grievances for management-union negotiations		2.5	0.5	2
	PC27 Take personnel actions, such as promotions, transfers, discharges or disciplinary measures, within the scope of authority		3	1	2
	PC28 Update self with knowledge of quality management system, legal and regulatory requirements, environmental issues related to the organisation, process and products produced		2.5	0.5	2
	PC29 Ensure system, plan and resources are in place to assure food products produced in the organisation meet the organisation standards, national and international regulations		3	1	2
	PC30 Implement procedure, standards and specifications to meet quality goals of the organisation, coordinate departments and provide support to implement food safety system like HACCP in the organisation		3	1	2
	PC31 Evaluate records on quality of product and process to assess the effectiveness of quality system followed in the organisation, review and revise the quality system through quality assurance manager and implement changes		2.5	1	1.5
	PC32 Organize training for employees to update on latest		2.5	0.5	2



Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	developments/systems/ tools and techniques in quality management system and evaluate their competency to fulfill organisation goals				
	PC33 Encourage employees of all functions to take personal responsibility for achieving quality standards of product and process and to address or report/address any non-conformance		2.5	1	1.5
	PC34 Monitor process and product quality against target and plan, identify and assess risks of shortfalls in the quality of processes and products/services and take immediate corrective action to address risks		3	1	2
	PC35 Direct and coordinate implementation of quality system like ISO, HACCP etc in the organisation through quality manager		3	1	2
	PC36 Ensure managers responsible for organizational processes understand the requirements of quality system, establish their roles in implementation of quality system in their functional areas, enhance their confidence and commitment to quality by providing continuous support		3	1	2
	PC37 Encourage and support department heads and employees for quality audit process to obtaining accreditation, certifications to a standard or a mark of quality, monitor quality audit process, review results and take immediate corrective action through concerned managers		2.5	1	1.5
	PC38 Identify the environmental impact related to the resources, process and products produced in the organisation like air/water/noise pollution, effluent treatment, waste disposal etc, identify risks to the environment, consult with experts and identify opportunities to improve environmental performance		1.5	0.5	1
	PC39 Set and implement policies and procedures through managers, monitor to ensure its efficiency and effectiveness and make changes as required to meet the regulatory requirements		1.5	0.5	1
			100	35	65

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
3. FIC/N9019: Manage new projects and implement health and safety system in food processing unit	PC1. Implement new project/business plans of the organisation for introducing new products or for improving processes, procedures and performance	100	3	1	2
	PC2. Map or perform comparative study of the project with the current project/product to understand the ways proposed project fits with the overall vision, objectives and plans of the organisation		4	1	3
	PC3. Read the key objectives and scope of the proposed project, prepare resource requirement for implementation of new project, negotiate with clarity and strong reasoning and get approved from superiors/management		5	2	3
	PC4. Consult with experts and managers and prepare realistic and thorough plan to implement the project successfully, prepare project report considering all possibilities		4	1.5	2.5
	PC5. Submit the project report to the superiors/management, discuss plan, consider suggestions and recommendations and make necessary changes where necessary, take approval of final plan		4	1.5	2.5
	PC6. Brief project team managers on the project plan and their roles and responsibilities, start implementation of project and provide ongoing support, encouragement and information for successful completion		5	2	3
	PC7. Monitor, control and review project plan during each stage of implementation		4	1.5	2.5
	PC8. Provide sufficient resources to deal with contingencies and to manage any potential risks		4	1.5	2.5
	PC9. Inform the management/superiors of the developments in the project on regular basis, discuss progress and problems, take approval for any changes in project plan		4	1.5	2.5
	PC10. Complete project within agreed level of resources meeting all legal and regulatory requirements, share the success with the project team		4	1.5	2.5



Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	members, recognize and reward their contribution				
	PC11. Read national and international food safety regulations and standards related to the food processing units, process and products produced in the organisation		3	1.5	2.5
	PC12. Ensure effective policies and procedures are in place in the organization to meet to legal and regulatory requirements		5	2	3
	PC13. Ensure regulatory standards set by the organisation for products are stringent than the national and international legal requirements		4	1.5	2.5
	PC14. Ensure managers of all functional area have a clear understanding of the policies and procedures on food regulatory standards		4	1.5	2.5
	PC15. Organize training for all employees on policies and procedures on food regulatory standards and the importance of following regulations		4	1	3
	PC16. Monitor and ensure relevant legal and regulatory requirements pertaining to food processing units and products produced in the organisation are followed and met		5	2	3
	PC17. Identify reasons for noncompliance, review and revise the policies and procedures in consultation with quality and regulatory affairs manager to correct and overcome failures, provide support to all managers to implement corrective actions for the organisation and products to comply with regulatory standards		5	2	3
	PC18. Read the health and safety requirements, and food safety, hygiene and sanitation requirements for the organization and products produced		3	1	2
	PC19. Ensure that the organisation has written policy and procedures on health and safety, food safety, hygiene and sanitation, and those are clearly communicated to all employees of the organisation, and are put into practice and being followed		4	1	3



Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	PC20. Implement system for identifying hazards and assessing risk in food processing and products, set procedures to control and prevent them		4	1	3
	PC21. implement system for GMP, HACCP, FIFO/FEFO, product recall etc, organize training to the employees on health and safety, food safety, hygiene and sanitation for effective implementation of the systems, allocate required resources for implementation, and ensure those are followed by all employees		5	2	3
	PC22. Ensure systems are in place for effective monitoring, measuring and reporting on the performance of health and safety system		4	1	3
	PC23. Evaluate the existing systems and procedures, consult with managers and experts and identify method to reduce risks/improve control measure		4	1	3
	PC24. Ensure health and safety policies are practiced across the organisation, effectively monitored, reviewed and revised at regular intervals to meet the changes in national and international regulations		4	1	3
	Total		100	35	65
	Grand Total	300	300	200	100
	Percentage Weightage		100	60%	40%
	Minimum Pass% to qualify (aggregate):			70%	



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 Orthogonality (**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 $J_\nu(x)$, Bessel differential equation, generating function for $J_\nu(x)$, Integrals for $J_0(x)$ and $J_\nu(x)$, recurrence formulae for $J_\nu(x)$, 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. Chattopadhyay 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 theorem (**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 $\eta_{ij} = \text{diag} (1 -1 -1 -1)$. 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 monoatomic 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 L^2 and L_z . Particle on a sphere and the rigid rotator. General angular momentum. The spectrum of 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. Spectroscopic 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) $3/2^2D - 1/2^2P$ 2) $5/2^2D - 3/2^2P$ 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 Edition, 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 $m \times n$ 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 \times 4 hours \times 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 \times 4 hours \times 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 \times 4 hours \times 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 crystal growth. Czochralski, Kyropoulos, 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. Phenomenological 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 trifluoride 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. Nordheim'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 Spectral Lines, 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. Papapetrou 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 Pyrhelimeter. **[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-Dushman 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 \times 4 hours \times 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 \times 4 hours \times 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. Randomicity 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 deposition, chemical vapor deposition. Top- Down Approach; Ball milling, Microfabrication, 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, New 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 $\frac{1}{2}$ 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 fields - 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. Chandrashekar 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), Leonard 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. Chu W.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. Hautjarvi 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, Poincaré 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 Poincaré 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(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

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-Dushman 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 \times 4 hours \times 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 \times 4 hours \times 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 \times 4 hours \times 16 weeks = **64 hours**