

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE
(An autonomous College of University of Mysuru)
Re-accredited by NAAC with 'A' grade
Ooty road, Mysuru-570 025, Karnataka



ESTD-1964

DEPARTMENT OF MICROBIOLOGY

SYLLABUS

**NATIONAL EDUCATION POLICY
FOR
B.Sc. PROGRAMME**

Microbiology & Biotechnology

Microbiology & Biochemistry

(W. E. F. 2021)

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSURU-25
DEPARTMENT OF MICROBIOLOGY
PROFORMA OF INSTRUCTIONS AND EXAMINATION FOR B.Sc. PROGRAMME IN MICROBIOLOGY (NEP)
DURATION OF THE COURSE: 4YEARS (8SEMESTER)
PROGRAMME: BSc Microbiology & Biotechnology
(2021-22)
BSc Microbiology (Basic / Hons.)

Year	Semester	Course code	Core course		Title of the paper	No. of credits			Total credits	Total hours		Maximum Marks in exam/Assessment			
						L	T	P		Th	Pr	IA(Theory)		Total	
												C-1	C-2		
I B.Sc	I	FSA500	DSC-I :Theory	General Microbiology	04	4	0	0	06	56		60	Total -20Marks 10- IA test 10-Assignment	Total -20Marks 10- IA test 10-Seminar	100
		FSA500	DSC-I: Pract-I	General Microbiology	04	0	0	2			60	25	10- Pract- IA test	10- Pract- IA test +5 (record)	50
		FSA980	OE-I	Microbial Technology for human welfare	03	3	0	0		03	42	-	-	Total -20Marks 10- IA test 10-Assignment	Total -20Marks 10- IA test 10-Seminar
		SEC-1	Microbiological methods and Analytical Techniques	01	1	0	0	01	14						100
	II	FSB500	DSC-II: Theory	Microbial biochemistry and physiology	04	4	0	0	06	56		60	Total -20Marks 10- IA test 10-Assignment	Total -20Marks 10- IA test 10-Seminar	100
		FSB500	DSC-II: Pract-II	Microbial biochemistry and physiology	04	0	0	2			60	25	10- Pract- IA test	10- Pract- IA test +5 (record)	50
FSB980		OE-II	Environmental and sanitary Microbiology	03	3	0	0	03		42			Total -20Marks 10- IA test 10-Assignment	Total -20Marks 10- IA test 10-Seminar	100

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DEPARTMENT OF MICROBIOLOGY
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DURATION OF THE COURSE: 4YEARS (8SEMESTER)
PROGRAMME: BSc Microbiology & Biochemistry
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I B.Sc	I	FSA500	DSC-I :Theory	General Microbiology	04	4	0	0	06	56		60	Total -20Marks 10- IA test 10-Assignment	Total -20Marks 10- IA test 10-Seminar	100
		FSA500	DSC-I: Pract-I	General Microbiology	04	0	0	2			60	25	10- Pract- IA test	10- Pract- IA test +5 (record)	50
		FSA980	OE-I	Microbial Technology for human welfare	03	3	0	0	03	42	-	-	Total -20Marks 10- IA test 10-Assignment	Total -20Marks 10- IA test 10-Seminar	100
		SEC-1	Microbiological methods and Analytical Techniques	01	1	0	0	01	14					100	
	II	FSB500	DSC-II: Theory	Microbial biochemistry and physiology	04	4	0	0	06	56		60	Total -20Marks 10- IA test 10-Assignment	Total -20Marks 10- IA test 10-Seminar	100
		FSB500	DSC-II: Pract-II	Microbial biochemistry and physiology	04	0	0	2			60	25	10- Pract- IA test	10- Pract- IA test +5 (record)	50
FSB980		OE-II	Environmental and sanitary Microbiology	03	3	0	0	03	42			Total -20Marks 10- IA test 10-Assignment	Total -20Marks 10- IA test 10-Seminar	100	

DEPARTMENT OF MICROBIOLOGY
PROGRAMME: B.Sc., Microbiology & Biotechnology
B.Sc., Microbiology & Biochemistry
PROGRAM OUTCOMES

Competencies need to be acquired by the candidate securing B.Sc (Basic) or B.Sc (Hons)

By the end of the program the students will be able to:

PO1	Knowledge and understanding of concepts of microbiology and its application in pharma, food, agriculture, beverages, nutraceutical industries.
PO2	Understand the distribution, morphology and physiology of microorganisms and demonstrate the skills in aseptic handling of microbes including isolation, identification and maintenance.
PO3	Competent to apply the knowledge gained for conserving the environment and resolving the environmental related issues.
PO4	Learning and practicing professional skills in handling microbes and contaminants in laboratories and production sectors.
PO5	Exploring the microbial world and analyzing the specific benefits and challenges.
PO6	Applying the knowledge acquired to undertake studies and identify specific remedial measures for the challenges in health, agriculture, and food sectors.
PO7	Thorough knowledge and application of good laboratory and good manufacturing practices in microbial quality control.
PO8	Understanding biochemical and physiological aspects of microbes and developing broader perspective to identify innovative solutions for present and future challenges posed by microbes
PO9	Understanding and application of microbial principles in forensic and working knowledge about clinical microbiology.
PO10	Demonstrate the ability to identify ethical issues related to recombinant DNA technology, GMOs, intellectual property rights, biosafety and biohazards.
PO11	Demonstrate the ability to identify key questions in microbiological research, optimize research methods, and analyze outcomes by adopting scientific methods, thereby improving the employability.
PO12	Enhance and demonstrate analytical skills and apply basic computational and statistical techniques in the field of microbiology.

PROGRAMME SPECIFIC OUTCOME

After completing the graduation in the Bachelor of Science the students are able to:

PSO 1	Demonstrate effectively the applications of biochemical and biological sciences
PSO2	Inculcating proficiency in all experimental techniques and methods of analysis
PSO3	Acquire, articulate, retain and demonstrate laboratory safety skills applicable to microbiological research or clinical methods, including accurately reporting observations and analysis
PSO4	Communicate scientific information effectively, especially relating to microbes and their role in ecosystem and health related issues
PSO5	Be knowledgeable in proper procedures and regulations in handling and disposal of chemicals
PSO6	Gain and understanding of biochemical and molecular processes that occur in and between cells to expand understanding of biology

ASSESSMENT

Weight age for assessments (in percentage)

Type of Course	Formative Assessment / IA	Summative Assessment
Theory	40%	60%
Practical	50%	50%
Projects	40%	60%
Experiential Learning (Internships/MOOC/ Swayam etc.)	40%	60%

Formative Assessment : 40%	
Assessment Occasion/ type	Weightage in Marks
C1 = IA -1 + Assignments / Visits	10% + 10% = 20% : 20 Marks
C2 = IA -2 + Seminars / Group Discussion	10% + 10 = 20% : 20 Marks
Total	40% : 40 Marks

Total Marks for each course = 100%
Formative Assesment (C1+C2) = 40%
Semester end examination (C3) = 60%

**BSc Microbiology (Basic / Hons.)
Semester 1**

Course Title: DSC-1T, MBL 101, General Microbiology	
Total Contact Hours: 56	Course Credits: 4+2
Formative Assessment Marks: 40%	Duration of ESA/Exam: 3 Hrs
Model Syllabus Authors: Curriculum Committee	Summative Assessment Marks: 60%

Course Outcomes (COs):

At the end of the course the student should be able to:

- 1. Thorough knowledge and understanding of concepts of microbiology.**
- 2. Learning and practicing professional skills in handling microbes.**
- 3. Thorough knowledge and application of good laboratory and good manufacturing practices in microbial quality control.**

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12
1. Thorough knowledge and understanding of concepts of microbiology	✓	✓		✓								
2. Learning and practicing professional skills in handling microbes		✓		✓			✓					
3. Thorough knowledge and application of good laboratory and good manufacturing practices in microbial quality control.		✓		✓			✓					

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark 'X' in the intersection cell if a course outcome addresses a particular program outcome.

BSc Microbiology (Basic / Hons.)

Semester 1

Title of the Courses:

Course 1: DSC-1T: General Microbiology

Course 2: OE 1T: Microbial Technology for Human Welfare

Course 3: SEC 1T: Microbiological Methods and Analytical Techniques

Course 1 : DSC-1T General Microbiology		Course 2 : OE 1T Microbial Technology for Human Welfare		Course 3 : SEC 1T Microbiological Methods and Analytical Techniques	
Number of Theory Credits	Number of lecture hours/semester	Number of Theory Credits	Number of lecture hours/semester	Number of Theory Credits	Number of lecture hours/semester
4	56	3	42	1	14

Content of Course 1: Theory: DSC-1T, MBL 101, General Microbiology	56 Hrs
Unit – 1: Historical development, major contributions, origin of microorganisms and microscopy	14Hrs
<p>Historical development of microbiology -Theory of spontaneous generation, Biogenesis and Abiogenesis. Contributions of Anton Von Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister and Edward Jenner, Alexander Fleming, Martinus Beijerinck, Sergei Winogradsky, Elie Metchnikoff. Contributions of Indian scientists in the field of Microbiology. Fossil evidences of microorganisms. Origin of life, primitive cells and evolution of microorganisms. Microscopy- working principle, construction and operation of simple and compound microscopes.</p>	
Unit – 2: Staining, sterilization and preservation of microorganisms	14Hrs
<p>Staining: Nature of stains, principles, mechanism, methods and types of staining- Simple, Differential-Gram staining, Acid fast staining, staining of capsule, cell wall, endospore, inclusion bodies.</p> <p>Sterilization: Principles, types and techniques, Physical and chemical methods. Preservation of microorganisms: Methods of preservation of microorganisms; slant culture, stab culture, soil culture, mineral oil overlaying, glycerol preservation.</p>	
Unit – 3: Types, structure, organisation and reproduction of prokaryotic microorganism	14Hrs
<p>Overview of Prokaryotic Cell Structure: Size, shape, arrangement. Diagram of Prokaryotic cell organisation, cell wall structure of Gram positive and negative bacteria, cell membrane; Bacterial and Archaeal, Cytoplasmic matrix- Cytoskeleton, ribosome, inclusion granules: Composition and function. Nuclear Materials – Bacterial chromosomes structure (its differences with the Eukaryotic chromosome); Extra Chromosomal materials. Components external to cell wall- capsule, slime, s- layer, pili, fimbriae, flagella; structure, motility, chemotaxis. Bacterial Endospore - Examples of spore forming organisms, habitats, function, formation and germination.</p> <p>Reproduction in bacteria and bacterial cell cycle.</p>	

Unit – 4: Types, structure, organisation and reproduction of eukaryotic microorganisms	14Hrs
<p>Over view of eukaryotic cell structure: General structure and types of cells; External cell coverings and cell membrane. Structure and function of Cytoplasmic matrix- cytoskeleton: Structure and function; single Membrane organelles- Endoplasmic reticulum, Golgi complex, Lysosomes, Vesicles and Ribosomes; Double Membrane organelles- Nucleus, Mitochondrion and Chloroplast: Structure and Functions; Peroxisomes; Organelles of motility- Structure and movement of flagella and cilia.</p>	

Course 1: Practical: DSC-1P : General Microbiology

1. Microbiological laboratory standards and safety protocols.
2. Standard aseptic conditions of Microbiological laboratory.
3. Operation and working principles of Light/ Compound microscope.
4. Working principles and operations of basic equipments of microbiological laboratory (Autoclave, Oven, Incubator, pH meter, Spectrophotometer, Colorimeter, Vortex, Magnetic stirrer).
5. Applications of basic microbiological tools (Pipettes, Micropipette, Bunsen burner, Inoculation loop, Spreader).
6. Demonstration and observations of microorganisms from natural sources under light microscope (Algae, Yeast and Protozoa).
7. Demonstration of bacterial motility by hanging drop method.
8. Simple staining.
9. Negative staining.
10. Differential staining - Gram staining.
11. Acid fast staining.
12. Structural staining - Flagella and Capsule.
13. Bacterial endospore staining.
14. Staining of reserved food materials.
15. Staining of fungi by Lactophenol cotton blue.

Text Books / References

1. General Microbiology 1st Edition, 2020 , Linda Bruslind, Oregon State University
2. Prescott, Harley, Klein's Microbiology, J.M. Willey, L.M. Sherwood, C.J. Woolverton, 7th International, edition 2008, McGraw Hill.
3. Foundations in Microbiology, K. P. Talaro, 7th International edition 2009, McGraw Hill.
4. A Textbook of Microbiology, R. C. Dubey and D. K. Maheshwari, 1st edition, 1999, S. Chand & Company Ltd.
5. Brock Biology of Microorganisms, M.T.Madigan, J.M.Martinko, P. V. Dunlap, D. P. Clark- 12th edition, Pearson International edition 2009, Pearson Benjamin Cummings.
6. Microbiology – An Introduction, G. J.Tortora, B. R.Funke, C. L. Case, 10th ed. 2008,Pearson Education.
7. General Microbiology, Stanier, Ingraham et al, 4th and 5th edition 1987, Macmillan education limited.
8. Microbiology- Concepts and Applications, Pelczar Jr,Chan, Krieg, International ed, McGraw Hill.
9. Alexopoulos, C.J., Mims, C.W., and Blackwell, M. 2002. Introductory Mycology. John Wiley and Sons (Asia) Pvt. Ltd. Singapore. 869 pp.
10. Atlas, R.M. 1984. Basic and practical microbiology. Mac Millan Publishers, USA. 987pp.
11. Black, J.G. 2008. Microbiology principles and explorations. 7edn. John Wiley and Sons Inc., New Jersey 846 pp.
12. Pommerville, J.C. Alcamo's Fundamentals of Microbiology. Jones and Bartlett Pub..Sudbury, 835 pp.
13. Schlegel, H.G. 1995.General Microbiology. Cambridge University Press, Cambridge, 655 pp.
14. Tortora, G.J., Funke, B.R. and Case, C.L. 2007. Microbiology 9th ed. Pearson Education Pte. Ltd., San Francisco. 958pp.

COURSE 2: THEORY: OE 1T: MICROBIAL TECHNOLOGY FOR HUMAN WELFARE

Course 2 : OE 1T: Microbial Technology for Human Welfare	42Hrs
Unit – 1: Food and Fermentation Microbial Technology	14Hrs
Fermented Foods – Types, Nutritional Values, Advantages and Health Benefits Prebiotics, Probiotics, Synbiotics and Nutraceutical Foods Fermented Products – Alcoholic and nonalcoholic beverages, fermented dairy products, Fruit fermented drinks,	
Unit – 2: Agricultural Microbial Technology	14Hrs
Microbial Fertilizers, Microbial Pesticides, Mushroom Cultivation, Biogas Production	
Unit – 3: Pharmaceutical Microbial Technology	14Hrs
Microbial Drugs – Types and Development of Drug resistance Antibiotics – Types, Functions and Antibiotic Therapy Vaccines – Types, Properties, Functions and Schedules	

COURSE 3: THEORY: SEC 1T

TITLE: MICROBIOLOGICAL METHODS AND ANALYTICAL TECHNIQUES

LEARNING OUTCOMES

- Demonstrate skills as per National Occupational Standards (NOS) of “Lab Technician/ Assistant” Qualification Pack issued by Life Sciences Sector Skill Development Council - LFS/Q0509, Level 3.
 - Perform microbiology and analytical techniques. Knowledge about environment, health, and safety (EHS), good laboratory practices (GLP), good manufacturing practices (GMP) and standard operating procedures (SOP)
 - Demonstrate professional skills at work, such as decision making, planning, and organizing, Problem solving, analytical thinking, critical thinking, and documentation.
1. Principles which underlies sterilization of culture media, glassware and plastic ware to be used for microbiological work.
 2. Principles of a number of analytical instruments which the students have to use during the study and also later as microbiologists for performing various laboratory manipulations.
 3. Handling and use of microscopes for the study of microorganisms which are among the basic skills expected from a practicing microbiologist. They also get introduced a variety of modifications in the microscopes for specialized viewing.
 4. Several separation techniques which may be required to be handled later as microbiologists.

COURSE 3: THEORY: SEC 1T

SEC 1T : MICROBIOLOGICAL METHODS AND ANALYTICAL TECHNIQUES	14Hrs
DIGITAL SKILLS: The components of digital skills provided by KSHEC, will be followed accordingly. Microbiological Skills Microbiological culture media: Types, Composition, Preparation, Application and storage; Ingredients of media, natural and synthetic media, chemically defined media, complex media, selective, differential, indicator, enriched and enrichment media. Isolation and cultivation of microorganisms: Collection of samples, processing of samples, serial dilution, technique, inoculation of samples, incubation and observations of microbial colonies. Morphological characterization of microorganisms - Colony characteristics, Microscopic characters, biochemical/physiological tests or properties and identification. Subculturing of microorganisms and pure culture techniques. Preservation of microorganisms. Advanced Microscopic Skills: Different types of microscopes - Phase contrast, Bright Field, Dark Field, Fluorescent, Confocal, Scanning and Transmission Electron Microscopy. Analytical Skills Centrifugation, Chromatography and Spectroscopy: Principles, Types, Instrumentation, Operation and applications.	

Course 3: Practicals: SEC 1P: Microbiological Methods and Analytical Techniques

1. Preparation of different microbiological culture media
2. Isolation and cultivation of bacteria, actinobacteria, fungi and algae
3. Characterization and identification of bacteria, actinobacteria, fungi and algae – colony characters and microscopic characters
4. Biochemical and physiological tests for identification of bacteria
5. Methods and practices in microbiology lab: MSDS (Material Safety Data Sheet), Good clinical Practices (GCP), Standard Operating Procedure (SOP), Good Laboratory Practices (GLP), Good Manufacturing Practices.
6. Usage and maintenance of basic equipment of microbiology lab: Principles, calibrations, and SOPs of balances (Types), pH meter (Types), Autoclaves (Types), Laminar flows and biosafety cabinets, basic Microscopes, homogenizers, stirrers.
7. Procedures for documentation, lab maintenance, repair reporting
8. Separation of mixtures of biomolecules by paper / thin layer chromatography.
9. Demonstration of column packing in column chromatography.

Pedagogy :

The general pedagogy to be followed for theory and practicals are as under. Lecturing, Tutorials, Group/Individual Discussions, Seminars, Assignments, Counseling, Remedial Coaching. Field/Institution/Industrial visits, Hands on training, Case observations, Models/charts preparations, Problem solving mechanism, Demonstrations, Project presentations, Experiential documentation and Innovative methods.

Active learning as per LSSSDC (NSDC) LFS/Q0509 guidelines, at skill training Level 3. Case studies about application of microbial biomolecules in various industries. Seminar on topics of microbial biochemistry

Formative Assessment : 40%	
Assessment Occasion/ type	Weightage in Marks
C1 = IA -1 + Assignments / Visits	10% + 10% = 20% : 20 Marks
C2 = IA -2 + Seminars / Group Discussion	10% + 10 = 20% : 20 Marks
Total	40% : 40 Marks

BSc Microbiology (Basic / Hons.)
Semester 2

Title of the Courses:

Course 1: DSC-2T: Microbial Biochemistry and Physiology Course

2: OE- 2T: Environmental and Sanitary Microbiology

Course 1: DSC-2T, MBL 102, Microbial Biochemistry and Physiology		Course 2: OE- 2T, MBL 302, Environmental and Sanitary Microbiology	
Number of Theory Credits	Number of lecture hours/semester	Number of Theory Credits	Number of lecture hours/semester
4	56	3	42

Content of Course: DSC-2T: Microbial Biochemistry and Physiology	56 Hrs
Unit - 1 Biochemical Concepts	14Hrs
<p>Basic Biochemical Concepts: Major elements of life and their primary characteristics, atomic bonds and molecules – bonding properties of carbon, chemical bonds- covalent and non covalent, Hydrogen bonds and Vander Waal Forces.</p> <p>Biological Solvents: Structure and properties of water molecule, Water as an universal solvent, polarity, hydrophilic and hydrophobic interactions, properties of water, Acids, bases, electrolytes, hydrogen ion concentration, pH, buffers and physiological buffer system, Handerson – Hasselbatch equation.</p>	
Unit - 2 Macromolecules – Types, Structure and Properties	14Hrs
<p>Carbohydrates: Definition, classification, structure and properties.</p> <p>Amino acids and proteins: Definition, structure, classification and properties of amino acids, Structure and classification of proteins.</p> <p>Lipids and Fats: Definition, classification, structure, properties and importance of lipids. Porphyrins and Vitamins: Definition, structure, properties and importance of chlorophyll, cytochrome and hemoglobin.</p>	
Unit – 3 Microbial Physiology	14Hrs
<p>Microbial Growth: Definition of growth, Mathematical expression, Growth curve, phases of growth, calculation of generation time and specific growth rate. Synchronous growth, Continuous growth (chemostat and turbidostat), Diauxic growth. Measurement of Growth: Direct Microscopic count - Haemocytometer; Viable count, Membrane filtration; Electronic Counting; Measurement of cell mass; Turbidity measurements-Nephelometer and spectrophotometer techniques; Measurements of cell constituents. Growth Yield (definition of terms). Influence of environmental factors on growth. Microbial growth in natural environments. viable non-culturable organisms. Quorum sensing.</p> <p>Microbial Nutrition: Microbial nutrients, Classification of organisms based on carbon source, energy source and electron source, Macro and micronutrients.</p> <p>Membrane Transport: Structure and organization of biological membranes, Types of Cellular transport, Passive, Facilitated, Active, Group Translocation, Membrane bound and binding protein transport system, Carrier models, Liposomes, Ion transduction Na K⁺, ATPase.</p>	
Unit – 4: Microbial Physiology- Bioenergetics, Microbial Respiration, Microbial Photosynthesis	14Hrs

<p>Bioenergetics: Free energy, Enthalpy, Entropy, Classification of high energy compounds, Oxidation reduction reactions, equilibrium constant, Redox potential, Law of thermodynamics.</p> <p>Microbial Respiration: Respiratory electron transport chain in bacteria, oxidation – reduction reactions, protein translocation, oxidative and substrate level phosphorylation – inhibitors and mechanism, chemiosmotic coupling. Fermentation reactions (homo and hetero)</p> <p>Microbial Photosynthesis: Light reaction: Light harvesting pigments Photophosphorylation, CO₂ fixation pathways: Calvin cycle, CODH pathway, Reductive TCA pathway.</p>	
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Course 1: Practicals: DSC-2P: Microbial Biochemistry and Physiology

1. Preparation of Solution: Normal and Molar solutions
2. Calibration of pH meter and determination of pH of natural samples
3. Preparation of Buffer Solutions
4. Qualitative determination and identification of Carbohydrates
5. Qualitative determination and identification of Proteins
6. Qualitative determination and identification of Amino Acids
7. Qualitative determination and identification of Fatty Acids
8. Quantitative estimation of Reducing Sugar by DNS method
9. Quantitative estimation of Proteins by Biuret and Lowry's method
10. Determination of lipid saponification values of fats and iodine number of fatty acids
11. Determination of bacterial growth by spectrophotometric method & calculation of generation time
12. Effect of pH, temperature and Salt concentration on bacterial growth
13. Effect of Salt concentration on bacterial growth
14. Effect of Temperature on bacterial growth
15. Demonstration of aerobic and anaerobic respiration in microbes

Text Books / References

1. Cohen, Georges N, 2014, Microbial Biochemistry, Springer Netherlands.
2. Felix Franks, 1993; Protein Biotechnology, Humana Press, New Jersey.
3. Stryer L, 1995; Biochemistry, Freeman and Company, New York.
4. Voet & Voet, 1995; Biochemistry, John Wiley and Sons, New York.
5. Nelson and Cox, 2000; Lehninger Principles of Biochemistry, Elsevier Publ.
6. Harper, 1999; Biochemistry, McGraw Hill, New York.
7. Palmer T. (2001), Biochemistry, Biotechnology and Clinical Chemistry, Harwood Publication, Chichester.
8. Boyer R. (2002), Concepts in Biochemistry 2nd Edition, Brook/ Cole, Australia.
9. Moat A. G., Foster J.W. Spector. (2004), Microbial Physiology 4th Edition Panama Book Distributors.
10. Caldwell, D. R. (1995) – Microbial Physiology and Metabolism. Brown Publishers.
11. Lodish H, T. Baltimore, A. Berck B.L. Zipursky, P. Mastsydaire and J. Darnell. (2004) – Molecular Cell Biology, Scientific American Books, Inc. Newyork.

Course 2: Theory: OE- 2T: Environmental and Sanitary Microbiology

Course 2 :Theory: OE- 2T:Environmental and Sanitary Microbiology	42 Hrs
Unit – 1: Soil and Air Microbiology	14 Hrs
Soil and Air as a major component of environment. Types, properties and uses of soil and air. Distribution of microorganisms in soil and air. Major types of beneficial microorganisms in soil. Major types of harmful microorganisms in soil	
Unit – 2: Water Microbiology	14 Hrs
Water as a major component of environment. Types, properties and uses of water. Microorganisms of different water bodies. Standard qualities of drinking water	
Unit – 3: Sanitary Microbiology	14 Hrs
Public health hygiene and communicable diseases. Survey and surveillance of microbial infections. Airborne microbial infections, waterborne microbial infections, Food borne microbial infections. Epidemiology of microbial infections, their detection and control.	

Text Books / References

1. Diana Marco, 2019, Microbial Ecology: Current advances from Genomics, Metagenomics and other omics, Caister Academic Press.
2. Prescott, Harley, Klein's Microbiology, J.M. Willey, L.M. Sherwood, C.J. Woolverton, 7th International, edition 2008, McGraw Hill.
3. Foundations in Microbiology, K. P. Talaro, 7th International edition 2009, McGraw Hill.
4. A Textbook of Microbiology, R. C. Dubey and D. K. Maheshwari, 1st edition, 1999, S. Chand & Company Ltd.
5. Brock Biology of Microorganisms, M.T.Madigan, J.M.Martinko, P. V. Dunlap, D. P. Clark- 12th edition, Pearson International edition 2009, Pearson Benjamin Cummings.
6. Microbiology – An Introduction, G. J.Tortora, B. R.Funke, C. L. Case, 10th ed. 2008,Pearson Education.
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9. Alexopoulos, C.J., Mims, C.W., and Blackwell, M. 2002. Introductory Mycology. John Wiley and Sons (Asia) Pvt. Ltd. Singapore. 869 pp.
10. Atlas, R.M. 1984. Basic and practical microbiology. Mac Millan Publishers, USA. 987pp.
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12. Pommerville, J.C. Alcamo's Fundamentals of Microbiology. Jones and Bartlett Pub..Sudbury, 835 pp.
13. Schlegel, H.G. 1995.General Microbiology. Cambridge University Press, Cambridge, 655 pp.
14. Toratora, G.J., Funke, B.R. and Case, C.L. 2007. Microbiology 9th ed. Pearson Education Pte. Ltd., San Francisco. 958pp.

Pedagogy:

The general pedagogy to be followed for theory and practicals are as under.

Lecturing, Tutorials, Group/Individual Discussions, Seminars, Assignments, Counseling, Remedial Coaching. Field/Institution/Industrial visits, Hands on training, Case observations, Models/charts preparations, Problem solving mechanism, Demonstrations, Project presentations, Experiential documentation and Innovative methods.

Formative Assessment : 40%	
Assessment Occasion/ type	Weightage in Marks
C1 = IA -1 + Assignments / Visits	10% + 10% = 20% : 20 Marks
C2 = IA -2 + Seminars / Group Discussion	10% + 10 = 20% : 20 Marks
Total	40% : 40 Marks

GENERAL PATTERN OF THEORY EXAMINATION

B.Sc MICROBIOLOGY

Duration: 3 Hours

Maximum: 60 Marks

*Note: All questions are compulsory
Draw neat labeled diagrams wherever necessary*

QNo. I Answer any EIGHT of the following: 2X8=16

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.

QNo. II Answer any SIX of the following: 4X6=24

- 11.
- 12.
- 13.
- 14.
- 15.
- 16.
- 17.
- 18.

QNo. III Answer any TWO of the following : 10X2=20

- 19.
- 20.
- 21.
- 22.

PATTERN OF PRACTICAL EXAMINATION

Practical examination – B. Sc MICROBIOLOGY

Duration: 3 hours

Max. Marks: 25

Q. 1	Major question	08 Marks
Q. 2	Minor question	05 Marks
Q. 3	Identify and comment	2X4 = 08Marks
Q. 4	Viva-voce	04 Marks

PATTERN OF FORMATIVE ASSESMENT - PRACTICALS

Max. Marks: 25

1	IA 1	05 Marks
2	IA 2	05 Marks
3	Assignment/ Field Visit Reports	10Marks
4	Record	05 Marks

SCHEME OF THEORY EXAMINATION

I B.Sc., I SEMESTER

DSC-I: GENERAL MICROBIOLOGY

Times:3hrs

Max Marks:60

Question Paper to be set for total of 92 marks including choices

UNITS	2 mark questions	4mark questions	10 mark questions	Total Marks
Unit – 1: Historical development, major contributions, origin of microorganisms and microscopy	2	2	1	22
Unit – 2: Staining, sterilization and preservation of microorganisms	2	2	1	22
Unit – 3: Types, structure, organisation and reproduction of prokaryotic microorganism	3	2	1	24
Unit – 4: Types, structure, organisation and reproduction of eukaryotic microorganisms	3	2	1	24

I Main: 2x10=20Marks

II Main: 4x8= 32Marks

III Main: 4x10=40Marks

SCHEME OF PRACTICAL EXAMINATION

I B.Sc., I SEMESTER

PRACTICAL-I: GENERAL MICROBIOLOGY

Time: 3hours

Max marks: 25

- I. Stain the given material **A** by.....method. Write the principle, procedure and leave the preparation for evaluation
(Simple staining/Negative staining/Gram-staining/Cell wall/ Endospore)
(Preparation-4 marks; Principle-2 ,Procedure-1& result-1 marks) 08
- II. Prepare a temporary slide **B** by method. Write the principle, procedure and leave the preparation for evaluation
(Wet mounting of Fungi/Hanging drop/Microbes from natural sources)
(Preparation-2 marks; Principle-1 ,Procedure- 1& result-1 marks) 05
- III. Identify the materials **C, D, E** and **F** with labelled diagrams and reasons 2X4=08
(Microscopes/ Basic equipments / Basic Microbiological tools as per syllabus)
(Identification -1mark; diagram and reasons-1mark)
- IV. Viva-voce 05

SCHEME OF THEORY EXAMINATION
I B.Sc., II SEMESTER
DSC-I: MICROBIAL BIOCHEMISTRY AND PHYSIOLOGY

Times:3hrs

Max Marks:60

Question Paper to be set for total of 92 marks including choices

UNITS	2 mark questions	4mark questions	10 mark questions	Total Marks
Unit – 1 : Biochemical concepts	2	2	1	22
Unit – 2: Macromolecules-Types, Structure and properties	2	2	1	22
Unit – 3: Microbial physiology	3	2	1	24
Unit – 4: Microbial physiology- Bioenergetics, Microbial respiration Microbial photosynthesis	3	2	1	24

I Main: 2x10=20Marks

II Main: 4x8= 32Marks

III Main: 4x10=40Marks

SCHEME OF PRACTICAL EXAMINATION
I B.Sc., I SEMESTER
PRACTICAL-I: GENERAL MICROBIOLOGY

Time: 3hours

Max marks: 25

- I. Demonstrate the experiment **A**, giving principle and procedure. Record the results.
(Effect of temperature on growth of microorganisms/Effect of pH on the growth of microorganisms /Effect of salt concentration on growth of microorganism)
(Demonstration-4marks; principle -2mark; procedure -1marks; result-1mark) 08

- II. Perform/conduct the experiment **B**, giving principle and procedure. Record the results. 05
(Demonstration-2marks; principle -1mark; procedure -1marks; result-1mark)

- III. Identify the materials **C, D, E** and **F** with labelled diagrams and reasons 2X4=08
(Normal /Molar solutions, pH meter, Spectrophotometer/Demonstration of aerobic and anaerobic Respiration, Effect of temperature on growth of microorganisms/Effect of pH on the growth of microorganisms /Effect of salt concentration on growth of microorganism)
(Identification -1mark; diagram and reasons-1mark)

- IV. Viva-voce 05

SCHEME OF THEORY EXAMINATION
I B.Sc., II SEMESTER
OE-I: MICROBIAL TECHNOLOGY FOR HUMAN WELFARE

Times:3hrs

Max Marks:60

Question Paper to be set for total of 92 marks including choices

UNITS	2 mark questions	4mark questions	10 mark questions	Total Marks
Unit – 1 : Food and Fermentation Microbial technology	3	2	2	34
Unit – 2: Agricultural Microbial technology	3	3	1	28
Unit – 3: Pharmaceutical Microbial Technology	4	3	1	30

I Main: 2x10=20Marks

II Main: 4x8= 32Marks

III Main: 4x10=40Marks

SCHEME OF THEORY EXAMINATION
I B.Sc., II SEMESTER
OE-II: ENVIRONMENTAL AND SANITARY MICROBIOLOGY

Times: 3hrs

Max Marks:60

Question Paper to be set for total of 92 marks including choices

UNITS	2 mark questions	4mark questions	10 mark questions	Total Marks
Unit – 1 : Soil and Air Microbiology	3	2	2	34
Unit – 2: Water Microbiology	3	3	1	28
Unit – 3: Sanitary Microbiology	4	3	1	30

I Main: 2x10=20Marks

II Main: 4x8= 32Marks

III Main: 4x10=40Marks

Approved list of Paper setters and Valuers

Sl No.	Name	College address
1	Dr..M .Seema	Chairperson, Dept. of Microbiology JSS College, Ooty road, Mysore
2	H.P.Spoorthy	Assistant prof. Dept. of Microbiology JSS College, Ooty road, Mysore
3	Dr.S.Mahadevamurthy	Associate Prof & HOD Dept. of Microbiology Yuvaraja's college Mysore.
4	Dr.Syeda Kauser Fathima	Associate Prof. of Microbiology Maharani's Science College for women JLB road Mysore.
5	Dr. H.S. Jayanth.	Asso.Prof.of Microbiology Dept. of Microbiology Yuvaraja's college Mysore.
6	Dr.Uma Maheshwari	Assistant prof. JSS University, JSSAHER, Mysuru
7	Sri. M. Girish	Assistant prof. Dept. of Microbiology JSS College for Women Saraswathipuram,Mysore
8	Dr. P.K.Maheshwar	Assistant Prof. Dept. of Microbiology Yuvaraja's college,Mysore.
9	Smt. M.S.Shobha	Assistant Prof, Dept. of Microbiology Maharani's Science College Mysore
10	Sri. R.A. Manjunath	Assistant Prof. Dept. of Microbiology Saradavilas College,Mysore
11	Dr.M.P. Ragavendra	Assistant Prof. Dept. of Microbiology Maharani's Science College,Mysore
12	Dr.K.Girish	Assistant Prof. Dept. of Microbiology Maharani's Science College, Mysore
13	Sri. G.S. Siddegowda	Assistant Prof. Dept. of Microbiology

		Maharani's Science College Mysore
14	Dr.N.S.Devaki	Assistant Prof. Dept. of Molecular Biology Yuvaraja's College , Mysore
15	Syeda Farahna Parveen	Assistant Prof. Dept. of Microbiology St.Philomina's College, Mysore
16	Smt. Vanitha	Assistant Prof. Dept. of Microbiology Maharani's Science College,Mysore
17	Smt. Revanamba	Assistant Prof. Dept. of Microbiology Maharani's Science College,Mysore
18	Mahadevaprasad	Assistant prof. Dept. of Microbiology JSS College for Women Saraswathipuram,Mysore
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20	RajaRajeshwari.R	Assistant prof. Dept. of Microbiology SDM College JLB Road,Mysuru
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22	Shruthi Prakash	Assistant Prof. Dept. of Microbiology Mahajana's Science College,Mysuru
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24	C.Poornima Devi	Assistant Prof. Dept. of Microbiology Yuvaraja's college,Mysore
25	Dr.Rakshith	Assistant Prof. Dept. of Microbiology Yuvaraja's college,Mysore
26	Vasundara Devi R	Assistant Prof. Dept. of Microbiology Maharani's Science College,Mysore
27	Niveditha Prakash	Assistant prof. Dept. of Microbiology JSS College for Women Saraswathipuram,Mysore
28	Dr.K.Sumana	Assistant prof. JSS University, JSSAHER ,Mysuru
	Samjna.S.R	Assistant Prof.

