

Assessment:

Weightage for assessments (in percentage)

Type of Course	Formative Assessment / IA	Summative Assessment
Theory	40	60
Practical	25	25
Projects	-	-
Experiential Learning (Internships etc.)	-	-

Contents of Courses for B.Sc. Microbiology as Major

Semester	Course code	Course Category	Theory/ Practical	Credits	Paper Title	Marks	
						S.A	I.A
I	MBL 101	DSC-1T	Theory	4	General Microbiology	60	40
		DSC-1P	Practical	2	General Microbiology	25	25
	MBL 301	OE 1T	Theory	3	Microbial Technology for Human Welfare	60	40
II	MBL 102	DSC-2T	Theory	4	Microbial Biochemistry and Physiology	60	40
		DSC-2P	Practical	2	Microbial Biochemistry and Physiology	25	25
	MBL 302	OE- 2T	Theory	3	Environmental and Sanitary Microbiology	60	40


Registrar
 Davangere University
 Shivagangotri, Davangere


CHAIRMAN,
 DEAS in Microbiology
 Department of Science, Davangere
 Davangere University
 Shivagangotri, Davangere-577 002.

B. Sc MICROBIOLOGY Semester-I
Title of the Course: MB DSC-1T – General Microbiology

Course 1: MBL DSC-1T – General Microbiology		Course 2: OE MBL, Microbial Technology for Human Welfare		Course 3: SEC 1T MBL Microbiological Methods and Analytical Techniques	
Number of Credits	Number of hours/semester	Number of Credits	Number of lecture hours/semester	Number of Credits	Number of hours/semester
4	56 Theory	3	42	2	14
2	52 Practical			(1 hour Theory +2 hours Practical)	

Content of Theory Course 1 : DSC-1T, MBL 101, General Microbiology	56 Hrs
Unit – 1: Historical development, major contributions, origin of microorganisms and microscopy	14 Hrs
Chapter 1: Scope and importance of microbiology. Chapter 2: Origin of microorganisms-Theory of spontaneous generation and Biogenesis. Fossil evidences of microorganisms. Origin of life, primitive cells and evolution of microorganisms. Chapter 3: Historical development of microbiology - Contributions of Antony Von Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister and Edward Jenner, Alexander Fleming, Martinus Beijerinck, Sergei Winogradsky, Elei Metchnikoff. Contributions of Indian scientists in the field of Microbiology. Chapter 4: Microscopy - Working principles of Microscopy: Resolving power, numerical aperture, working distance and Magnification.	
Unit -2: Overview of Microorganisms, Sterilization and Staining	14 Hrs
Chapter 1: Whittaker's five kingdom classification. General properties, occurrence and importance of microorganisms - Viruses, Bacteria, Fungi, Algae and Protozoa. Chapter 2: Sterilization - Physical methods – Moist heat (pasteurization, boiling, fractional sterilization and autoclaving). Dry heat – incineration and hot air oven. Filtration – membrane filter, Seitz filter, diatomaceous earth filter and laminar air flow. Radiation – nonionizing radiation and ionizing radiation. Chemical methods– alcohol, aldehydes, halogens, phenols, metallic salts, quaternary ammonium compounds and gaseous agents Chapter 3: Staining - types of stains-Basic, acidic and neutral stains. Physical and chemical theory of staining. principles, methods and types of staining - simple staining (positive and negative staining), differential staining(Gram and acid fast staining), structural staining (endospore staining and capsule staining) Fungal staining- lacto phenol cotton blue staining.	

Unit – 3: Types, structure, organisation and reproduction of prokaryotic microorganisms:	14 Hrs
Chapter 1: Size, shape, arrangement of bacteria. Chapter 2: Overview of Prokaryotic Cell Structure. Ultrastructure of Prokaryotic cell. Cell wall, cell membrane; Bacterial and Archaeal. Cytoplasmic matrix- Cytoskeleton, ribosome, inclusion granules: Composition and function. Nuclear Materials – Bacterial chromosomes structure (its differences with the Eukaryotic chromosome); Extra Chromosomal materials. Components external to cell wall- capsule, slime, s-layer, pilli, fimbriae, flagella; structure, motility, chemotaxis. Bacterial Endospore - Examples of spore forming organisms, habitats, function, formation and germination. Chapter 3: Reproduction in bacteria and bacterial cell cycle.	
Unit – 4: Types, structure, organisation and reproduction of eukaryotic microorganisms	14 Hrs
Chapter 1: General structure and types of cells, Chapter 2: Over view of eukaryotic cell structure Chapter 3: 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. Chapter 4: Reproduction in eukaryotic microorganisms.	

PRACTICAL I

PAPER MB DSC-1P – General Microbiology (4 hrs/week)

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 etc).
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 – positive and Negative staining
9. Differential staining - Gram staining.
10. Acid fast staining.
11. Structural staining - Flagella and Capsule.
12. Bacterial endospore staining.
13. Staining of reserved food materials.
14. Staining of fungi by Lactophenol cotton blue.
15. Study of Contributions of microbiologists with the help of photographs.

REFERENCES:

1. Prescott, Harley, Klein's Microbiology, J.M. Willey, L.M. Sherwood, C.J. Woolverton, 7th International, edition 2008, McGraw Hill.
2. Foundations in Microbiology, K. P. Talaro, 7th International edition 2009, McGraw Hill.
3. A Textbook of Microbiology, R. C. Dubey and D. K. Maheshwari, 1st edition, 1999, S. Chand & Company Ltd.
4. 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.
5. Microbiology – An Introduction, G. J.Tortora, B. R.Funke, C. L. Case, 10th ed. 2008,Pearson Education.
6. General Microbiology, Stanier, Ingraham et al, 4th and 5th edition 1987, Macmillan education limited.
7. Microbiology- Concepts and Applications, Pelczar Jr,Chan, Krieg, International ed, McGraw Hill.
8. Alexopoulos, C.J., Mims, C.W., and Blackwell, M. 2002. Introductory Mycology. John Wiley and Sons (Asia) Pvt. Ltd. Singapore. 869 pp.
9. Atlas, R.M. 1984. Basic and practical microbiology. Mac Millan Publishers, USA. 987pp.
10. Black, J.G. 2008. Microbiology principles and explorations. 7edn. John Wiley and Sons Inc., New Jersey 846 pp.
11. Pommerville, J.C. Alcamo's Fundamentals of Microbiology. Jones and Bartlett Pub..Sudbury, 835 pp.
12. Schlegel, H.G. 1995.General Microbiology. Cambridge University Press, Cambridge, 655 pp.
13. Toratora, G.J., Funke, B.R. and Case, C.L. 2007. Microbiology 9th ed. Pearson Education Pte. Ltd., San Francisco. 958pp
14. Aneja K R 2017: Experimental in Microbiology Plant Pathology and Biotechnology. 5th Edition, New age International. New Delhi
15. Josephine A. Morello Paul A. Granato Helen Eckel Mizer (2003). "Laboratory Manual and Workbook in Microbiology". The McGraw-Hill Companies.

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 30%	
Assessment Occasion/ type	Weightage in Marks
Two Tests	20%: 20
Assignment/visits	10%: 10
Group/Individual Discussions/Seminars/ Models preparation/charts preparation/Project presentations	10%: 10
Total	10%: 40

Date:

BoS Chairperson

Course 2: Theory: OE 1T, MBL 301, Microbial Technology for Human Welfare (Credits:3)

THEORY

Total hours allotted: 42 hrs (3 hrs/ week)

Course 2 : OE 1T, MBL 301, Microbial Technology for Human Welfare	42 Hrs
Unit –1 Food and Fermentation Microbial Technology	14 Hrs
Chapter 1: Fermented Foods – Types, Nutritional values, Advantages and Health Benefits Chapter 2: Prebiotics, Probiotics, Synbiotics and Nutraceutical foods. Chapter 3: Fermented Products Alcoholic – Wine, Beer, Whisky and nonalcoholic beverages-Coffee, Tea, Kefir; fermented dairy products-Curd, Cheese, Butter milk and Yoghurt, Fruit fermented drinks – Raw mango cider and Guava cider.	
Unit-2 Agriculture Microbial Technology	14
Chapter 1: Microbial Fertilizers- <i>Rhizobium</i> , <i>Azotobacter</i> fertilizer Chapter 2: Microbial Pesticides-Bacterial, Fungal and Viral Chapter 3: Mushroom Cultivation Chapter 4: Biogas Production.	
Unit- 3 Pharmaceutical Microbial Technology	14
Chapter 1: Microbial Drugs – Types and Development of Drug Resistance Antibiotics – Types (Antibacterial- Penicillin, Chloramphenicol, Antifungal- cycloheximide, Flucanazole and Antiviral- Acycloguanosine), Functions and Antibiotic Therapy Chapter 2: Vaccines – Types (live attenuated (polio & BCG), killed (DPT), toxoid (tetanus), Recombinant (Hepatitis B), DNA Vaccine & synthetic vaccine. , Properties, Functions and Schedules	

Course 3: Theory: SEC 1T, MBL 701,

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, MBL 701,
Microbiological Methods and Analytical Technique**

Course 3: SEC 1T, MBL Microbial Analytical Techniques and quality control

(Credits: 2)

Total hours allotted 14 hrs (one hour theory followed by 2 hours practicals)

SEC 1T, MBL 701, Microbiological Methods and Analytical Techniques	14 Hrs
DIGITAL SKILLS: I. Microbiological Skills Chapter 1: Microbiological culture media: Types- (Solid, liquid and semi solid), Composition, Preparation, Application and storage; Ingredients of media, Types of media based on applications-natural and synthetic media, chemically defined media, complex media, selective, differential, indicator, enriched and enrichment media. Chapter 2: Isolation and cultivation of microorganisms: Collection of samples, processing of samples, serial dilution technique, inoculation of samples (spread plate, streak plate and pour plate method), incubation and observations of microbial colonies. Morphological characterization of microorganisms - Colony characteristics, Microscopic characters, biochemical/physiological tests or properties and identification. Sub culturing of microorganisms and pure culture techniques. Preservation of microorganisms. Chapter 3: Advanced Microscopic Skills: Different types of microscopes - Phase contrast, Bright Field, Dark Field, Fluorescent, Confocal, Scanning and Transmission Electron Microscopy, Scanning Probe Microscopy II. Analytical Skills Chapter 1: Centrifugation, Chromatography and Spectroscopy: Principles, Types, Instrumentation, Operation and applications.	

Course 3: Practicals: SEC 1P, MBL 701,

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.

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

BSc Microbiology (Basic / Hons.)

Semester 2

Title of the Courses:

Course 1: DSC-2T, MBL 102, Microbial Biochemistry and Physiology

Course 2: OE- 2T, MBL 302, Environmental and Sanitary Microbiology

Course 1: DSC-2T, MBL 102, Microbial Biochemistry and Enzymology		Course 2: OE- 2T, MBL 302, Environmental and Sanitary Microbiology	
Number of Credits	Number of hours/semester	Number of Credits	Number of lecture hours/semester
4 Theory	56 Theory	3	42
2 Practical	52 Practical		

Title of the Course: DSC-2T, MBL 102, - Microbial Biochemistry and Physiology

Content of Course: DSC-2T, MBL 102, Microbial Biochemistry and Physiology	56 Hrs
Unit - 1 Biochemical Concepts	14 Hrs
<p>Chapter 1. Basic Biochemical Concepts: Major elements of life and their primary characteristics</p> <p>Chapter 2. Atomic bonds and molecules – bonding properties of carbon</p> <p>Chapter 3. Chemical bonds- covalent and non covalent, Hydrogen bonds and Vander Waal Forces.</p> <p>Chapter 4. Biological Solvents: Structure and properties of water molecule, Water as a universal solvent, polarity, hydrophilic and hydrophobic interactions, properties of water.</p> <p>Chapter 5. Acids, bases, electrolytes, hydrogen ion concentration, pH, buffers and physiological buffer system, Handerson – Hasselbatch equation.</p>	
Unit - 2 Macromolecules – Types, Structure and Properties	14 hrs
<p>Chapter 1. Carbohydrates: Definition, classification, structure, properties and importance.</p> <p>Chapter 2. Amino acids and proteins: Definition, structure, classification and properties of amino acids.</p> <p>Structure, classification and importance of proteins.</p> <p>Chapter 3. Lipids and Fats: Definition, classification, structure, properties and importance of lipids.</p> <p>Chapter 4. Vitamins: Definition, structure, properties and importance of vitamins chlorophyll, cytochrome and hemoglobin.</p> <p>Chapter 5. Porphyrins: Definition, structure, properties and importance of vitamins chlorophyll, cytochrome and hemoglobin.</p>	
Unit - 3 Microbial Physiology	14 Hrs
<p>Chapter 1. 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.</p> <p>Chapter 2. 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</p>	

Yield (definition of terms). Chapter 3. Influence of environmental factors on growth. Microbial growth in natural environments. Viable non-culturable organisms. Quorum sensing. Chapter 4. Microbial Nutrition: Microbial nutrients, Classification of organisms based on carbon source, energy source and electron source, Macro and micronutrients, Uptake of nutrients by microorganisms- passive, facilitated, active transport and group translocation.	
Unit – 4: Microbial Physiology- Bioenergetics, Microbial Respiration, Microbial Photosynthesis	14 Hrs
Chapter 1. Bioenergetics: Free energy, Enthalpy, Entropy, Classification of high energy compounds, Oxidation reduction reactions, equilibrium constant, Redox potential, Laws of thermodynamics. Chapter 2. Cellular respiration: Definition, Embden-Mayerhoff-Paranas (EMP) pathway (Glycolysis), Tricarboxylic Acid Cycle (TCA), Electron transport chain and oxidative phosphorylation. Fermentation: Definition, Types of fermentations-Alcoholic fermentation, lactic acid fermentation (homo & hetero lactic fermentation), Anaerobic respiration: Definition, Nitrate respiration, sulfate respiration & carbonate respiration. Chapter 3. Photosynthesis – Definition, photosynthetic apparatus and Photosynthetic pigments in photosynthetic bacteria & blue green algae. Types of photosynthesis – oxygenic photosynthesis (blue green algae) and non-oxygenic photosynthesis (purple & green bacteria). Comparative study of oxygenic and non-oxygenic photosynthesis. Photophosphorylation – cyclic & non-cyclic photophosphorylation.	

Course 1: Practicals: DSC-2P, MBL 102,

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. Felix Franks, 1993; Protein Biotechnology, Humana Press, New Jersey.
2. Stryer L, 1995; Biochemistry, Freeman and Company, New York.
3. Voet & Voet, 1995; Biochemistry, John Wiley and Sons, New York.
4. Nelson and Cox, 2000; Lehninger Principles of Biochemistry, Elsevier Publ.
5. Harper, 1999; Biochemistry, McGraw Hill, New York.
6. Palmer T. (2001), Biochemistry, Biotechnology and Clinical Chemistry, Harwood Publication, Chichester.
7. Boyer R. (2002), Concepts in Biochemistry 2nd Edition, Brook/ Cole, Australia.
8. Moat A. G., Foster J.W. Spector. (2004), Microbial Physiology 4th Edition Panama Book Distributors.
9. Caldwell, D. R. (1995) – Microbial Physiology and Metabolism. Brown Publishers.
10. Lodish H, T. Baltimore, A. Berck B.L. Zipursky, P. Mastsydaire and J. Darnell. (2004) Molecular Cell Biology, Scientific American Books, Inc. Newyork.
11. Peleczar, M.J.. Chan. E.C.S and Krieg, N.R. (2020)"Microbiology"7th Edition. Tata McGraw HillBook.
12. Nelson David, L and Cox Michael, M., Lehninger, (2008). "Principles of Biochemistry". Macmillan Press, Worth Publishers, New Delhi.
13. Joanne Willey and Kathleen Sandman and Dorothy Wood Eleventh edition.(2020). "Prescott's Microbiology". New York, NY : McGraw-Hill Education.

Course 2 : Theory: OE- 2T, MBL 302, Environmental and Sanitary Microbiology

Course 2 :Theory: OE- 2T, MBL 302, Environmental and Sanitary Microbiology	42 Hrs
Unit -1: Soil and Air Microbiology	14 Hrs
Chapter 1: Soil and Air as a major component of environment. Chapter 2: Types, properties and uses of soil and air. Chapter 3: Distribution of microorganisms in soil and air. Chapter 4: Major types of beneficial microorganisms in soil. Chapter 5: Major types of harmful microorganisms in soil .	
Unit - 2: Water Microbiology	14 Hrs
Chapter 1: Water as a major component of environment. Chapter 2: Types, properties and uses of water. Chapter 3: Microorganisms of different water bodies. Chapter 4: Standard qualities of drinking water	
Unit - 3 Sanitary Microbiology	14 Hrs
Chapter 1: Public health hygiene and communicable diseases. Chapter 2: Survey and surveillance of microbial infections. Chapter 3: Epidemiology, detection and control of Airborne microbial infections- Bacterial (Tuberculosis), Viral (Chicken pox, Common cold and Covid 19) and Fungal (Aspergillosis). Chapter 4: Epidemiology, detection and control of Waterborne microbial infections- Bacterial (Cholera), Viral (Hepatitis A and Polio) and Protozoal (Amoebiasis). Chapter 5: Epidemiology, detection and control of Food borne microbial infections- Salmonellosis,	

Text Books / References


1. Prescott, Harley, Klein's Microbiology, J.M. Willey, L.M. Sherwood, C.J. Woolverton, 7th International, edition 2008, McGraw Hill.
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Formative Assessment 30%	
Assessment Occasion/ type	Weightage in Marks
Two Tests	20%: 20
Assignment/visits	10%: 10
Group/Individual Discussions/Seminars/ Models preparation/charts preparation/Project presentations	10%: 10
Total	10%: 40

Date


BoS Chairperson
CHAIRMAN,
BOS in Microbiology
Department of Microbiology
Kannur University
Shengangathri, Davangere-577 302.

GENERAL PATTERN OF THEORY EXAMINATION

B.Sc. MICROBIOLOGY

Duration: 3 Hours

Maximum: 60 Marks

All questions are compulsory

Draw neat labeled diagrams wherever necessary

Q No. I Answer any TEN of the following

10X02=20

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.
- 11.
- 12.

Q No. II Answer any Four of the following


04X05=20

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

Q No. III Answer any two the following

02X10=20

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


CHAIRMAN,
BOS in Microbiology
Department of Microbiology
Davangere University
Shivagangothri, Davangere-577 002.