



DAVANGERE UNIVERSITY

DAVANGERE

NEP 2020

Syllabus and Structure

For

B. Sc. (Basic / Hons.) MICROBIOLOGY

2021-22




Registrar
Davangere University
Shivagangotri, Davangere.

Preamble

The Government of India identified Microbiology as a thrust area for development in the field of life science. It has a well-defined objective of establishing several centres of excellence, conducting research and promoting academic institutions focusing on Microbiology-based programmes. In addition, Universities have also been a congenial environment with the knowledge of Microbiology.

The main objective of a B.Sc. (Honors) program in Higher Education system is to prepare the students for the society. The Microbiology involves understanding how microorganisms' function at the molecular and cellular level. It combines several disciplines including biology, physics, chemistry, mathematics, and technology, with special emphasis on genetics, biochemistry, molecular biology, immunology, medical microbiology, bioprocess engineering, etc.. New technologies and products are developed every year within the areas of medicine, agriculture, food and dairy, environmental and Bio based industry. There are varieties of methods to achieve transformation including those associated with biological vectors and physical methods of introduction through direct exposure of cells or protoplasts to DNA and the acceleration of small DNA-coated projectiles into plant, animal or microbial cells.

Microbiology is a science – driven industry sector that uses microorganisms and molecular biology to produce healthcare-related products. The program in Microbiology will offer a wonderful opportunity to students with an ability to gain specialization while customizing and individualizing the education for desired skills and careers in food and dairy microbiology, Industrial Microbiology, Fermentation Technology, Environmental Microbiology, Medical Microbiology, and Research methodology. Students are made aware of the economic impact and are supported in creating significant workforce opportunities in Microbiology as entrepreneurs or as employees in major sectors such as therapeutics, drugs, pharmaceuticals, food and dairy technologies, industries and research, testing, and medical labs. Microbiology integrates medical science, research, manufacturing, and Microbiology-based business skills with leadership, teamwork and entrepreneurship skills that are essential for career success in the Microbiology field.


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Model Curriculum

Name of the Degree Program: BSc (Basic / Hons.)

Discipline Core: MICROBIOLOGY

Total Credits for the Program: 188

Starting year of implementation: 2021-22

Program Outcomes (PO):

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:

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


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Curriculum Structure for the Undergraduate Degree Program BSc Microbiology

Total Credits for the Program: 188

Starting year of implementation: 2021-22

Name of the Degree Program: BSc

Discipline/Subject: Microbiology

Program Articulation Matrix:

This matrix lists only the core courses. Core courses are essential to earn the degree in that discipline/subject. They include courses such as theory, laboratory, project, internships etc. Elective courses may be listed separately

Semester	Title /Name of the course	Program outcomes that the course addresses (not more than 3 per course)	Pre-requisite course (s)	Pedagogy	Assesment
1	DSC-1T MBL 101 General Microbiology 4 Credits 100 Marks	1. 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.	PUC or +2 (Life sciences as one of the core disciplines)	The general pedagogy to be followed for theory and practicals are as under. Lecturing, Tutorials, Group/Individual Discussions, Seminars, Assignments, Counselling, 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.	LSSSDC (NSDC) assessment and certification for lab technician or Lab assistant or other significant jobs.
	DSC-1P MBL 101 General Microbiology 2 Credits 50 Marks				
2	DSC-2T MBL 102 Microbial Biochemistry and Physiology 4 Credits 100 Marks	Thorough knowledge and understanding of concepts of Biochemistry, microbial physiology and its		The general pedagogy to be followed for theory and practicals are as under. Lecturing, Tutorials,	LSSSDC (NSDC) assessment and certification for lab technician or Lab assistant or other significant jobs.

		application in different microbiological industries.		Group/Individual Discussions, Seminars, Assignments, Counseling, Remedial Coaching. Field/Institution/ Industries visits Hands on training, Case observations, Models/charts preparations, Problem solving mechanism, Demonstrations , Project presentations, Experiential documentation and Innovative methods.	
	DSC-2P MBL 102 Microbial Biochemistry and Physiology 2 Credits 50 Marks				
3	DSC- 3T Microbial Diversity 4 Credits 100 Marks				
	DSC-3P MBL 103 Microbial diversity 2 Credits 50 Marks				
4	DSC-4T Microbial physiology and Metabolism 4 Credits 100 Marks				
	DSC-4P MBL 104 Microbial Enzymology and Metabolism 2 Credits 50 Marks				
	DSC- 5 T Microbial Genetics and Molecular Biology 3 Credits 100 Marks				

5.	DSC-5P MBL 105 Microbial genetics and Molecular biology 2 Credits 50 Marks				
	DSC – 6T Immunology and Medical Microbiology 3 Credits 100 Marks				
	DSC-6P MBL 106 Immunology and Medical microbiology 2 Credits 50 Marks				
6.	DSC – 7T Food and Dairy Microbiology 3 Credits 100 Marks				
	DSC-7P MBL 107 Food and Dairy Microbiology 2 Credits 50 Marks				
	DSC – 8T Microbial Genetic Engineering 3 Credits 100 Marks				
	DSC-8T MBL 108 Industrial Microbiology and Bioprocess Technology 3 Credits 100 Marks				
7.	DSC – 9T Environmental and Agricultural Microbiology 3 Credits 100 Marks			Project based learning, Term paper Assignment, Group Discussion	Class work Seminar Project writing Articles
	DSC-9P MBL 109 Microbial Genetic Engineering 2 Credits 50 Marks				

	DSC – 10T Industrial Microbiology and Bioprocess Technology 3 Credits 100 Marks			Research Project Instrumentation	writing,
	DSC-10P MBL 110 Environmental and Agricultural Microbiology 2 Credits 50 Marks				
	DSC – 11T Pharmaceutical and Forensic Microbiology 3 Credits 100 Marks	PO5,PO7			
	DSC-11T MBL 111 Pharmaceutical and Forensic Microbiology 4 Credits 100 Marks				
8.	DSC – 12T Biosafety, Bioethics and IPR 4 Credits 100 Marks				
	DSC – 13T Genomics, Proteomics and Metabolomics 4 Credits 100 Marks				
	DSC – 14T Aquatic Microbiology 4 Credits 100 Marks				

Note:

Pedagogy

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

Lecturing, Tutorials, Group/Individual Discussions, Seminars, Assignments, Counselling, 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.

\$ Every course needs to include assessment for higher order thinking skills (Applying/ Analyzing/ Evaluating/ Creating). However, this column may contain alternate assessment methods that help formative assessment (i.e. assessment for learning).

BSc Semester 1

Course Title: MICROBIOLOGY	
Total Contact Hours:56	Course Credits: T-4,P-2, TOTAL: 6
Formative Assessment Marks:IA-40	Duration of ESA/Exam: 3hrs
Summative Assessment Marks:60	

Course Pre-requisite(s): *Mention only course titles from the curriculum that are needed to be taken by the students before registering for this course.*

Course Pre-requisite(s):

PUC or +2 (Life sciences as one of the core disciplines)

Course Outcomes (COs):

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

(Write 3-7 course outcomes. Course outcomes are statements of observable student actions that serve as evidence of knowledge, skills and values acquired in this course)

PO1: At the end of the course the student will have broad and balanced knowledge of Microbiology, history, general characters and classification of Microorganisms, Viz-Bacteria, Fungi, algae, protozoa and virus, Understanding the microbiological techniques, cultivation and detection of microorganisms. Comprehend evolutionary importance and economic significance of microorganisms and microbiology. Learning and practicing professional skills in handling microbes. Thorough knowledge and application of good laboratory and good manufacturing practices in microbial quality control.

PO2 : At the end of the course the student should be able to develop thorough knowledge and understanding of concepts of Biochemistry, enzymes, microbial metabolism, growth, bioenergetics and physiology . Students will become efficient in managerial skills, able to employ analytical reasoning, problems solving and interpretation and documentation of laboratory experiments at a level suitable to succeed at an entry- level position in Microbiology.


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CO1.	At the end of the course the student will have broad and balanced knowledge of Microbiology, history, general characters and classification of Microorganisms, Viz-Bacteria, Fungi, algae, protozoa and virus, Understanding the microbiological techniques, cultivation and detection of microorganisms. Comprehend evolutionary importance and economic significance of microorganisms and microbiology. Learning and practicing professional skills in handling microbes. Thorough knowledge and application of good laboratory and good manufacturing practices in microbial quality control..
CO2	At the end of the course the student should be able to develop thorough knowledge and understanding of concepts of Biochemistry, enzymes, microbial metabolism, growth, bioenergetics and physiology . Students will become efficient in managerial skills, able to employ analytical reasoning, problems solving and interpretation and documentation of laboratory experiments at a level suitable to succeed at an entry- level position in Microbiology..
CO3.	To develop in students a range of practical skills so that they can understand and assess risks and work safely
CO4	To develop in students the ability to apply standard methodology to the solution of problems in Microbiology
CO5	To provide students with industrial problem based knowledge and skill towards employment or higher education in Microbiology or multi-disciplinary areas involving different branches of sciences
CO6	To provide students with the ability to plan and carry out experiments independently and assess the significance of outcomes.
CO7	To develop in students the ability to adapt and apply methodology to the solution of unfamiliar types of industrial problems
CO8	To instil critical awareness of advances at the forefront of Microbiology.
CO9	To prepare students effectively for professional employment or research degrees in Microbiology.
CO10	To build confidence in the candidate to be able to work on his own in Industry and Institution of higher education.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs1-12)

S E M	Course Outcomes (COs) / Program Outcomes(POs)	1	2	3	4	5	6	7	8
1	C-1	X	X	X			X		X
2	C-2		X	X	X	X		X	X
3	C-3	X	X	X	X		X		X
4	C-4		X	X		X	X	X	X
5	C-5,C-6	X	X	X			X	X	X
6	C-7,C-8			X	X	X	X	X	X
7	C-9,C-10,C-11			X	X	X	X		X
8	C-12,C-13,C-15			X	X	X	X	X	X

Course Articulation Matrix related 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.

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.

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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.
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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

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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

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

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

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2. Stryer L, 1995; Biochemistry, Freeman and Company, New York.
3. Voet & Voet, 1995; Biochemistry, John Wiley and Sons, New York.
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**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.
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. Tortora, 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 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

BoE Chairperson


Registrar
Davangere University
Shivangotri, Davangere.

Davangere University, Davangere

GENERAL PATTERN OF THEORY EXAMINATION

B.Sc MICROBIOLOGY

Duration: 3 Hours

Maximum: 60 Marks

All questions are compulsory

Draw neat labeled diagrams wherever necessary

QNo. I Answer any TEN of the following

2X10=20

- | | |
|------|------|
| (1) | (2) |
| (3) | (4) |
| (5) | (6) |
| (7) | (8) |
| (9) | (10) |
| (11) | (12) |

QNo. II Answer any Four of the following

5X4=20

- | | |
|------|------|
| (13) | (14) |
| (15) | (16) |
| (17) | |
| (18) | |

QNo. III Answer any two the following

10X2=20

- | |
|------|
| (19) |
| (20) |
| (21) |
| (22) |


Registrar
Davangere University
Shivagangotri, Davangere.