



**MANGALORE UNIVERSITY
MANGALURU**

**B. Sc. MICROBIOLOGY
SYLLABUS**

With Effect from 2024-25

Ist & IInd Semester

DISCIPLINE SPECIFIC CORE COURSE (DSC) FOR SEM I – II
(SEP MODEL – 2024)

Board of Studies in Microbiology
Department of Studies in Microbiology
Mangalore University
Mangalagangothri, Konaje- 574 199
Karnataka, India

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Senior Professor in Microbiology
Dean: Faculty of Science and Technology
Mangalore University

MANGALORE UNIVERSITY

B.Sc MICROBIOLOGY

(Effective from 2024- 2025)

SUBJET TITLES, SCHEME FOR INSTRUCTION AND EXAMINATION

SEMESTER SCHEME

Paper Code	Title of the Paper	Type of paper	Periods/ Week	Duration of Exam (Hours)	IA	EA	Max. Marks	Credits
FIRST SEMESTER								
101	Fundamental Microbiology	Theory	4	3	20	80	100	3
102	Fundamental Microbiology	Practical	4	3	10	40	50	2
Total Marks and Credits							150	5
SECOND SEMESTER								
201	Microbial Taxonomy and Culture Techniques	Theory	4	3	20	80	100	3
202	Microbial Taxonomy and microbial Culture Techniques	Practical	4	3	10	40	50	2
Total Marks and Credits							150	5
THIRD SEMESTER								
301	Basic Biochemistry ,Microbial Physiology and Genetics	Theory	4	3	20	80	100	3
302	Microbial Biochemistry, Physiologyand Genetics	Practical	4	3	10	40	50	2
Total Marks and Credits							150	5
FOURTH SEMESTER								
401	Molecular Biology, Biostatistics and Bioinformatics	Theory	4	3	20	80	100	3
402	Molecular Biology, Biostatistics and Bioinformatics	Practical	4	3	10	40	50	2
Total Marks and Credits							150	5

Paper Code	Title of the Paper	Type of paper	Periods/ Week	Duration of Exam (Hours)	IA	EA	Max. Marks	Credits
FIFTH SEMESTER								
501	Medical Microbiology and Immunology	Theory	4	3	20	80	100	3
502	Agricultural Microbiology and Plant Pathology	Theory	4	3	10	80	100	3
503	Medical and Agricultural Microbiology	Practical	4	3	10	40	50	2
Total Marks and Credits							250	08
SIXTH SEMESTER								
701	Food and Industrial Microbiology	Theory	4	3	20	80	100	3
702	Environmental Microbiology	Theory	4	3	20	80	100	3
703	Industrial and Environmental Microbiology	Practical	4	3	10	40	50	2
Total Marks and Credits							250	08
Total Marks and Credits (All Six Semesters)							1100	36

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:

1. Knowledge and understanding of concepts of microbiology and its application in **pharma, food, environment, medical field, 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 key questions in microbiological research, optimize research methods, and analyze outcomes by adopting scientific methods, there by improving the employability.
11. Enhance and demonstrate analytical skills and apply basic computational and statistical techniques in the field of microbiology.

Course Outcomes (COs):

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

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.

SCHEME OF THEORY EXAMINATION

All Sections are compulsory. Illustrate/Draw wherever necessary

Time 3 Hours		Max. Marks 80
Section A		
Write briefly on any ten of the following	2x10=20	1 – 12 questions
Section B		
Write short notes on any four of the following	4 X 5 = 20	13-18 questions
Section C		
Answer any four of the following	4 X 10 = 40	19-24 questions

SCHEME OF PRACTICAL EXAMINATION

Time 3 hours			Max. Marks 40
Question No.	Experiment	No. of Questions and Marks	Marks
1	Major Experiment	Experiment 1 = 12 marks	12
2	Minor Experiment	Experiment 2 = 08 marks	08
3	Spotters	4 spotters X 3 marks = 12 marks	12
4	Record & Viva-voce	4+4= 08 marks	08
Total marks			40

SCHEME OF INTERNAL ASSESSMENT

Assessments	Theory Examination	Practical Examination	Elective
Tests	10	05	05
Seminar	05	05	05
Assignment	05	00	00
Total	20	10	10

Question Paper Pattern of all semester.

1. All Sections are compulsory
2. Illustrate/Drew diagrams wherever necessary

Section – A

Write briefly **any Ten** of the following:

10x2= 20

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

Section – B

Write Short notes on **any Four** of the following

4x10= 40

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

Section – C

Answer **any Four** of the following

4x10= 40

- 19.
- 20.
- 21.
- 22.
- 23.
- 24.

Questions shall be selected from all the units of the syllabus for all sections of the question papers.

Internal Assessment (Theory)

1. Two theory tests to be conducted for 20 marks and converted in to 10 marks
2. Assignments - 05 marks
3. Seminars - 05 marks

Total = 20 marks

Internal practical assessment - 10 marks

One practical test to be conducted

Question paper pattern for Practicals :

- | | |
|---|---------|
| Q-1: Perform Major Experiment Performa selected by lots | 1x12=12 |
| Q-2: Perform Minor Experiment selected by lots | 1x8=8 |
| Q-3: Identify the given spotters with reasons (a, b, c) | 4x3=12 |
| Q-4: Viva & Record submission | 4+4= 8 |

Total = 40 Marks

Mangalore University
Under Graduate Programme in Microbiology
Syllabus for 1th and 2th Semester
(B.Sc in MICROBIOLOGY)

Program Name	BSc in MICROBIOLOGY		Semester	I
Course Title	Fundamental Microbiology (Theory)			
Course Code:	MIC T 1	No. of Credits	03	
Contact hours	56 Hours Theory	Duration of EA Exam	3 Hours	
Formative assessment	20	Summative assessment	80	

I SEMESTER

101 Fundamental Microbiology (Theory)

Total 56hrs -4 hrs/week

UNIT I: History & Scope of Microbiology:

14hrs

- Origin of life and evolution of Microorganisms. History and scope of Microbiology as a modern science-..Microorganisms-Types and significance in general (Beneficial and Harmful). Branches of Microbiology
- Contribution of Antony Von Leuwenhoek, Edward Jenner, Lazaro Spallanzani, Louis Pasteur, Joseph Lister, Robert Koch, Alexander Fleming and Iwanovsky to Microbiology.
- Contribution of M. S. Swaminathan, Har Gobind Khorana, Ananda Mohan Chakrabarty.

UNIT II: Microscopy and Staining Techniques

14hrs

- Microscopy: Principles of Microscopy-Magnification, Resolving power, Numerical aperture, Tube length and Focal length of compound Microscope.
- Principle, construction, working and applications of a) Compound microscope c) Phase Contrast microscope d) Fluorescent Microscope e) Electron Microscope -TEM and SEM
- Stains, Types of stains, General procedure of staining of bacteria and fungi.
a) Simple staining and negative staining b) Differential Staining- Grams and Acid fast staining
c) Structural staining – cell wall, endospore, and capsular staining

UNIT III: Sterilization Techniques

14hrs

- Definition of terms-sterilization, disinfectant, antiseptic, sanitizer, germicide, micro biostatic agents, micro biostatic agents and antimicrobial agent.
- Physical methods of sterilization-Heat-a) Dry heat-Hot Air Oven and Incineration b) Moist heat, Autoclave, Pressure Cooker. c) Tyndallization (fractional sterilization). Filtration-Types of filters, laminar airflow. Radiation methods: UV rays and cathode rays.
- Chemical methods of sterilization: Use and mode of action of Alcohol, aldehydes, phenols, halogen, Heavy metal and metallic salts, Quaternary ammonium compounds and sterilizing gases as Antimicrobial agents.

UNIT IV: Microbial Nutrition

14hrs

- Nutritional requirements of microorganisms-Macronutrients, micronutrients and growth factors. Nutritional types of microorganisms: Autotrophs and heterotrophs, phototrophs and chemotrophs. Physical factors affecting growth of microorganisms: Temperature, pH and Oxygen. Growth rate and generation time, Bacterial growth curve – phases of growth and their significance. Diauxic and synchronous growth, Continuous and batch cultivation.
- Measurement of growth -Direct Microscopic count, Hemocytometer, viable count, Membrane filtration, Electronic coulter counting method. Measurement of cell mass. Chemostat and Turbidostat-Batch and continuous culture
- Nutrient transport-passive, facilitated active and group translocation

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1. Black J. G. and Black L. J. (2017) Microbiology – Principles and Explorations, 10 th ed. John Wiley & Sons Inc. New York, USA.
2. Dubey R. C. And Maheshwari D. K. (2022) A Text Book of Microbiology, 5 th ed. S. Chand & Company Ltd.
3. Madigan M. T., Martinko J. M., Bender K. S., Buckley D. H., Sattley W.M, Stahl D. A. (2021). Brock biology of micoorganisms, 16 th ed. Pearson, Boston.
4. Michael Pelczar, Jr., Chan E. C. S., Noel Krieg. (2023). Microbiology. 5 th ed. Affiliated East West Press Private Ltd.
5. Stanier, Ingraham. (2008). General Microbiology, International ed. McGraw Hill.
6. Tortora G. J., Funke B. R., Case C. L., Warner B.B., Weber D. (2023). Microbiology an Introduction, 14 th ed. Pearson Education Pvt. Ltd.
7. Willey J. M., Sherwood L., Sandman K., & Wood D. (2022) Prescott's Microbiology. 12 th ed. McGraw – Hill Higher Education.

Ist SEMESTER

102: I SEMESTER PRACTICAL

Course Title	Fundamental Microbiology (Practical) Sem- I	Practical Credits	02
Course Code	MIC P-1	Contact Hours	4 Hours/ week
Formative Assessment	10 Marks	Summative Assessment	40 Marks

1. Safety measures in Microbiology Laboratory
2. Study of compound microscope- Construction, working, principle, care to be taken while using the microscope. Use of oil immersion objective.
3. Study of instruments-Autoclave, Hot air oven. Laminar air flow chamber, Colony counter, Inoculation loop and needle, Incubator, Centrifuge, pH meter, and colorimeter/spectrophotometer.
4. Study of aseptic techniques, preparation of cotton plugs for test tubes and pipettes, wrapping of Petri plates and pipettes, transfer of media and inoculum.
5. Cleaning and sterilization of glass wares
6. Simple staining technique for bacteria
7. Negative staining technique
8. Gram's staining technique
9. Endospore staining technique
10. Staining and mounting of Algae
11. Staining and mounting of Fungi.
12. Study of bacterial motility by hanging drop technique

SEMESTER II

Program Name	BSc in MICROBIOLOGY	Semester	II
Course Title	Microbial Taxonomy and Culture Techniques (Theory)		
Course Code:	MIC T-2	No. of Credits	03
Contact hours	56 Hours	Duration of EA Exam	3 Hours
Formative assessment	20	Summative assessment	80

Total 56hrs -4 hrs/week

UNIT I: Bacterial Taxonomy and Diversity

14hrs

Criteria for classification of prokaryotes – Morphological, Physiological, Biochemical. Chemotaxonomy and Numerical taxonomy. A brief account on Bergey's manual of systematic bacteriology. Cladograms and Genograms.

Bacteriology- General characteristics of bacteria, cell structure Size, Shape and arrangement of bacterial cells, Fine structure, composition and function of bacterial cell wall, cell membrane, cytoplasm, nucleoside, flagella, Pili/fimbriae, slime layer, capsule, spores, cysts and reproduction. Classification of Bacteria, reproduction of bacteria. General characteristics and significance of Rickettsia, Chlamydia, Mycoplasma, Actinomyces, Brief account on Archaea.

UNIT II: Fungal and Viral Taxonomy and Diversity

14hrs

- **Classification of Viruses**, (Baltimore & ICTV) Ultrastructure of viruses – capsid symmetry, envelope, enzymes and genome. Structure, replication and significance of – Bacteriophage (T 4 and Lambda), Herpes (Enveloped), Polyoma virus (Icosahedral), Adeno virus (DNA genome) and HIV (RNA genome and reverse transcriptase enzyme).
- Brief account on - Cyanophages and mycophages, acellular entities – Viroids and Prions.
- Brief history of Mycology, General characteristics, structure and organization of fungi. Classification of fungi (Alexopoulos and Mims) Fungi: General aspects of fungal nutrition. Reproduction and significance of major groups of fungi (Phycomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes). Type study (Aspergillus, Rhizopus, Penicillium, Trichoderma and Yeast)

UNIT III: Taxonomy and Diversity of Algae and Protozoa

14hrs

- **Algae:** Introduction, Classification of Algae (G. M. Smith), general structure and reproduction (Vegetative, Asexual and Sexual). Type study - Chlamydomonas, Volvox and Spirogyra
- General characteristics, cell structure and reproduction of Cyanobacteria - Type study of Anabaena and Spirulina. Parallelism between bacteria and cyanobacteria.
- **Protozoa:** General features and significance. Type study - Amoeba and Plasmodium.

UNIT IV: Microbial Culture Media and Culture Techniques

14hrs

- Synthetic and non-synthetic – solid, liquid and semisolid media. Special media – Enriched, Selective, transport, differential, maintenance (NA, PDA, YEMA, SDA, MacConkey's agar,

Blood agar, Chocolate agar, EMB, Cary Blair's media, RCM, VR medium).

- Methods of isolation of bacteria and fungi. Streak plate, spread plate method, Serial dilution technique, Slide culture technique, Cultivation of Anaerobic bacteria. Strain selection and improvement technique. Preservation and maintenance of cultures. Microbial culture collection centers. Media and methods used for cultivation of algae, large scale cultivation. Cultivation and assay of Viruses.

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2. Becker E. W., (2008). *Microalgae: Biotechnology and Microbiology*. Cambridge University Press.
3. Dimmock N. J., Easton A. J. and Leppard K. N. (2016). *Introduction to Modern Virology*. 7 th ed. Blackwell publishing, USA.
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SEMESTER II: Practical II

Course Title	Microbial Taxonomy and Culture Techniques (Practical) Sem- II	Practical Credits	02
Course Code	MIC P-1	Contact Hours	4 Hours/ week
Formative Assessment	10 Marks	Summative Assessment	40 Marks

1. Preparation of media-Nutrient broth, Nutrient Agar, SDA/ PDA/Mc Con keys Agar
 2. Isolation of microorganisms: Spread plate, Streaking technique, Swab technique and point inoculation
 3. Isolation of bacteria by Serial dilution and Pour plating technique
 4. Study of Morphological characterization of Gram positive and Gram negative bacteria.
 5. Measurement of size of cells by Micrometry
 6. Enumeration of microorganisms by Hemocytometer
 7. Study of Bacterial growth curve .
 8. Study of effect of pH and temperature on bacterial growth
 9. Study of Slide culture technique.
 10. Type study of *Aspergillus*, *Penicillium*, *Yeast*, *Rhizopus* and *Fusarium* (Specimens)
 11. Study of protozoa-Amoeba, Paramecium and Euglena. (Permanent slides)
 12. Study of Blue green algae-*Nostoc*, *Oscillatoria* and *Spirulina*. (Specimens)
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