



BENGALURU CITY UNIVERSITY

CHOICE BASED CREDIT SYSTEM

(as per SEP 2024)

Syllabus for I & II Semester B.Sc. Microbiology

2024-25

BENGALURU CITY UNIVERSITY

Regulations and Syllabus for MICROBIOLOGY

in

Three-Year BSc Course (SEP 2024)

Eligibility

1. Only those candidates who have passed a Pre-University course or an equivalent course with BIOLOGY as one of the optional subjects are eligible to take Microbiology as one of the optional subjects in the B.Sc., course.

Scheme of Instruction/ Examination

1. The theory question paper for each paper shall cover all the topics in the pertaining syllabus with proportional weightage to the number of hours of instruction prescribed.
2. The practical Classes are to be conducted in batches of 10 students per batch (maximum 12) per teacher as per the University norms for the faculty of science for giving instructions, explaining the principles of experiments, supervising the conduct of experiments and correction of Records.
3. It is expected that each student conducts and learns the experiments in the practical classes.
4. Students are required to use biotechnology instruments and tools to run the experiments and record the outputs to the practical records in each practical class.
5. Maximum marks for practical records in the examinations is 5.
6. A study tour or visit to industries and research institutes for the students is strongly recommended to gain practical knowledge of applications of Biotechnology in Industries/Agriculture/Medical field and research.

**B.Sc. CREDIT BASED SEMESTER SCHEME
MICROBIOLOGY
SCHEME OF INSTRUCTIONS AND CREDITS**

Paper No.	Title of the paper	Type of paper	Hours/Week	Duration of Exam (Hours)	IA	Exam	Total Marks	Credits
I SEMESTER								
MBT - 101	Basic Microbiology	T	4	3	20	80	100	3
MBP - 102	Basic Microbiology	p	3	3	10	40	50	2
							150	5

II SEMESTER								
MBT - 201	Microbial Biodiversity and Culture Techniques	T	4	3	20	80	100	3
MBP - 202	Microbial Biodiversity and Culture Techniques	p	3	3	10	40	50	2
							150	5

Internal assessment:

Theory : (20)

- (a) Tests and assignments – 15
- (b) Attendance - 05

Practical : (10)

- (a) Tests – 10

B.Sc. SEMESTER SCHEME (SEP 2024)
MICROBIOLOGY
SCHEME OF THEORY EXAMINATION

Duration: 3 Hrs

Max.Marks: 80

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| I. Answer any 10 of the following: (out of 12)
Marks
Questions 1 to 12 | 10 x 2 marks = 20 |
| II. Answer any 6 of the following: (out of 8)
Marks
Questions 13 to 20 | 6 x 5 marks = 30 |
| III. Answer any 3 of the following: (out of 5)
Marks
Questions 21 to 25. | 5 x 10 marks = 30 |

BANGALORE UNIVERSITY, BANGALORE
Syllabus for B.Sc., Microbiology
CBCS SEMESTER I
MBT- 101 Basic Microbiology

Total hours allotted: 56
14 Hours

Unit 1. Introduction, History, and Scope of Microbiology

1. Microbes and origin of life.
2. Historical development of Microbiology – Theory of Spontaneous generation and Biogenesis.
Contributions Antony Von Leeuwenhoek, Edward Jenner, Lazzaro Spallanzani, Louis Pasteur, Joseph Lister, Robert Koch, Alexander Flemming, Beijerinck, Winogradsky and Iwanovsky.
3. Contributions of Indian Scientists to the field of Microbiology.
4. Scope of microbiology as a modern and allied Health science.
5. Branches of Microbiology.

Unit 2. Instruments and Staining Techniques Used in Microbiology

14 Hours

Microscopy

1. Principles of Microscopy - resolving power, numerical aperture, focal length and magnification
2. Principles of photomicrography.
3. Working principles and applications of
 - a) Simple and Compound Microscope
 - b) Dark field microscope
 - c) Fluorescence Microscope
 - d) Electron Microscopy -TEM and SEM

Stains and Staining Techniques

1. Nature of dyes
2. Physical and chemical theories of staining
3. Staining Techniques -principle, procedure, and applications of
 - a) Simple staining - negative staining
 - b) Differential staining - Grams and Acid fast staining
 - c) Structural staining - Cell wall, Endospore, Flagella and Capsular staining

Unit 3. Sterilization Techniques

14 Hours

1. Definition of terms -sterilization, disinfectant, antiseptic, sanitizer, germicide, microbicidal agents, microbiostatic agents, and antimicrobial agents.
2. Evaluation of antimicrobial chemical agents -Tube dilution and agar plate techniques
3. Physical methods of control - Principle, construction, and application of - Boiling, Pasteurization, Fractional sterilization -Tyndallization, Moist heat sterilization under pressure - Autoclave.
Dry heat sterilization - Incineration and hot air oven
Filtration - Diatomaceous earth filter, Seitz filter, Membrane filter, and Laminar air low
Radiation - Ionizing radiation – γ rays and non-ionizing radiation -UV rays
4. Chemical methods of sterilization: Alcohol, aldehydes, phenols, halogen, metallic salts, quaternary ammonium compounds, and sterilizing gases as antimicrobial agents.

Unit 4. Introduction to Kingdom Monera

14 Hours

1. Comparison of the three domains of organisms: Bacteria, Archaea, and Eucarya. A brief account of Archaea
2. Study of Bacteria :
 - a) Size, shape, and arrangement of bacterial cells
 - b) Fine structure; Composition and function of - Eubacterial cell wall, cell membrane, cytoplasm, nucleoid, flagella, pili, fimbriae, slime layer, capsule, spores and cysts
 - c) Classification of Bacteria- Brief account of major characteristics used in bacterial classification.
3. Classification, Morphology, Cultivation, Reproduction, and significance of:
 - i] Rickettsia
 - ii] Chlamydia
 - iii] Mycoplasma
 - iv] Actinomycetes

SEMESTER I
MBP 102 -Basic Microbiology - Practical

Total hours allotted: 14

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| 1. Safety measures in the Laboratory. | 1 unit |
| 2. Study of student microscope and research microscope -Construction, working principle, care to be taken while using the microscope. Use of oil immersion objective | 1 unit |
| 3. Study of instruments - Autoclave, Hot air oven, Laminar air flow cabinet, Inoculation loop and needle, Incubator, Centrifuge, pH meter, Seitz filter, Colony counter, a membrane filter, and Colorimeter/Spectrophotometer. | 4 units |
| 4. Cleaning and sterilization of glassware. | 1 unit |
| 5. Study of aseptic techniques -preparation of cotton plugs for test tubes and pipettes, wrapping of Petri plates and pipettes, transfer of media and inoculum. | 2 units |
| 6. Staining of bacteria - | |
| a) Simple staining -methylene blue staining. | |
| b) Gram staining. | |
| c) Structural staining - Cell wall, Endospore staining, and Capsule staining | 5 units |

References:

1. Aneja K.R., Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom cultivation, New C Age International, New Delhi.
2. Atlas R.M., *Microbiology -Fundamentals and applications*, Macmillan Publishing Company, New York.
3. Benson Harold J., *Microbiological Applications*, WCB McGraw- Hill, New York.
4. Brock T .D. and Madigan M. T., *Biology of Microorganisms*, Prentice Hall of India Private Limited.
5. Narayanan P., *Essentials of Biophysics*, New Age International, New Delhi.
6. Pelczar M.J., Chan E.C.S. and Krieg N.R., *Microbiology*, McGraw Hill Book Company, New York.
7. Prescott Lansing M., Harley John P. and Klein Donald A., *Microbiology*, WCB McGraw- Hill New York,
8. Salle A.J., *Fundamental Principles of Bacteriology*, Tata McGraw- Hill Publishing Company Limited, New Delhi.
9. Stanier R. Y., Ingraham J.L., *General Microbiology*, Prentice Hall of India Private Limited, New Delhi,

SEMESTER II
MBT 201 -Microbial Biodiversity and Culture Techniques

Unit 1. The Microbial World -Viruses and Prions

14 hours

1. Study of viruses
 - a) Early developments of virology
 - b) General structure and properties of viruses
 - c) Virus purification and assay
 - d) Principles of Viral Taxonomy -
 - e) Structure, reproduction, cultivation and significance of:
 - Bacteriophages (T4 and lambda)
 - Plant viruses (TMV)
 - Animal viruses (HIV, Herpes and Corona virus)
 - f) Prions and Viroid's - Nature and significance

Unit 2. The Microbial World – Cyanobacteria and Fungi

14 hours

- 1 .a. General characteristics, classification, cell structure, and reproduction of
Cyanobacteria : Type - Nostoc and *Spirulina*.
- b. **Fungi**- ultrastructure of the fungal cell,
- c. Salient features, classification, reproduction and significance of major groups of fungi (Phycomycetes, Ascomycetes, Basidiomycetes, and Deuteromycetes).
- d. Type study of *Rhizopus*, *Aspergillus*, *Saccharomyces* and *Fusarium*.
- e. Protozoa - General features, classification and significance.

Unit 3. Microbial growth and Nutrition

14 hours

1. Nutritional requirements of microorganisms -Macronutrients, micronutrients, and growth factors.
Nutritional types of microorganisms: Autotrophs and heterotrophs, phototrophs and chemotrophs.
2. Physical factors affecting the growth of microorganisms: Temperature, pH and Oxygen.
3. Bacterial growth curve, phases of growth, generation time, synchronous culture and Diauxic growth.
4. Continuous culture - Chemostat and Turbidostat
5. Enumeration of bacteria -Viable count -SPC, Total count - DMC and turbidimetric estimation.
6. Membrane transport – Structure and organization of biological membranes.Types of cellular transport – Passive, active, membrane bound protein transport, ion channels and Na⁺K⁺ ATPase

Unit 4. Culturing of microorganisms and Chemotherapeutic agents

14 hours

Culturing of Microorganisms

- 1.Culture media -Synthetic and non-synthetic -solid, liquid and semi-solid media,
Special Media - Enriched, selective, transport, differential, maintenance and enrichment media.
- 2.Methods of isolation of bacteria, and fungi -Serial dilution, pour plate, spread plate and streak plate.
- 3.Maintenance of Pure cultures. Cultural collection centers.
- 4.Multiplication in bacteria - binary fission, budding and fragmentation.

Chemotherapeutic agents

1. Definition and classification of Antibiotics
2. Mode of action of antimicrobial agents – a brief account
3. Mode of action of the following antimicrobial agents :
 - a) **Antibacterial** - Penicillins, Cephalosporins, Polymyxins, Streptomycin, and Tetracyclines
 - b) **Antifungal** – Amphotericin and Griseofulvin.
 - c) **Antiviral** – AZT and Acyclovir
4. Development of Antibiotic resistance in microbes - a brief account.

SEMESTER II
**MBP 202 -Microbial Biodiversity and culture techniques -
practical**

Total units allotted: 14

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| 1 Preparation of Media -Nutrient broth, Nutrient Agar, MRBA medium, SDA medium and Mac Conkey Agar. | 2 units |
| 2. Isolation of Bacteria and Fungi from soil | |
| a) Serial dilution technique. | 4 units |
| b) Spread plate and pour plate techniques. | |
| c) Streaking techniques for isolation and purification of bacteria. | |
| d) Study of colony characteristics and Gram reaction of bacteria | |
| 3. Motility of bacteria by hanging drop technique. | 1 unit |
| 4. Measurement of size of cells by Micrometry. | 1 unit |
| 5. Counting of yeast cells and fungal spores using Haemocytometer. | 1 unit |
| 6. Study of fungi -Identification of fungi by Wet-mount method using Lactophenol cotton blue | 1 unit |
| 7. Type study of <i>Aspergillus</i> , <i>Penicillium</i> , Yeast, <i>Rhizopus</i> and <i>Fusarium</i> (Specimens) | 2 units |
| 8. Study of protozoa - <i>Amoeba</i> , <i>Paramoecium</i> and <i>Euglena</i> . (Permanent slides) | 1 unit |
| 9. Study of Blue-green algae - <i>Nostoc</i> and <i>Spirulina</i> . (Specimens) | 1 unit |

References:

1. Alexopoulos C.J. and Mims C.W., *Introductory Mycology*, New Age International, New Delhi.
2. Aneja K.R., *Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom cultivation*, New Age International, New Delhi. .
3. Atlas R.M., *Microbiology -Fundamentals and applications*, Macmillan Publishing Company, New York.
4. Benson Harold J., *Microbiological Applications*, WCB McGraw- Hill New York.
5. Bold H.C. and Wynne M.J., *Introduction to Algae*, Prentice Hall of India Private Limited, New Delhi.
6. Brock T.D. and Madigan M.T., *Biology of Microorganisms*, Prentice Hall of India Private Limited.
7. Mehrotra R.S. and Aneja K.R., *An Introduction to Mycology*, New Age International, New Delhi.
8. Pelczar M.J., Chan E.C.S. and Krieg N.R., *Microbiology*, McGraw Hill Book Company, New York.
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10. Salle A,J., *Fundamental Principles of Bacteriology*, Tata McGraw- Hill Publishing Company Limited, New Delhi.
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