Course: MICROBIOLOGY PG

Semester	1
Paper Number	MMCB4111
Paper Title	BASIC CLASSICAL MICROBIOLOGY
No of credits	6
Non composite/composite	Composite
No. of periods assigned	6
Course description/objective	• To characterize the taxonomy and diversity of life forms • To know physiology of different life forms • To determine growth and physiological parameters of microbes
Reference List	1. Madigan MT, and Martinko JM (2014). Brock Biology of Microorganisms. 14th edition. Prentice Hall International Inc. 2. Moat AG and Foster JW. (2002). Microbial Physiology. 4th edition. John Wiley & Sons 3. Reddy SR and Reddy SM. (2005). Microbial Physiology. Scientific Publishers India 4. Gottschalk G. (1986). Bacterial Metabolism. 2nd edition. Springer Verla 5. Stanier RY, Ingrahm JI, Wheelis ML and Painter PR. (1987). General Microbiology. 5th edition, McMillan Press. 6. Willey JM, Sherwood LM, and Woolverton CJ. (2013). Prescott's Microbiology. 9th edition. McGraw Hill Higher Education
Evaluation	Theory: 70 (60 End sem + 10 CIA) Practical: 30 (10 End sem + 20 CIA) **Question Paper format:** Theory: End sem 60 marks Module 1: 30 marks 3 questions form 5 (10x3=30) Module 2: 30 marks 3 questions form 5 (10x3=30) Viva: End sem 10 marks

BASIC CLASSICAL MICROBIOLOGY

- **MODULE 1**:

Taxonomy & Diversity of Life forms (35 MARKS)

Morphology: Morphological features of algae, fungi, bryophyte and pteridophyte and their evolution considering the molecular characterization. Economic importance of these members. Anatomy and morphology of gymnosperms and angiosperms, brief idea of their development and morphogenesis including APC systems. Concept of Chemotaxonomy. (**AKM**)

Taxonomy: Taxonomic principles, Taxonomic hierarchy, Binomial nomenclature, types of bacterial classification systems, new approaches to bacterial taxonomy (numerical taxonomy, ribotyping, rRNA sequencing, fatty acid profile) Bergey's Manual of Determinative Bacteriology, Bergey's manual of systematic bacteriology. Phenetic, phylogenetic and polyphasic approach to taxonomy. molecular chronometers**. (MM)**

Microbial diversity - The expanse of microbial diversity, phylogenetic trees and three domain universal phylogenetic trees. Measures and indices of diversity. General characteristics of various groups of prokaryotes: Archaebacteria, Eubacteria ,mycoplasmas, rickettsiae, chlamydiae, spirochaetes, cyanobacteria, actinomycetes**. (DD)**

Methods of studying microbial diversity (Conventional and molecular tools) - Concept of 'unculturable' Strategies for culture of 'unculturable' bacteria. Culture independent molecular methods for identifying unculturable bacteria. Methods of extracting total bacterial DNA from a habitat and metagenome analysis. **(MM+DD)**

- **MODULE 2:**

Physiology of Microbes and Plants (35 MARKS)

Water relations, mineral nutrition, nitrogen, phosphorus and sulpher metabolism, stomatal physiology, source and sink relationship, physiology and biochemistry of seed dormancy and germination, hormonal regulation of growth and development. Photoregulation, growth responses, physiology of flowering, senescence. Plant breeding principles, important conventional methods of breeding of self and cross pollinated and vegetatively propagated crops. Non-conventional methods, mutation breeding. (AKM)

Introduction to Microbial Physiology: The *E.coli* Paradigm, Metabolic genetic regulation, Energy, oxidation-reduction vs. fermentation.

Microbial growth: Growth cycle, continuous culture, factors affecting growth, details of synchronous and Diauxic growth curve. Fermentation pathways in specific group of microorganisms: Lactic acid, propionic acid, butyric acid producing fermentation;

Bacterial Sporulation- Sporulating bacteria, molecular architecture of spores, induction and stages of sporulation, Influence of different factors on sporulation. Cytological and macromolecular changes during sporulation. Heat resistance and sporulation. (MM)

Nutritional classification of microorganisms- Classification of microorganisms based on carbon source, energy source and electron sources. Macro & micronutrients. Energy generation in cyanobacteria, green bacteria, purple sulphur bacteria and chemolithotrophs.

Introduction to two component system, regulatory systems during aerobic-anaerobic shifts. Osmotic control of gene expression, SOS response and Heat shock response, regulation of nitrogen assimilation and fixation, Phosphate starvation, controlled stimulon, oxidation stress, The Lon system (Proteolytic control) (AB)

PRACTICAL: 30 MARKS 20CIA+ 10 END SEM

Basic Microbiology Practicals(MM+DD)

1. To learn pure culture techniques used for isolation and purification of microorganisms. a. Streak plate method. b. Pour plate method. c. Spread plate method
2. To perform different staining methods to study morphological and structural characteristics of bacteria and fungi. a. Gram Staining. b. Acid fast staining. c. Fungal staining (Lacto-phenol cotton blue). d. Spore staining. e. Flagella staining. f. Capsule staining. g. Negative staining

Microbial physiology practicals (AB+MM+AKM)

1. To study catalase activity of given microbial culture.
2. To study oxidase activity of given microbial culture.
3. To study ability of microorganisms to hydrolyse casein
4. To demonstrate phenylalanine deaminase activity of given bacterial culture.
5. To demonstrate L-lysine decarboxylase activity of bacterial culture.
6. To demonstrate Fat hydrolysis (lipase activity) by bacteria
7. To demonstrate the diauxic growth curve of bacteria.
8. To determine the thermal death point and thermal death time of a microbial culture.
9. Differentiate between plant parasite and other

phyloplaneorganism

Reference:

1. Madigan MT, and Martinko JM (2014). Brock Biology of Microorganisms. 14th edition. Prentice Hall International Inc.
2. Moat AG and Foster JW. (2002). Microbial Physiology. 4th edition. John Wiley & Sons
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5. Stanier RY, Ingrahm JI, Wheelis ML and Painter PR. (1987). General Microbiology. 5th edition, McMillan Press.
6. Willey JM, Sherwood LM, and Woolverton CJ. (2013). Prescott's Microbiology. 9th edition. McGraw Hill Higher Education
7. Lee (2018) Phycology, Cambridge University Press.
8. Mitra and Chakraborty (2021) Mycology and Phytopathology Taurean Publishers.
9. Shaw and Goffinet (2000) Bryophyte Biology. Cambridge University Press.
10. Sharma (2006) Pteridophyta, Sharma. McGrawHill.
11. Byng (2015) Gymnosperm Handbook.Plant Gateway.

12. Soltis (2005) Phylogeny and Evolution of Angiosperms. University of Chicago Press.
13. Mitra (2014) Applied Plant Physiology. Book Syndicate Pvt. Ltd.
14. Brown and Caligari (2008) An Introduction to Plant Breeding. Blackwell Publishing.
15. Madigan MT, and Martinko JM (2014). Brock Biology of Microorganisms. 14th edition. PrenticeHall International Inc.
1. Stanier RY, Ingrahm JI, Wheelis ML and Painter PR. (1987). General Microbiology. 5th edition, McMillan Press.
2. Reddy SR and Reddy SM. (2005). Microbial Physiology.
3. Albert G. Moat, John W. Foster, Michael P. Spector. Microbial Physiology 4th ed.