UG SEMESTER 7

Semester:	**UG 7**	
Course :	Major	
Paper Title: Modern Tools of Prokaryotic and Eukaryotic Classification		
Paper code:	C4MB230712T/P	**Credits: 6**
Hours/week :	**3T/4P**	
Category: Core/MDC/SEC/VAC :	Core	
Theory / Practical / Composite :	Composite	
No of Modules :	No	

Course Overview:

This course provides an integrated understanding of microbial and plant diversity, taxonomy, evolution, and ecology, with emphasis on modern approaches to biological classification. Students explore conventional and molecular taxonomy, phylogenetic relationships, microbial diversity, culture-independent methods and metagenomics, and the characteristics and evolution of major microbial and plant groups.

The course also covers ecosystem structure and function, community dynamics, succession, energy flow, biogeochemical cycles, conservation, sustainable development, environmental impact assessment, and ecological modelling. Practical training develops skills in quadrat sampling and biodiversity assessment using Shannon–Wiener, Shannon evenness, Simpson's, and Margalef indices.

Course Outcome:

1. **Remember:** Recall taxonomic principles and modern molecular tools to classify and establish evolutionary relationships among microorganisms and plants.
2. **Understand:** Fundamental principles of microbial and plant taxonomy, taxonomic hierarchy, classification systems, and modern molecular approaches such as numerical taxonomy, ribotyping, rRNA sequencing, fatty-acid profiling, and chemotaxonomy. Also understand morphology and characteristics of atypical bacteria.
3. **Analyze:** Analyze and interpret microbial diversity using phylogenetic trees, three-domain classification, diversity indices, and conventional and molecular approaches for studying culturable and unculturable microorganisms.
4. **Apply:** Calculate, interpret, and compare species frequency and ecological diversity using quadrat-based methods and indices including Shannon–Wiener diversity, Shannon evenness, Simpson's index, and Margalef diversity index, and draw appropriate ecological conclusions from the results.
5. **Evaluate**: Analyze and evaluate interactions among abiotic and biotic factors, ecological niches, limiting factors, succession, community structure, energy flow, food webs, ecosystem stability, biogeochemical cycles, conservation, sustainable development, and environmental impact assessment.
6. **Create:** Design and propose appropriate conventional, culture-independent, molecular, metagenomic, and ecological modelling approaches for investigating microbial diversity, ecosystem processes, and environmental problems.

Prerequisites: ***Basic knowledge about any prior course***

SYLLABUS				
UNIT/Module	**CONTENT**	**HOURS or NUMBER OF CLASSES**	**CO Mapping**	**COGNITIVE LEVEL**
I.	Taxonomic principles, Taxonomic hierarchy, Types of bacterial classification systems, new approaches to bacterial taxonomy (numerical taxonomy, ribotyping, rRNA sequencing, fatty acid profile).	3	CO1, CO2	K1, K2
II.	**Microbial diversity:** The expanse of microbial diversity, phylogenetic trees and three domain universal phylogenetic trees. Measures and indices of diversity. Concept of conventional and molecular tools. Strategies to study unculturable bacteria. Culture independent molecular methods for identifying unculturable bacteria. Metagenomic analysis.	6	CO1, CO2, CO3, CO4, CO6	K1, K2, K3, K4, K6
III.	**General characteristics of various groups of prokaryotes:** Eubacteria, Rickettsiae, Chlamydia, Spirochaetes, Actinobacteria, Cyanobacteria, Myxobacteria, Mycoplasma and Archaebacteria.	9	CO1, CO2	K1, K2
IV.	**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	9	CO1, CO2, CO4	K1, K2, K4

	gymnosperms and angiosperms, brief idea of their development and morphogenesis including APC systems. Concept of Chemotaxonomy.			
V.	Interaction between abiotic and biotic factors in an ecosystem, ecological niche, limiting factor, concept of community, fluctuation and succession. Ecological pyramid, energy flow, food chain, food webs and their dynamism, stability and complexity of ecosystem, bio geo chemical cycles, conservation and sustainable development, environmental impact assessment. Ecological modelling: Concept and Approach.	**9**	CO1,C4,CO5	K1, K4, K5
VI.	PRACTICAL Calculation of frequency of species through ground quadrat determination, calculation of Shannon Wiener diversity index, calculation of Shannon evenness, calculation of Simpson's index, demonstration of Margalef diversity index.	**12**	CO1, CO2, CO3, CO4, CO5, CO6	K1.K2,K3, K4,K5,K6

Text Books

1. Bergey's Manual of Systematic Bacteriology
   Whitman, W.B. (Ed.). Springer.
2. Prescott's Microbiology
   Willey, J.M., Sherwood, L.M., & Woolverton, C.J.
   McGraw-Hill Education.
3. Microbial Ecology: Fundamentals and Applications
   Atlas, R.M. & Bartha, R.
   Pearson Education.
4. Plant Systematics
   Simpson, M.G.
   Academic Press.
5. Plant Taxonomy and Biosystematics
   Singh, C.B.
   Rastogi Publications.

6. Ecology: From Individuals to Ecosystems Begon, M., Townsend, C.R., & Harper, J.L. Wiley-Blackwell.
Suggested readings
1. Powerpoint slides provided in class
Web Resources
Evaluation: Theory CIA (10+3+2), Practical CA (38+2)
Paper Structure for Theory Semester Exam: **Full Marks: 45** **Long questions: 4 (each 10 marks) from 6 (4x10=40)** **Short questions: 5 (each 1 mark) from 7 (5x1=5)**

Course outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive levels
CO1	**Remember:** Recall taxonomic principles and modern molecular tools to classify and establish evolutionary relationships among microorganisms and plants.	K1
CO2	**Understand:** Fundamental principles of microbial and plant taxonomy, taxonomic hierarchy, classification systems, and modern molecular approaches such as numerical taxonomy, ribotyping, rRNA sequencing, fatty-acid profiling, and chemotaxonomy. Also understand morphology and characteristics of atypical bacteria.	K2
CO3	**Analyze:** Analyze and interpret microbial diversity using phylogenetic trees, three-domain classification, diversity indices, and conventional and molecular approaches for studying culturable and unculturable microorganisms.	K3
CO4	**Apply:** Calculate, interpret, and compare species frequency and ecological diversity using quadrat-based methods and indices including Shannon–Wiener diversity, Shannon evenness, Simpson's index, and Margalef diversity index, and draw appropriate ecological conclusions from the results.	K4
CO5	**Evaluate:** Analyze and evaluate interactions among abiotic and biotic factors, ecological niches, limiting factors, succession, community structure, energy flow, food webs, ecosystem stability, biogeochemical cycles, conservation, sustainable development, and environmental impact assessment.	K5
CO6	**Create:** Design and propose appropriate conventional, culture-independent, molecular, metagenomic, and ecological modelling approaches	K6

	for investigating microbial diversity, ecosystem processes, and environmental problems.	