

**Subject Code: 02MB0455**

**Subject Name: Microbial Diversity and Molecular Phylogenetics**

**M. Sc. Semester - II**

**Objective:** To impart knowledge about concepts of origin of microbial life and its divergence in different families.

**Credits Earned:** 6 Credits

**Course Outcomes:** After completion of this course, student will be able to

- State approach of evolution and classification of life forms.
- Develop and analyze different methods for determining evolutionary relationships among microorganisms.
- Describe mechanisms involved for microbial sustenance at extreme conditions and its significance.

**Pre-requisite of course:** N.A.

**Teaching and Examination Scheme**

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	Mid Sem (M)	Internal(I)/(CSE)	Viva (V)	Termwork (TW) /Practicals (P)	
4	0	4	6	50	30	20	25	25	150

**Contents:**

Unit	Topics	Contact Hours
1	<b>Microbial taxonomy</b> Microbial Evolution and Systematic; Evolution of Earth and early life forms. Primitive life forms:-RNA world; molecular coding; energy and carbon metabolism; origin of Eukaryotes; endosymbiosis.	15
2	<b>Methods for determining evolutionary relationships</b> Evolutionary chronometers; Ribosomal RNA sequencing; signature sequences; phylogenetic probes; microbial community analysis. Derivation of Microbial Phylogeny:- characteristics of domain of life; classical taxonomy; chemotaxonomy; bacterial speciation.	15
3	<b>Microbial Diversity: Archaea</b> General Metabolism and Autotrophy in archaea Phylum Euryarchaeota:-Halophilicarchaea; methanogens; thermoplasma. Phylum Crenarchaeota:-Energy metabolism; Thermoproteales; sulfolobales; desulfolobales. Phylum Nanoarchaeota:-Nanoarchaeum. Heat stable biomolecules and extremophiles; Evolutionary significance of hyperthermophiles.	15
4	<b>Microbial Diversity: Bacteria</b> Phylum Proteobacteria:-Free living N <sub>2</sub> fixing bacteria; purple phototrophic bacteria nitrifying bacteria; sulphur and iron oxidizing bacteria; sulphate and sulphur reducing bacteria. Phylum: Prochlorophytes and cyanobacteria: Evolutionary history; types; characteristics. Phylum: Planctomyces; Phylum: Verrucomicrobia.	15
	<b>Total Hours</b>	<b>60</b>

**References:**

1. Christopher Woolverton, Linda Sherwood, Joanne Willey. *Prescott's Microbiology*. (2013). McGraw-Hill higher education. New York, NY.
2. Clive Edward. *Microbiology of Extreme environments*. (1990). McGraw-Hill higher education. New York. NY.
3. Gerard J. Tortora, Berdell R. Funke, Christine L. Case. *Microbiology: An Introduction*. (2007). Pearson Benjamin Cummings, San Francisco, CA.

4. N. R. Krieg, P. H. A. Sneath, J. T. Staley, S. T. Williams. *Bergey's Manual of Determinative Bacteriology*. (1994). Williams and Wilkins publication. Baltimore.
5. Prakash Bisen, Mousumi Debnath, G. Prasad. *Microbes: Concepts and Applications*. (2012). John Wiley & Sons.
6. Fergus Priest, Michael fellow. *Applied Microbial Systematics*. (2012). Springer Science. Germany.
7. T. Satyanarayana and B. N. Johri. *Microbial Diversity: Current Perspectives and Potential Applications*. (2005). I. K. International Pvt Ltd, New Delhi.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
20%	20%	30%	15%	10%	5%

**Instructional Method:**

- a. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board may also use any of tools such as demonstration, role play, Quiz, brainstorming, etc.
- b. The internal evaluation will be done on the basis of continuous evaluation of students in the class-room in the form of attendance, assignments, verbal interactions etc.
- c. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.

**List of Practicals:**

- Isolation of Microorganism from diverse samples.
- Morphological and Biochemical Identification of isolated culture by Bergey's Manual of systematic microbiology.
- Use of bioinformatics tools like Blastn for identification of microbes by sequencing.
- Use of Mega software for building of phylogenetic tree.