Syllabus template MICROBIOLOGY SEMESTER I

Semester: I	
Course : Microbiology	
Paper code: C3MB230111T	**Credits: 4**
Hours/week : 4	
Category: Core/MDC/SEC/VAC : CORE (Major)	
Theory / Practical / Composite : Theory	
No of Modules : No Modules	

Course Overview: This course provides a comprehensive overview of microbial diversity, focusing on the classification, ecology, and physiology of bacteria, archaea, fungi, and viruses. Students will explore bacterial morphology, cell structure (e.g., peptidoglycan), metabolic pathways, and their crucial roles in ecosystems, biotechnology, and human health. Key topics include taxonomic classification, genetic diversity, extremophiles, and laboratory techniques for identification

Course Outcome:

1. **Remember** the concepts of microbial diversity and learn the morphological identification methods.
2. **Understand** the process of the bacterial reproduction, growth and nutrition.
3. **Apply** the knowledge of diversification of bacteria for the development of phylogeny tree.
4. **Analyse** the role of modern bacterial identification methods in the evolution of new strains and species.
5. **Evaluate** the modern approaches of identification to the classical morphological, biochemical and physiological approaches.
6. **Create** and develop new phylogenetic methods that are more easier and less expensive as well as can be performed by the taxonomists.

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

SYLLABUS

UNIT/Module	CONTENT	HOURS or NUMBER OF CLASSES	CO Mapping	COGNITIVE LEVEL
I.	General characteristics of Algae and fungi • Algae --General characteristics of algae including occurrence, thallus organization, algal cell ultra-structure, pigments, flagella, eyespot, food reserves and reproduction- vegetative, asexual and sexual. Different types of life cycles in algae with suitable examples: Haplobiontic, Haplontic,	**5**	**CO1,CO2,CO3,CO4,CO5**	**K1,K2,K3,K4,K5**

	Diplontic, Diplobiontic and Diplohaplontic life cycles. Applications of algae in agriculture, industry, environment and food. • Fungi--General characteristics of fungi including habitat, distribution, nutritional requirements, fungal cell ultra- structure, thallus organization and aggregation, fungal wall structure and synthesis, asexual reproduction, sexual reproduction, heterokaryosis, heterothallism and parasexual mechanism. Economic importance of fungi with examples in agriculture, environment, Industry, medicine, food, biodeterioration and mycotoxins. • Protozoa --General characteristics with special reference to Amoeba, Paramecium, Plasmodium, Leishmania and Giardia			
II.	Diversity of Microbial World Difference between prokaryotic and eukaryotic microorganisms. Development of Classification systems - Aim and principles of classification, systematics and taxonomy. Early approaches to classification. Phenetic classification system - Whittaker's five kingdom-General characteristics of different groups.	**5**	**CO1,CO2,CO3,CO4,CO5**	**K1,K2,K3,K4,K5**

	Numerical Taxonomy. Binomial Nomenclature- Rules and scientific sources of naming. Bergey's Manual of Systematic Bacteriology [First Edition] Acellular microorganisms like Viruses, Viroids, Prions with emphasis on distribution, occurrence, morphology, mode of reproduction and economic importance.			
III.	Bacterial Systematics Molecular and modern approaches to phylogenetic classification systems - evolutionary chronometers, rRNA oligonucleotide sequencing, signature sequences, Tm value, G+C content and protein sequences. Carl Woese's classification systems and their utility. Bergey's Manual of Systematic Bacteriology [Second Edition]. Differences between eubacteria and archaebacteria.	6	**CO1,CO3,CO4,CO5,CO6**	**K1,K3,K4,K5,K6**
IV.	Bacterial Cell Organization Morphology: Cell size, shape and arrangement Cell wall: Structure and function of Gram positive and Gram negative cell wall; Archaebacterial cell wall. Cell membrane: Structure and function of bacterial and archaeal cell membranes. Cytoplasm: Nucleoid, plasmid,	7	**CO1,CO3,CO4,CO5**	**K1,,K3,K4,K5**

	ribosomes, mesosomes, inclusion bodies. Structures external to cell wall: Glycocalyx, capsules, flagella, endoflagella, pili and fimbriae. Special structure: Endospores			
V.	Bacterial Staining Stains: Definition, chemistry and classification of stains. Staining techniques: Principles and mechanisms of Simple (Positive and Negative) Staining, Differential (Gram and Acid Fast) Staining, Special (Endospore, Capsule, Flagella).	**5**	**CO1,CO3,CO5,CO6**	**K1,K3,K5,K6**
VI.	Bacterial Nutrition and Growth Nutrition: Nutritional requirements in bacteria and nutritional categories Culture Media: Components of media, natural and synthetic media, complex media, selective and differential media, enriched and enrichment media, transport and anaerobic media Growth: Definition, Measurement of growth, batch culture (phases of growth, generation time and growth rate), continuous culture, Synchronous growth, diauxic growth.	5	**CO1,CO2,CO3,CO5,CO6**	**K1,K2,3,K5,K6**
VII.	Control of Bacterial Growth Physical methods of microbial control: Heat, low temperature, high	5	**CO1,CO3,CO5,CO6**	**K1,K3,K5,K6**

	pressure, filtration, desiccation, osmotic pressure, radiation Chemical methods of microbial control: types and mode of action of disinfectants.			
VIII.	Reproduction in Bacteria General methods of reproduction in bacteria. Binary fission: overview.	3	**CO1,CO3,CO5,CO6**	**K1,K3,K5,K6**
Text Books				
1. Tortora GJ, Funke BR and Case CL. (2008). Microbiology: An Introduction. 9th edition. Pearson Education				
2. Madigan MT, Martinko JM, Dunlap PV and Clark DP. (2014). Brock Biology of Microorganisms. 14th edition. Pearson International Edition				
3. Cappucino J and Sherman N. (2010). Microbiology: A Laboratory Manual. 9th edition. Pearson Education Limited				
4. Wiley JM, Sherwood LM and Woolverton CJ. (2013) Prescott's Microbiology. 9th Edition. McGraw Hill International.				
Suggested readings				
1. Pelczar MJ, Chan ECS and Krieg NR. (1993). Microbiology. 5th edition. McGraw Hill Book Company				
2. Stanier RY, Ingraham JL, Wheelis ML, and Painter PR. (2005). General Microbiology. 5th edition. McMillan				
3. Atlas RM. (1997). Principles of Microbiology. 2nd edition. WM.T.Brown Publishers.				
Web Resources				
1.				
2.				
3.				
4.				
Evaluation Theory CIA: 30 Semester Exam:70				
Paper Structure for Theory Semester Exam Module : Full marks 70 Short questions: 10 (each 2 marks) from 12 (10x2=20) Long questions: 5 (each 10 marks) from 7 (5x10=50)				

Course outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive levels
CO1	**Remember** the concepts of microbial diversity and learn the characteristic features of cellular and acellular microorganisms.	K1
CO2	**Understand** the basis of bacterial systematics and modern approaches to bacterial classification.	K2
CO3	**Apply** the knowledge of chemistry on bacterial staining and nutrition.	K3

CO4	**Analyse** the role of chemical and physical factors on the bacterial growth and development.	K4
CO5	**Evaluate** the role of culture media and control measures to limit the bacterial growth and reproduction.	K5
CO6	**Create** and develop analytical methods to control bacterial growth and reproduction. Also to apply modern tools and techniques for updating bacterial systematics.	K6