



**Subject:** Microbial Diversity-MSCMB12508

**Type of course:** Major

**Prerequisite:** Students should have knowledge of general classification of living system, structural properties of fungi and virus and knowledge of evolution.

**Rationale:** By understanding the microbial taxonomy, students can gain a detailed classification of micro-organism, structural organization of fungi & bacteria and detailed study of bacterial diversity and microbial evolution.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits	Examination Marks					Total Marks
CI	T	P		C	Theory Marks		Practical Marks		
			ESE		MSE	V	P	ALA	
4	0	0	4	60	30	10	00	50	150

*Legends: CI-Class Room Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.*

**Course Content:**

Unit No	Course content	Hrs	% Weightage
1	<p><b>Chapter:1-Classification of Microorganisms</b></p> <ul style="list-style-type: none"> <li>• Haeckel’s three kingdom concept.</li> <li>• Whittaker’s five kingdom classification.</li> <li>• Classification, Nomenclature and Taxonomy (Bacterial classification and nomenclature)</li> <li>• Numerical taxonomy, phylogeny, molecular chronometer, evolutionary distance.</li> <li>• Data types used in taxonomy and phylogeny, Phylogenetic trees, Algorithms like maximum parsimony, UPGMA, 16s rRNA typing, Probabilistic models of evolution.</li> </ul>	15	25



2	<p><b>Chapter:2- Microbial Evolution</b></p> <ul style="list-style-type: none"> <li>• The Evolutionary Process &amp; Analysis</li> <li>• Microbial Phylogeny</li> <li>• Genotypic Analyses (DNA-DNA Hybridization, GC Ratios, Multilocus sequence Typing)</li> <li>• The Species Concept in Microbiology</li> <li>• Phylogenetic Overview of Bacteria</li> <li>• Physiology of Bacteria (Growth and Multiplication, Bacterial nutrition, Bacteriosins).</li> </ul>	15	25
3	<p><b>Chapter:3- Bacterial Diversity</b></p> <ul style="list-style-type: none"> <li>• Evolution of life.</li> <li>• Principles and concept of microbial diversity.</li> <li>• Structural and functional diversity.</li> <li>• Methods of studying microbial diversity: Unculturable and culturable bacterial diversity, Metagenomics, polyphasic approach for analysis of microbial diversity, Diversity indices.</li> <li>• NGS and pyrosequencing.</li> <li>• Problems and limitations in microbial diversity studies.</li> </ul>	15	25
4	<p><b>Chapter:4- Mycology &amp; Virology:</b></p> <ul style="list-style-type: none"> <li>• General aspects of fungi</li> <li>• Enumeration of fungi (Zygomycetes, Ascomycetes, Basidiomycetes, Deuteromycetes)</li> <li>• General properties of Viruses</li> <li>• Classification and nomenclature of Viruses</li> <li>• Viral Diversity (Viruses of Bacteria and Archaea, RNA Viruses of Eukaryotes, DNA Viruses of Eukaryotes)</li> </ul>	15	25

**Continuous Assessment:**

Sr. No	Active Learning Activities	Marks
1	<p><b>Chain notes</b> Faculty will assign the start point of the chain and group of students will complete the chain and upload on to the GMIU web portal.</p>	10
2	<p><b>Video analysis</b> Faculty will provide a particular video to students and students have to analyze and report will be upload on to the GMIU web portal.</p>	10



3	<b>Brain Storming</b> Faculty will conduct twisted quizzical sessions in the classroom per unit of their respective subject and marks will be uploaded to the GMIU web portal.	10
4	<b>Presentation</b> Faculty will assign the topic from syllabus to the students and students will prepare the presentation on given topic and upload it to GMIU web portal.	10
5	<b>Evolutionary chart</b> Faculty will assign the task to the students to prepare evolutionary chart and upload it on GMIU web portal.	10
<b>Total</b>		<b>50</b>

### Suggested Specification table with Marks (Theory):60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	50%	30%	20%	-	-	-

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

### Course Outcome:

After learning the course the students should be able to:	
CO1	Characterize bacteria on the basis of their living environment, structural organization & Physiological appearance.
CO2	Acquire skill in genotypic analysis & phylogenetic overview of Microbial world.
CO3	Apply various methods to study unculturable and culturable microorganisms.
CO4	Classify fungi and various viruses on the bases of their structure & general properties.



**Instructional Method:**

The course delivery method will depend upon the requirement of content and the needs of students. The teacher, in addition to conventional teaching methods by black board, may also use any tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory

The internal evaluation will be done on the basis of Active Learning Assignment

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in the laboratory.

**Reference Books:**

- 1) Principles of Microbiology (2<sup>nd</sup> edition) by Ronald M. Atlas.
- 2) Textbook of Microbiology (10<sup>th</sup> edition) by Ananthanarayan and Paniker.
- 3) Brock Biology of microorganisms (13<sup>th</sup> edition) by Michael T. Madigan, John M. Martinko, David A. Stahl, David P. Clark.
- 4) Modern Microbiology by Bridge, E. A.
- 5) Text book on principles of Bacteriology, Virology and Immunology by Topley and Wilson.

