



Subject: Metabolism of Microbes-MS CMB13514

Type of course: Major

Prerequisite: Student must have comprehensive understanding of Metabolism of Microorganisms.

Rationale: It helps in understanding Growth cycle, transportation mechanism of cell surface, spore formation, locomotion, regulation of metabolic pathways, cell communication etc.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks					Total Marks
CI	T	P		Theory Marks		Practical Marks		CA	
			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>Chapter 1: Transportation and Molecular mechanism of Prokaryotes.</p> <ul style="list-style-type: none"> Bacterial organs for locomotion: Flagella: structure, types, synthesis, function and mechanism of locomotion, Swarming motility, Motility in spirochetes, Gliding motility, Twitching. Chemotaxis: Molecular mechanism and physiological significance. Bacterial Cell Structure and its type, Bacterial Cell surfaces, Bacterial Cell wall structure function and synthesis, Membrane transport in bacteria-simple, group translocation, ABC transporters, Protein export in bacteria-Type 1,2,3&4. 	15	25%
2	<p>Chapter 2: Growth of Bacteria and Metabolism</p> <ul style="list-style-type: none"> Bacterial cell division: molecular mechanisms involved in formation of Z-ring, Cell division machinery. Yeast cell division: Growth and cell division coordination, Cell division events, molecular basis of cell cycle and control. Bacteriocins: Structure, Classification and physiological significance of it. Siderophores; structure, function and significance. Bacterial differentiation: endospore formation, physiological and genetic aspects of sporulation, Sporulation inducing signals and events in sporulation 	15	25%
3	<p>Chapter 3: Regulation of Prokaryotic Gene Expression - I</p> <ul style="list-style-type: none"> Bioluminescence: process, biochemistry, genetics and significance. Bacterial biofilm: formation steps, dispersion and control strategies. Microbial fuel cells: Energy generation principle and application. Microbial stress responses: Osmotic pressure, Osmolarity regulation in E.coli (Omp system), Phosphate assimilation in E.coli (Pho system), Nitrogen fixation in Klebsiella & Rhizobium (Ntr system). 	15	25%



4	<p>Chapter 4: Regulation of Prokaryotic Gene Expression - II</p> <ul style="list-style-type: none"> • Two component signal transduction in prokaryotes. • Quorum sensing process in gram positive and gram negative bacteria and quorum quenching and its use in developing antimicrobial tools. Microbial production of Hydrogen. • The prokaryotic “immune system”, CRISPR/Cas. • Structure and Mechanism of action of Endotoxin, Exotoxin and Exoenzymes formed by bacteria. 	15	25%
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Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	<p>Flow chart preparation Faculty will assign the topic on metabolic activity of organism and students need to prepare flow chart and upload them to GMIU web portal.</p>	10
2	<p>Virtual Metabolic analysis Students have to analyze phototrophic metabolism of given microbes and prepare 100 word report and upload to GMIU web portal.</p>	10
3	<p>Paper Review Faculty will provide a particular portion of the research paper and a group of students will review it and prepare a conclusion in 100 words and upload it to GMIU web portal.</p>	10
4	<p>Microbial Ecology Simulation Faculties will organize a game where students act as different microorganisms within an ecosystem. Each student can represent a different microbial species and simulate interactions such as competition for resources, symbiosis, or predation. Students have to prepare and submit video on that specific species on GMIU web Portal.</p>	10
5	<p>Industrial visit Students will visit Industry and prepare the report on instruments and techniques used in specific industry and upload it to GMIU web portal.</p>	10
Total		50



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	20%	50%	30%	10%	-	-

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	Understand the perception of bacterial locomotion, chemotaxis, and cellular transport mechanisms.
CO2	Identify bacterial community and discuss the physiological and genetic aspects of Bacteriocin and siderophres.
CO3	Analyze and interpret research findings related to the regulation of prokaryotic gene expression in various environmental contexts.
CO4	Relate the concepts learned in this chapter to real-world examples of bacterial communication, genetic defense mechanisms, and virulence factors.

Instructional Method:

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, 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 laboratory.



Reference Books:

- [1] Bacterial Signalling, Kramar and Jung
- [2] Microbial Physiology, Moat, Foster and Spector
- [3] The Physiology and Biochemistry of prokaryotes, David White
- [4] Bacterial physiology: A molecular approach, W. E. Sharoud
- [5] Modern Microbial Genetics, Uidis N. Streips & Ronald E. Yasbin
- [6] The desk encyclopedia of Microbiology, M. Schaechter
- [7] Topic related latest review articles.

