Master of Science (Biotechnology)
M.Sc. (Biotechnology) Semester (I)

Course Code	PS04EBIT53	Title of the Course	Microbial Physiology
Total Credits of the Course	04	Hours per Week	04

Course Objectives:	1. The primary objective of the course is to build a strong foundation in the area of bacterial cell structure, division, survival and propagation. 2. To provide conceptual information into the understanding of signal transduction in bacteria, adaptation to stress and differentiation of microbial systems. 3. Understand the various physiological aspects of bacterial systems like quorum sensing, ion acquisition, Bioluminescence, Host Parasite interactions and Prokaryotic Immune response.

Course Content		
Unit	Description	Weightage* (%)
1.	Two component signal transduction in prokaryotes Bacterial Cell Structure and its type, BacterialCell 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, Protein export pathways. Bacterial capsules structure and importance. 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.	25%
2.	Bacterial differentiation: endospore formation, physiological and genetic aspects of sporulation, Sporulation inducing signals and events in sporulation 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. Microbial stress responses: Oxygen toxicity, pH, Heat shock, Osmotic pressure, Osmolarityregulation in *E.coli* (Omp system), Phosphate assimilation in *E.coli* (Pho system), Nitrogen fixation in *Klebsiella& Rhizobium* (Ntr system). Gut microbiome and human health.	25%
3.	Bioluminescence: process, biochemistry, genetics and significance.	25%

	Mechanism of action of antibiotics and mechanisms of drug resistance. Bacteriocins: Structure, Classification and physiological significance of it. Siderophores; structure, function and significance Bacterial biofilm: formation steps, dispersion and control strategies Microbial fuel cells: Energy generation principle and application.	
4.	Quorum sensing process in gram positive and gram negative bacteria and quorum quenching and its use in developing antimicrobial tools. Microbial production of Hydrogen. Host Parasite interactions: Structures and functions involved in Host-parasite interactions, Bacterial damages to host upon infection. Structure and Mechanism of action of Endotoxin, Exotoxin and Exoenzymes formed by bacteria. The prokaryotic "immune system", CRISPR/Cas	25%
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Teaching-Learning Methodology	Topics will be taught and discussed in interactive sessions using conventional black board and chalk as well as ICT tools such as power point presentations and videos. Practical sessions will be conducted in a suitably equipped laboratory either individually or in groups depending on the nature of exercise as well as availability of infrastructure. Course materials will be provided from primary and secondary sources of information.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learnerwill be able to	
1.	Students will understand thedetails of bacterial cell structure, their organelles in terms of structure and functions. They will be knowingdifferent secretion systems existing in bacteria for secretion of biomolecules and their role in bacterial survival.

2.	Students will have detailed information on bacterial and yeast cell division and bacterial endospore formation.
3.	They will be made conversant withsignallingsystem in bacteria in response to various nutritional and physiological stresses.
4.	Students will be gaining in-depth knowledge about density-based signal transduction in bacteria and its significance in competence, sporulation and antibiotic resistance; would know about quorum quenching and its use in developing antimicrobial tools.

Suggested References:

Sr. No.	References
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, Uldis N. Streips& Ronald E. Yasbin
6.	The desk encyclopedia of Microbiology, M. Schaechter
7.	Topic related latest review articles.

On-line resources to be used if available as reference material
https://www.nature.com/nrmicro/
https://academic.oup.com/femsre
https://www.swayamprabha.gov.in/index.php/home

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