

Institute of Microbiology and Molecular Genetics
Faculty of Life Sciences
University of the Punjab, Lahore
Course Outline



Programme	BS	Course Code	MMG205	Credit Hours	
Course Title	AQUATIC MICROBIOLOGY				
COURSE INTRODUCTION					
<p>This course explores the fascinating world of microorganisms that inhabit aquatic environments, including freshwater and marine ecosystems. Aquatic microorganisms play crucial roles in shaping the health, biodiversity, and functioning of these ecosystems. Throughout this course, we will delve into the diversity, ecology, and importance of microorganisms in aquatic environments. We will examine the complex relationships between microorganisms and their environment, including the impact of human activities on these ecosystems.</p>					
LEARNING OUTCOME					
<p>On the completion of the course, the students will be able to:</p> <ol style="list-style-type: none"> 1. Analyze the diversity and ecological roles of microorganisms in aquatic ecosystems. 2. Apply microbiological methods to assess water quality and microbial processes in aquatic environments. 3. Evaluate the impact of microbial activities on the health and sustainability of aquatic ecosystems. 					
COURSE CONTENT					
<p>Introduction to Aquatic Microbiology: Overview of aquatic microbiology, Importance of microorganisms in aquatic ecosystems, Types of aquatic environments (oceans, rivers, lakes, wetlands), Bacteria in Aquatic Environments: Diversity of aquatic bacteria, Nutrient cycling (N, P, C), Decomposition and heterotrophy, Symbiotic relationships (e.g., coral-algae): Archaea and Fungi in Aquatic Environments: Diversity of aquatic archaea (e.g., methanogens, ammonia-oxidizers), Diversity of aquatic fungi (e.g., chytrids, oomycetes), and their roles in nutrient cycling and decomposition. Protozoa and Viruses in Aquatic Environments: Diversity of aquatic protozoa (e.g., flagellates, ciliates), Roles in grazing and nutrient cycling, Diversity of aquatic viruses: (e.g., bacteriophages, phytoplankton viruses), Water Quality and Nutrient Cycling: Microbial influences on water chemistry (e.g., pH, DO, nutrients), Nutrient cycling processes (e.g., N-fixation, denitrification), Microbial indicators of water quality, Food Webs and Human Impact: Microorganisms in aquatic food webs, Human impacts on aquatic microbial communities (e.g., pollution, climate change), Case Studies in Aquatic Microbiology, Plasmids and Their Role in Natural Aquatic Bacterial Communities</p>					
PRACTICALS					
<ol style="list-style-type: none"> 1. Isolation and identification of aquatic microorganisms 2. Microscopic examination of aquatic microbial communities 3. Measurement of microbial processes such as nutrient uptake, decomposition, and respiration using techniques like spectrophotometry and titration. 4. Water Quality Analysis: Analyze water samples for physical and chemical parameters like pH, temperature, dissolved oxygen, and nutrient levels. 5. Microbial Enumeration Techniques: Different microbial enumeration techniques like plate counts, MPN, and fluorescence microscopy. 					

6. Identification of Aquatic Microorganisms using molecular techniques.
7. Study of Microbial Communities: Design and conduct experiments to study microbial ecology concepts like competition, predation, and symbiosis.

1. Overbeck, J., & Chróst, R. J. (Eds.). (2012). *Aquatic microbial ecology: biochemical and molecular approaches*. Springer Science & Business Media.
2. Kemp, P. F., Cole, J. J., Sherr, B. F., & Sherr, E. B. (Eds.). (1993). *Handbook of methods in aquatic microbial ecology*. CRC press.
3. Munn, C. B. (2019). *Marine microbiology: ecology & applications*. CRC Press
4. Stal, L. J., & Cretoiu, M. S. (Eds.). (2022). *The marine microbiome*. Springer.
5. Hurst, C. J. (Ed.). (2019). *Understanding Terrestrial Microbial Communities*. Springer International Publishing.

ASSESSMENT

Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on activities, short tests, projects, practicals, reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, fieldwork , report writing etc.