

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



<b>Programme</b>	BS	<b>Course Code</b>	MMG104	<b>Credit Hours</b>	3(2+1)
<b>Course Title</b>	<b>MICROBIAL GENETICS</b>				
<b>COURSE INTRODUCTION</b>					
<p>This course explores into the fundamental aspects of bacterial and viral genetics, exploring the involved mechanisms that direct genetic processes in prokaryotes. Students will gain a comprehensive understanding of the structural organization and functional dynamics of bacterial and viral chromosomes. The course will cover critical genetic exchange mechanisms among prokaryotes, including transformation, conjugation, and transduction, and their roles in genetic diversity.</p>					
<b>LEARNING OUTCOMES</b>					
<p>On the completion of the course, the students will understand:</p> <ol style="list-style-type: none"> <li>1. Structure and organization of Bacterial and Viral Chromosomes</li> <li>2. Mechanisms of Genetic Exchange Among Prokaryotes</li> <li>3. Genetic Mapping and Complementation Analysis</li> <li>4. DNA Replication, Gene Expression and Regulation in Bacteria</li> <li>5. Critical Thinking and Problem-Solving by analyzing and solving problems related to Microbial genetics</li> </ol>					
<b>COURSE CONTENT</b>					
<p>Chromosomes: Structure of Bacterial and viral chromosomes. Extra chromosomal elements: Episomes, Plasmids, sex factors. entry exclusion, incompatibility and basis for incompatibility. Constitution of an R-plasmid, F factor and its restriction map. Various types of bacteriocin plasmids, Curing of Plasmids. Mechanisms of genetic exchange: Horizontal gene transfer among prokaryotes, recombination, Transformation conjugation and transduction, Bacteriophages. virulent and avirulent phages. DNA replication and Expression: Bacterial DNA replication, Genetic Code, transcription and translation, Gene expression and regulation, Mutation. Components of Operon, Positive and negative control and its examples. Constitutive and induced pathways. Genetic mapping, complementation. analysis. Mobile Genetic Elements: Definition, Structure and classification of Insertion sequences (IS), Transposons and Integrons in prokaryotes, mutations of <i>E. coli</i> caused by insertion sequence elements, transposons and plasmids, antibiotic resistant transposons, their integration and excision, Transposition Mechanisms. Mobile genetic elements in Maize, insertion mutations in <i>Drosophila</i>.</p>					
<b>PRACTICALS</b>					
<p>Methods of genetic exchange (conjugation, transformation and transudation), Curing of Plasmid: Study of effects of media composition, starvation, pH, temperature on plasmid curing Plasmid, Transposons mutagenesis, Genetic mapping experiments and Problem solving. Mapping of Tn/Int sequences from bacterial genome</p>					

### TEXTBOOKS AND READING MATERIAL

1. Griffiths, A. J. F., Wessler, S. R., Carroll, S. B., & Doebley, J. (2020). *Introduction to genetic analysis* (12th ed.). W. H. Freeman.  
<https://www.scribd.com/document/673161469/Introduction-to-Genetic-Analysis-12th-Edition>.
2. Hartl, D. L., & Jones, E. W. (2011). *Genetics: Analysis of genes and genomes* (8th ed.). Jones & Bartlett Learning.
3. Klug, W. S., & Cummings, M. R. (2018). *Concepts of genetics* (12th ed.). Pearson.
4. Pierce, B. A. (2020). *Genetics: A conceptual approach* (7th ed.). W. H. Freeman.
5. Primrose, S. B., Twyman, R. M., & Old, R. W. (2013). *Principles of gene manipulation and genomics* (8th ed.). Wiley-Blackwell.

### 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.

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