

**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>	MMG308	<b>Credit Hours</b>	3(2+1)
<b>Course Title</b>	<b>MOLECULAR BIOLOGY</b>				
<b>COURSE INTRODUCTION</b>					
<p>This BS course in Molecular Biology offers a comprehensive exploration of the fundamental concepts and techniques that define the field. Beginning with an introduction and a brief history of molecular biology, the course provides an in-depth study of the molecular tools used to analyze genes and gene activity. Students will explore the transcriptional machinery of both prokaryotes and eukaryotes, delving into the intricacies of operon regulation, RNA polymerases, and the roles of general transcription factors and activators. The course also covers key post-transcriptional modifications, including splicing, capping, and polyadenylation, which are crucial for RNA processing. Additionally, the molecular mechanisms underlying translation and DNA replication are examined, along with the processes of homologous and site-specific recombination. This curriculum is designed to equip students with both theoretical knowledge and practical skills, preparing them for advanced studies and careers in molecular biology and related fields.</p>					
<b>LEARNING OUTCOMES</b>					
<p>On the completion of the course, the students will be able to:</p> <ol style="list-style-type: none"> <li>1. Understand the Historical and Conceptual Foundations of Molecular Biology</li> <li>2. Master Molecular Tools and Techniques</li> <li>3. Comprehend the Mechanisms of Transcription and Translation in Prokaryotes and Eukaryotes</li> <li>4. Explore Post-Transcriptional Modifications and RNA Processing</li> </ol>					
<b>COURSE CONTENT</b>					
<p>Introduction and a brief history of Molecular Biology, Methods in Molecular Biology, including molecular tools for studying gene and gene activity, The transcription apparatus of prokaryotes, operons: fine control of prokaryotic transcription, Eukaryotic RNA polymerases and their promoters, General transcription factors in eukaryotes, transcription activators, Posttranscriptional events I, II, III: Spicing, Capping, Polyadenylation, RNA processing, The Mechanism of translation I, II, DNA replication I, II, Homologous and Site-specific recombination.</p>					
<b>PRACTICALS</b>					
<p>Calculations and practice of making solutions/buffers, Isolation of DNA from bacteria (Heat lysis, CTAB, SDS methods), Miniprep/alkaline lysis Plasmid Isolation, extraction of DNA from blood, Saliva, Hair, fruit (banana or strawberry), plant (leaves, roots), yeast, Horizontal and vertical Gel electrophoresis, Preparation of loading dye, Polymerase chain reaction, Restriction digestion</p>					
<b>TEXTBOOKS AND READING MATERIAL</b>					
<ol style="list-style-type: none"> <li>1. Weaver, R. F. (2018). <i>Molecular Biology</i> ,6th Edition. McGraw-Hill Education.</li> <li>2. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., &amp; Walter, P. (2022). <i>Molecular Biology of the Cell</i> ,7th Edition. Garland Science. Taylor and Francis, London</li> <li>3. Cox, M. M., Doudna, J. A., &amp; O'Donnell, M. (2020). <i>Molecular Biology: Principles and Practice</i>, 3<sup>rd</sup> Edition. Macmillan Learning.</li> </ol>					

4. Brown, T. A. (2018). *Genomes 4*. Garland Science.
5. Snyder, L., Peters, J. E., Henkin, T. M., & Champness, W. (2020). *Molecular Genetics of Bacteria*, 4th Edition. ASM Press.
6. Miller, H., Witherow, D. S., & Haro von Mogel, K. J. (2020). *Molecular Biology Techniques: A Classroom Laboratory Manual*, 3<sup>rd</sup> Edition. Academic Press.
7. Frederick M. Ausubel, Roger Brent, Robert E. Kingston, David D. Moore, J.G. Seidman, John A. Smith, and Kevin Struhl, (2020); *Short Protocols in Molecular Biology*, John Wiley & Sons. SBN: 978-0471250921
8. Sambrook, J., Fritsch, E. F., & Maniatis, T. (2012). *Molecular Cloning: A laboratory manual*. 4<sup>th</sup> Edition. Cold Spring Harbor Laboratory Press.

#### 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.