

Programme	BS Biochemistry	Course Code	BC. 307	Credit Hours	3
Course Title	Methods in Molecular Biology				
Course Introduction					
This course will provide in-depth knowledge about modern molecular research through an introduction to basic techniques in molecular biology and their applications in experimental settings. This course will help students to get hands-on experience in cutting-edge methodologies, spanning DNA manipulation, protein analysis, and genetic engineering.					
Learning Outcomes					
On completion of the course, the student will be able to learn:					
<ul style="list-style-type: none"> • Understand fundamental molecular biology techniques. • Interpret experimental data from molecular biology assays. • Design molecular biology experiments to investigate gene function and expression. 					
Course Content					
Theory unit					
<ul style="list-style-type: none"> • Introduction to recombinant DNA technology; restriction and modifying enzymes; • Cloning and expression vectors and their types; cDNA libraries • Expression of recombinant proteins and their purification by affinity chromatography; • An Introduction to Basic Techniques in Molecular Biology (Gel Electrophoresis, Agarose, native- PAGE, SDS-PAGE; Sanger Sequencing; Radioisotopes and their Applications) • Polymerase Chain Reaction (PCR) and its Types, application of PCR; • The basic principles of gene cloning and DNA analysis. Importance of gene cloning and DNA analysis. • RACE • Genome editing techniques. • Nucleic acid sequencing strategies; Sanger sequencing and pyrosequencing. • Next Generation DNA Sequencing methods and applications. • Computer-based Analysis of Large-Scale Nucleotide Sequence Data, including DNA sequence assembly and mapping, • Multiple Sequence Alignment tools • Phylogenetic analyses • Immunoassays; Immunohistochemistry; ELISA; Immunofluorescence. 					
Practical Unit					
<ul style="list-style-type: none"> • Detection of Mutations and SNPs; Restriction Fragment Length Polymorphism (RFLP); DNA fingerprinting. • Extraction of DNA& RNA from tissue/blood sample & determination of concentration and purity by agarose and formaldehyde agarose gel electrophoresis. • Synthesis of cDNA • Primer designing and preparation of working solutions of primers • Amplification of target gene by polymerase chain reaction (PCR) and analysis of amplicon by agarose gel electrophoresis • Gel purification and restriction analysis • Ligation reaction, preparation of competent cells and transformation • Plasmid isolation and electrophoretic analysis • Blotting Techniques, southern, western and northern. • DNA sequencing data analysis 					

Textbooks and Reading Material

- Cheryl L. P. & Bernard R. G. (2022). *Molecular Biotechnology: Principles and Applications of Recombinant DNA*. (6th ed.). ASM Press, USA
- Robert, F. W. (2021). *Molecular Biology* (7th ed.). McGraw-Hill
- Michael, S. (2019). *Genetic Engineering* (3rd ed.). Cambridge University Press, UK.
- Primrose, S. B. & Twyman, R. M. (2014). *Gene Manipulation and Genomics* (8th ed.). Blackwell Publishing
- Michael M. C., Jennifer A. D. and Michael O'D. (2016). *Molecular Biology: Principles and Practice* (1st Ed.). W.H. Freeman.
- Alberts, B. et al. (2021). *Molecular Biology of the Cell*. (6th Ed.). Garland Science.
- Heather, M. (2020). *Molecular Biology Techniques*. (4th Ed). Academic Press.
- 8. Green, M. and Sambrook, J. (2012) *Molecular Cloning: A Laboratory Manual*. 4th Edition, Vol. II, Cold Spring Harbor Laboratory Press, New York.

Teaching Learning Strategies

- Lecture presentations
- Quizzes
- Written Assignment
- Class activities and discussions

Assignments: Types and Number with Calendar

- 1st Quiz in 4th Week of 5 marks
- 2nd Quiz in 10th Week of 5 marks
- 3rd Quiz in 14th Week of 5 marks
- Assignment in 8th Week of 10 marks

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, practical, 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, field work and report writing etc.