

<b>Semester: 5</b>				
<b>Course: Major 3</b>				
<b>Paper Title: RECOMBINANT DNA TECHNOLOGY</b>				
<b>Paper Code: C3BT230532T/P</b>			<b>Credits: 4 (3 Th + 1 Pr)</b>	
<b>Hours/week: 3 + 3</b>				
<b>Category: Core/MDC/SEC/VAC: Core</b>				
<b>Theory / Practical / Composite: Composite</b>				
<b>No of Modules : 2</b>				
<b>Course Overview:</b> This course introduces the principles, tools, and applications of recombinant DNA technology and molecular biotechnology. It focuses on the enzymatic manipulation of nucleic acids, strategies for gene recombination and transfer, and advanced DNA amplification and modification techniques such as PCR and its variants. The course further explores the construction and comparative analysis of genomic and cDNA libraries, modern screening and interaction assays, and display technologies. In addition, learners are introduced to a wide range of cloning and expression vectors, their design features, and applications in therapeutic protein production and synthetic biology. Emphasis is placed on understanding methodological principles, experimental strategies, and translational applications, enabling students to integrate molecular tools for research, diagnostics, and biotechnological innovation.				
<b>Course Outcome: At the completion of the course, a student should be able to:</b>				
1. To <b>recall and define</b> fundamental molecular tools such as DNA-modifying enzymes (ligases, polymerases, phosphatases, kinases, inhibitors) different types of PCR techniques (RT-PCR, inverse PCR, nested PCR, RACE, real-time PCR) and various types of cloning vectors including plasmids, bacteriophage-based vectors, cosmids, BACs, YACs, expression and shuttle vectors.				
2. To <b>explain the principles</b> underlying gene recombination, gene transfer, and various PCR-based techniques.				
3. To <b>apply appropriate molecular tools and PCR methods</b> to solve problems related to DNA amplification, mutation analysis, and gene expression studies				
4. To <b>differentiate</b> between various cloning and expression vectors and analyze their suitability for specific recombinant DNA applications.				
5. To <b>assess</b> experimental designs and methodologies involving recombinant DNA technology, including PCR-based approaches and vector selection.				
6. To <b>design</b> and propose original experimental strategies, including the construction of recombinant vectors, gene libraries etc. Hands on training to learn RDT based experimental techniques.				
<b>Prerequisites:</b> Basic knowledge about biology				
<b>SYLLABUS</b>				
<b>UNIT/Module</b>	<b>CONTENT</b>	<b>HOURS or NUMBER OF CLASSES</b>	<b>CO Mapping</b>	<b>COGNITIVE LEVEL</b>
<b>Module A</b>	<b>UNIT I:</b> Molecular tools and applications- DNA modifying enzymes: ligases,	2 classes per week	CO1-CO6	K1-K6

	<p>polymerases (DNA and RNA), alkaline phosphatases, polynucleotide kinases, inhibitors Gene Recombination and Gene transfer.</p> <p><b>UNIT II:</b> Applications of Polymerase chain reaction (PCR): RT- (Reverse transcription) PCR; Inverse PCR, Nested PCR, RACE (5' and 3'), Real time PCR, Site-directed mutagenesis, Primer extension. <b>UNIT III:</b> Construction and comparison of genomic and cDNA library; Artificial chromosomes; Yeast two hybrid assay; Phage Display</p>			
<b>Module B</b>	<p><b>UNIT IV:</b> Vectors: Different types of cloning vectors (Plasmids, Bacteriophage <math>\lambda</math>-based vectors, Cosmids, M13 bacteriophagebased vectors, BACs, YACs, Expression Vectors and Shuttle Vectors), therapeutic products produced by recombinant DNA technology, construction of synthetic cells</p>	1 class per week	CO1-CO6	K1-K6
<b>Practical</b>	<ol style="list-style-type: none"> <li>1. Generation of competent cells</li> <li>2. Transformation of competent cells and Calculation of transformation efficiency.</li> <li>3. Plasmid Isolation and agarose gel electrophoresis</li> <li>4. Restriction digestion of plasmid DNA</li> <li>5. Isolation of chromosomal DNA from bacteria</li> <li>6. Qualitative and quantitative analysis of DNA using spectrophotometer.</li> <li>7. Recombinant expression of protein in bacteria: IPTG induction and SDS PAGE.</li> </ol>	3 classes per week	CO1-CO6	K5-K6
<b>Text Books</b>				
1. Principles of Gene Manipulation & Genomics-Primrose & Twyman				
2. Molecular Cloning- Sambrook et al.				
3. Gene Cloning and DNA Analysis: An Introduction – T.A Brown				
<b>Evaluation:</b>				

Theory CIA- 10 Assignment – 02 Attendance - 03 Semester Exam- 45	Practical CA- 30 Attendance - 02 Semester Exam- 08
<b>Module A (30 marks)</b> <ul style="list-style-type: none"> <li>• <b>Compulsory: 1 question of 10 marks (2 x 5 = 10 marks),</b></li> <li>• <b>4 out of 6 questions to be answered of 5 marks each (4 x 5= 20 marks).</b></li> </ul>	
<b>Module B (15 Marks)</b> <ul style="list-style-type: none"> <li>• <b>Answer any three of the five questions given, each carrying 5 marks (Part questions will not be less than 1 mark and more than 5 marks).</b></li> </ul>	

### Course outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive levels
<b>Module A &amp; Module B</b>		
<b>CO1</b>	To <b>recall and define</b> fundamental molecular tools such as DNA-modifying enzymes (ligases, polymerases, phosphatases, kinases, inhibitors) different types of PCR techniques (RT-PCR, inverse PCR, nested PCR, RACE, real-time PCR) and various types of cloning vectors including plasmids, bacteriophage-based vectors, cosmids, BACs, YACs, expression and shuttle vectors.	K1-K6
<b>CO2</b>	To <b>explain the principles</b> underlying gene recombination, gene transfer, and various PCR-based techniques.	K1-K6
<b>CO3</b>	To <b>apply appropriate molecular tools and PCR methods</b> to solve problems related to DNA amplification, targeted mutation generation, gene expression studies, library construction	K1-K6
<b>CO4</b>	To <b>differentiate</b> between various cloning and expression vectors and analyze their suitability for specific recombinant DNA applications.	K1-K6
<b>CO5</b>	To <b>assess</b> experimental designs and methodologies involving recombinant DNA technology, including PCR-based approaches and vector selection.	K1-K6
<b>CO6</b>	To <b>design</b> and propose experimental strategies, including the construction of recombinant vectors, DNA library generation, etc.	K1-K6