Gyanmanjari Innovative University

Course Syllabus
Gyanmanjari Science College
Semester-3 (M.Sc.)

Subject: Recombinant- DNA Technology (MSCMB13513)

Type of course: Major

Prerequisite: Student must have comprehensive understanding of genome and DNA structure.

Rationale: r-DNA technology offers a powerful tool for improving medical application and research, agricultural technology, environmental sustainability, and scientific research.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks		Practical Marks		CA	
CI	T	P	C	ESE	MSE	V	P	ALA	
4	0	0	4	60	30	10	00	50	150

Legends: CI-Class Room Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

Course Content:

Unit No	Course content	Hrs	% Weightage
1	**Chapter:1 Basics of Genetics engineering** • Scope of Genetic Engineering, • Concept and importance of Genetic Engineering; General strategies and Steps involved in gene cloning; • Extraction and purification of DNA from bacteria, plant and animal cells; • Restriction enzymes, DNA ligase and other enzymes involved in gene cloning; mRNA and cDNA preparation.	15	25%

2	**Chapter:2 PCR and Recombination technology** • Polymerase chain reaction, Molecular markers Linkage mapping using meiotic recombination frequencies • Genomic mapping using radiation induced Chromosome rearrangement • Genomic mapping using DNA sequence polymorphism as genetic marker In-vitro Mutagenesis • Metagenomics, Metabolic engineering, Gene therapy • Recombinant products- recombinant hormones, recombinant DNA vaccines, Transgenic plants, Transgenic animals, • Genetic Engineering Guidelines • Levels of Physical containment, Levels of Biological containment, The Indian Guidelines.	15	25%
3	**Chapter: 3 DNA Cloning and expression vectors** • Introduction about Plasmids • Type of Plasmids, - Bacteriophages, M-13 based vectors, Phagemids, Cosmids, YAC, BAC, HAC/MAC, etc. • Expression of cloned gene in heterogonous host • Introduction of DNA into different host systems.	15	25%
4	**Chapter:4 Recombinant selection and screening** • Southern blotting & hybridization, • Northern analysis, Western blot analysis, • Agarose gel electrophoresis, • Pulse Field Gel Electrophoresis, Rotating Gel. Electrophoresis (RGE), PAGE, SDS-PAGE, • Iso-electric Focusing, Two Dimensional Electrophoresis • Capillary Electrophoresis- Capillary Gel Electrophoresis, • Mapping Regulatory Sequences by in vivo expression assay • Mapping of Protein Binding Site by DNAse I Protection	15	25%

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	**Gene amplification** Faculty will provide DNA sample and group of students (3 students) have to amplify targeted gene and amplified gene photo will be upload on GMIU web portal.	10
2	**Plasmid Construction Simulation** Group of students (3 students) simulate scenario where they need to design and construct a recombinant plasmid for a specific purpose, such as gene cloning or protein expression. Students can use molecular biology software or physical models (e.g LEGO® kits representing DNA fragments) to plan the construction of the plasmid. Acquired data will be upload on GMIU web portal.	10
3	**Gel/Recombination analysis** Faculty will provide gel photo or cloned organism on to the plate students has to define transformation and submit report on GMIU web portal.	10
4	**Virtual lab Exploration** Students will virtually explore the various type of sequencing and upload a sequencing flow chart on GMIU web portal.	10
5	**Bioinformatics Analysis of Recombinant DNA** Introduce students to bioinformatics tools and databases used in recombinant DNA technology. Assign students a bioinformatics project where they analyze DNA sequences, design primers for PCR amplification, or predict protein structure and function. Acquired data will be upload on GMIU web portal.	10
Total		**50**

Suggested Specification table with Marks (Theory):60

Distribution of Theory Marks **(Revised Bloom's Taxonomy)**						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	10%	30%	30%	30%	-	-

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcome:

After learning the course the students should be able to:	
CO1	Extract, purify and interpret DNA from bacteria, plant and animal cells
CO2	Understand the principles and operation sequence analysis on different tools
CO3	Apply DNA Cloning methodology and expression vectors
CO4	Screen Recombinant gene form the transformed organism and learn various techniques for screening of expressed gene.

Instructional Method:

The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory

The internal evaluation will be done on the basis of Active Learning Assignment

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

Reference Books:

[1] Genome 3rd Edition -- Brown
[2] Molecular Biotechnology – Glick
[3] Principles of Genetic Manipulation – Old & Primrose
[4] Applied Molecular Genetics – Roger Miesfeld
[5] Biotechnology – H. K. Das