ST. JOSEPH’S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

III SEMESTER **BIOTECHNOLGY** TIME: 4Hrs/Week

BTH-Ma-3-3701 (3) **GENETIC ENGINEERING** Max. Marks: 100

W.e.f. 2023-24 admitted batch (23AK) **SYLLABUS**

**OBJECTIVES:** To enable the students to

1. Acquire knowledge about the history and tools of genetic engineering.
2. Comprehend the usage of cloning vectors.
3. Swot the advanced genetic hybridization techniques.
4. Gain the basic concepts in construction of gene libraries & expressions.
5. Acquire knowledge about gene engineering, mutagenesis & sequencing.

**COURSE OUTCOMES: Students will**

* **CO1:** Accustomed with the tools & techniques of genetic engineering and molecular

cloning.

* **CO2:** Be comprehend about different cloning vectors.
  + - **CO3:** Acquire insights in probes and PCR reactions.
* **CO4:** Be proficient at DNA library construction & vector screening techniques.
* **CO5:** Acquire knowledge on gene editing, mutagenesis & sequencing.

**UNIT- I: Recombinant DNA Technology – 1**

1. Basics, history, scope, and recent developments in Genetic Engineering; guidelines; strategies in plant and animal genetic engineering.
2. Molecular tools in genetic engineering – Restriction enzymes: Endo & Exo nucleases. Enzymes used in rDNA Technology: Polymerases, ligases, phosphatases, methylases, Kinases and nucleases.
3. Ligation (cohesive & blunt end ligation) – linkers & adaptor.

**UNIT – II: Recombinant DNA Technology – 2**

1. Cloning vectors: plasmid -definition, properties and types. pUC19 & pBR322 & phage vectors (λ & M13),
2. Cosmid vectors, Shuttle and expression vectors; YAC (*S.cerevisiae* as a model) & BAC (*E.coli*).
3. Gene transfer methods.
4. Screening and selection of recombinants.

**UNIT – III: Techniques in Genetic Engineering**

1. Hybridization techniques: Probes (radioactive & non-radioactive), detection.
2. Polymerase Chain Reaction (PCR) – Principle, Applications and types of PCR
3. Labeling of DNA-Nick translation, Random priming method & labeling by primer extension.

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**UNIT – IV: Gene Libraries and Expression patterns**

1. Construction of genomic & c DNA libraries.
2. Vector engineering & codon optimization (Change in mRNA constitution), strategies of gene delivery, *in-vitro* translation
3. Expression in bacteria, yeast, insects, plant & mammalian cells

**UNIT V: Gene editing and DNA Sequencing**

1. Chromosome engineering, targeted gene replacement.
2. Gene editing, gene regulation & silencing.
3. Site-directed mutagenesis.
4. DNA sequencing – Maxam Gilbert (chemical) & Sanger’s, Nicolson sequencing, Pyro-sequencing. Human Genome Project.

**REFERENCES**

1. Textbook of Biotechnology - 2007, By H.K. Das (Wiley Publications)
2. Principles of Gene Manipulation - 7th edition, 2006, By R.W. Old & S.B. Primrose, Publ: Blackwell
3. Molecular Biology & Biotechnology- 1996, By H.D. Kumar, Publ: Vikas
4. Molecular Biotechnology - 4th edition, 2010, G.R. Click and J.J. Pasternak, Publ: Panima
5. Genes and Genomes – 1991, By Maxine Singer and Paul Berg
6. Genes VII- 2000, By B. Lewin - Oxford Univ. Press
7. Molecular Biology - 4th Edition, 2008, By D. Freifelder, Publ: Narosa Publishing house New York, Delhi
8. Brown TA. (2006). Gene Cloning and DNA Analysis. 5th edition. Blackwell Publishing, Oxford, U.K.
9. Clark DP and Pazdernik NJ. (2009). Biotechnology-Applying the Genetic Revolution.
10. Elsevier Academic Press, USA.
11. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology-Principles and Applications of recombinant DNA. ASM Press, Washington
12. Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7thedition. Blackwell Publishing, Oxford, U.K.
13. Sambrook J, Fritsch EF and ManiatisT. (2001). Molecular Cloning-A Laboratory Manual. 3rdedition. Cold Spring Harbor Laboratory Press.

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