

Course Code	Course Name	Credits
26BY513	GENETIC ENGINEERING AND BIOTECHNOLOGY	04

Course Objectives

- Introduce to the basic concepts in genetic engineering and plant biotechnology
- To study recombinant DNA technology, including tools such as restriction enzymes, vectors, ligases, and cloning techniques
- To teach students the various approaches in genetic engineering and their applications.
- To learn about the current advances in the field of recombinant DNA technology.
- Overall, it prepares students for applications in agriculture, medicine, and research.

Learning Outcomes

Upon successful completion of this course it is intended that a student will be able to:

- Understand the basic principles and modern age applications of recombinant DNA technology.
- Knowledge on the different molecular techniques and its applications.
- Apply genetic engineering tools in crop improvement programmes.
- Evaluate applications of biotechnology in fields like agriculture, medicine, industry, and environmental management.
- Design basic experiments and apply molecular techniques in research and industrial applications.

Unit 1 Classical and modern biotechnology: (12 Hrs).

Introduction to classical and major achievements in plant biotechnology, Preparation and standardization of MS medium Sterilization methods - Dry heat, moist heat, fumigation and filter, selection of explants and their significances.

Unit 2- Micropropagation: (12Hrs).

Techniques and stages of micropropagation, Advantages and disadvantages of micropropagation, Cellular Totipotency, Differentiation of cells in callus, Types of cultures: meristem, node and embryo, (mature and immature). Agrobacterium mediated gene transfer (brief) and applications and particle bombardment.

Unit 3 -Recombinant DNA & Vectors: (12 Hrs).

Creation of recombinant DNA, Restriction endonuclease enzyme and its types, Ligases enzyme. Vectors – necessary properties of a vector, Construction and specific uses of plasmid, phage, cosmid, and artificial chromosomes.

Unit 4- Cloning, Transformation and Expression: (12 Hrs).

Procedure of gene cloning- Isolation and purification of vector and the DNA. Introduction of recombinant DNA into host cell – preparation of competent host cells. Selectable markers and reporter genes. Genetically Modified (GM) Crops: Insect resistance (Bt-cotton), herbicide tolerance, abiotic stress tolerance (drought/salt), and nutritional enhancement (Golden Rice).

Unit 5- Applications of biotechnology and genetic engineering (12 Hrs).

In agriculture, medicine and biodiversity conservation. Advanced tools and techniques: Construction of genomic library and cDNA library; PCR - Procedure and its applications; Blotting techniques: procedure and applications of southern, northern and western, Microarray (gene chip) technology. ELISA types- Procedure and applications. Potential impact of GMOs.

Reference Books:

1. Genetic Engineering & Biotechnology (2023) by Dr. Madhushri Das Datta et al..
2. Plant Tissue Culture: Principles, Tools, and Techniques (2024) - Ramrao Sinkar & Mahendra Rai.
3. Molecular Biology and Genetic Engineering (4th Reprint 2019) by Prof. P.K. Gupta.
4. Susan R. Barnum (1998). Biotechnology: an introduction. Thomson Brooks/cole.
5. James D. Watson, Amy A. Caudy, Richard M. Myers, Jan A. Witkowski (2007). Recombinant DNA (III Edn). W H Freeman.
6. S. B. Primrose, R. M. Twyman (2006). Principles of gene manipulation and genomics (VII Edn). Blackwell publishing. 5. Robert J Brooker (2009). Genetics: Analysis & principles (III Edn.). McGraw