Elective Courses

Semester in which the course will be offered: VIIth Semester

Course Title: Biotechnology for Crop Improvement

Course Credits: 4 (3+1)

Objectives

1. To acquaint with biotechnological tools of crop improvement
2. To know about direct and indirect methods of gene transfer
3. To introduce about gene editing in plants
4. To provide knowledge about marker assisted breeding and genomic selection

Theory

Impact of Biotechnology on crop improvement and the perspective of society; Difference between Prokaryotic and Eukaryotic genome, various biotechnological techniques available for crop improvement:

Plant Tissue Culture technique: Crop improvement using Somaclonal variation, anther/pollen culture and Somatic cell hybridization,

Recombinant DNA technology& GM Crops: Details of rDNA technique, Direct and Indirect methods of gene transfer in plants; Creation and evaluation of GM crops, Biosafety regulations and their application in Agricultural Biotechnology.

Genome editing: Various tools of genome editing; CRISPR-Cas9 with specific emphasis on Indian regulations.

Gene silencing techniques: Introduction to siRNA and Micro RNA technology

Marker Assisted Breeding and Genomic Selection: Introduction to various DNA-based markers and their use in marker-assisted breeding; Foreground Selection, Recombinant Selection and background Selection; Marker-assisted backcross breeding, marker-assisted selection – success stories; Introduction to Genomic Selection.

Various Molecular techniques: DNA Extraction, Quality and quantity of isolated DNA, Electrophoresis, PCR and its variants, DNA sequencing technologies.

Introduction to bioinformatics, genomics and proteomics: Concepts of different *omics* techniques, introduction to bioinformatics, Databases and types; DNA sequence analysis, Protein Sequence analysis, Molecular Phyolgenetics

Practical

Extraction of Plant genomic DNA; Extraction of Vector DNA, Digestion of Vector and Insert, Preparation rDNA molecule, Preparation of Competent Cell, *E. coli.* Transformation, Antibiotic based selection of putative transformants, validation using PCR; Cell Culture, Agarose gel Electrophoresis, SDA-PAGE, Analysis of Primer Characteristics, DNA marker based diversity analysis. Planning of a MABB programme – selection of parents, crossing strategies