6th Semester

BRANCH	Subject Title	Subject Code
B.Sc. (Botany-Major)	Cytology, Plant Breeding and Biotechnology	BOM1-161

Course Objective:- To impart theoretical knowledge and practical skills about plant breeding objectives, modes of reproduction and genetic consequences, breeding methods for crop improvement. To give the details of plant cells and its functions. To provide the basics of agrobacterium and applications of biotechnology. To provide the need of gene transfer and cloning strategy to develop transgenic plants.

Course Learning outcomes (CLO),
After completion of the course student will be able to learn -

1. Learn the basic principles of cytology, plant breeding, and biotechnology
2. Acquire the applicability of Biotechnology in relation to the welfare of society
3. Explain the importance of plant breeding
4. Differentiate between cell division types

CONCEPT

Unit – 1

1. Cytology

1.1 Definition and Scope
1.2 The cell theory
1.3 Structure of prokaryotic and Eukaryotic cell.

2. Cell Envelops-

2.1 Cell membrane: composition, models and function.
2.2 Plant cell wall structure and function.

Unit - 2

1. Cell organelles Structure and Function:

1.1 Endoplasmic reticulum, Golgi body.
1.2 Mitochondria, Plastids- types and Chloroplast.
1.3 Nucleus- nuclear membrane, nucleoplasm, nuclear pore, nucleolus, chromatin material,
1.4 Lysosomes, peroxisomes, vacuole,
1.5 Cytoskeleton - microtubules and macro filaments,
1.6 Ergastic substance (such as starch grains, crystals, gums, resins and other compounds).

Unit – 3

1.Chromosomal organation:

1.1 Structure, types and functions
1.2 Ultrastructure of chromosomes
1.3 karyotype and Idiograms
1.4 Nucleosome model.
1.5 special types of chromosomes.

2. Variations in chromosome structure:

2.1 Structural change-deletion, duplication translocation and inversion.

2.2 Variation in chromosome number- euploidy, aneuploidy.

3 Cell cycle and Cell division- Mitosis and Meiosis.

Unit - 4

1. Plant Breeding-

1.1 Introduction and goals.

1.2 Principles and techniques: classical (conventional) - hybridization.

1.3 Hybrid vigor and heterosis.

1.4 Modern techniques- production of genetic variation, technique at plant level, cell /tissue level, at DNA level.

1.5 Significance and limitations of plant breeding.

2. Plant Breeding programs in India-Rice, Wheat, Sugarcane and Cotton.

2.1 Important National and International Institutes

Unit - 5

1. Biotechnology:

1.1 History, definition, and scope

1.2 Basic aspects of plant tissue culture and Totipotency.

1.3 Important achievements in crop biotechnology.

2. Genetic Engineering:

1.1 Tools and techniques of Recombinant DNA technology.

1.2 Types of cloning vectors.

1.3 Biology of Agrobacterium, vector for gene delivery and marker gene.

1.4 Genomic and cDNA library.

1.5 PCR and DNA Fingerprinting.

Practicals

1. Study of Plant cells by slide preparation (e.g. Onion leaf or Hy in leaf etc.)
2. Electron micrograph study: Prokaryotic cell (Bacteria), art cell, Cyanobacteria and Virus
3. Study of different cell organelles by specimen/ diagram and micrograph.
4. Study of different types of plastids
5. Study of Mitosis in the onion root tip.
6. Study of Meiosis in anthers.
7. Study of different models of Cell Membrane through charts/ diagram
8. Demonstration of the special chromosome of the Salivary gland/ Polytene and - Lamp brush chromosome through diagrams/ photographs.
9. Isolation of DNA from banana or onion
10. Perform the technique of Hybridization in a self-pollinated plant through selection, bagging, tagging up to pollination, and crossing.
11. Demonstration of different equipment used for plant tissue culture technique
12. Sterilization of explants in PTC
13. Preparation of Nutrient Medium for tissue culture experiment
14. Demonstration of PCR through Models/charts.
15. Study of Cloning Vectors through Models/charts/Diagrams.
16. Study of Instruments used in Plant Tissue culture Lab