

B. Sc. III – Semester VI

ELECTIVE

BTT- 601: PLANT AND ANIMAL BIOTECHNOLOGY

UNIT I:

Cell and tissue culture: Introduction to cell and Tissue culture Laboratory facilities Tissue culture media (composition and preparation) Callus and suspension cultures: initiation and maintenance of callus and suspension cultures; single cell clones.

UNIT II:

Tissue and micropropagation, regeneration, production of haploids, protoplast culture and somatic hybridization. Cloning in plants - Ti plasmid organization. Concept of transgenic plants Bt cotton and other plant applications.

UNIT III:

Various techniques of animal cell and tissue culture: Culture media, growth factors, laboratory facilities.

Characteristics of cells in culture: Contact inhibition, anchorage dependence, cell-cell communication etc.; Cell senescence; cell and tissue response to trophic factors. Primary culture, immortal cells, cell lines. d) Maintenance of cell lines in the laboratory.

UNIT IV:

rDNA products: Brief idea about recombinant DNA products in medicine (insulin, somatostatin, vaccines), Concept of Gene therapy, Production of recombinant vaccines – hepatitis. Concept of transgenic animals

In vitro fertilization and embryo transfer in humans and farm animals.

UNIT V:

IPR: Intellectual property rights. Protection of Copy rights. Patents and their significance. Management studies: society and ethical aspects of Biotechnology.

PRACTICALS: BTP- 602 PLANT AND ANIMAL

BIOTECHNOLOGY

1. Establishing a plant cell culture (both in solid and liquid media) – seed germination, callus culture, suspension cell culture, regeneration from callus cells.
2. Suspension culture.
3. Cell count by hemocytometer.
4. Cytology of callus.
5. Establishing primary cell culture of chicken embryo fibroblasts.
6. Animal tissue culture – maintenance of established cell lines.
7. Animal tissue culture – virus cultivation.
8. Measurement of cell size.
9. Microphotography.
10. IMViC test.
11. Determination of seed viability.

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CLUSTER ELECTIVE - 1

BTT: 603- ENVIRONMENTAL BIOTECHNOLOGY (theory)

Unit I:

Principles of Ecology, Water and terrestrial ecosystems, Bio-geo chemical cycles - Carbon, Nitrogen cycles. Role of microbes in bio-geochemical cycles.

Unit II:

Inorganic and Organic pollutants of air, land and water; maintenance of standards, Environmental monitoring. Detection, treatment and prevention of pollution. Biological indicators

Unit III:

Biocides, Four stage alternatives, Refuse disposal - Treatment methods, effluent from pharmaceuticals, fertilizers, pulp and paper industry.

Unit IV:

Waste water management - Aerobic and anaerobic treatment, primary, secondary and tertiary treatment of municipal wastes, Solid waste management.

Unit V:

Bioremediation, Biodegradation of recalcitrant compounds and the role of genetically engineered microbes and genetically modified organisms in the environmental management.

PRACTICALS BTP:604- ENVIRONMENTAL BIOTECHNOLOGY

1. Detection of coliforms for determination of the purity of potable water.
2. Determination of total dissolved solids of water
3. Determination of Hardness and alkalinity of water sample.
4. Determination of dissolved oxygen concentration of water sample
5. Determination of biological oxygen demand of sewage sample
6. Determination of chemical oxygen demand (COD) of sewage sample.
7. Isolation of xenobiotic degrading bacteria by selective enrichment technique
8. Estimation of heavy metals in water/soil
9. Estimation of nitrate in drinking water.
10. Preparation and formulation of microbial biopesticide (bacteria, fungi and viruses)
11. In vitro evaluation of medicinal plants against pathogenic microbes.
12. Effect of mycorrhizal fungi on growth promotion of plants.
13. Production of microbial fertilizers (Rhizobium, Azotobacter and AMF).

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CLUSTER ELECTIVE - 2

BTT: 605 Industrial Biotechnology (theory)

Unit I:

Isolation, Screening, Preservation and Improvement of Industrially Important Microorganisms. Synthetic and Natural Medium, Precursors, Antifoams, Sterilization Methods and Inoculum Preparation.

Unit II:

Definition of bioreactor, basic principles of bioreactor. Classification of bioreactors. Analysis of batch, continuous, fed batch and semi-continuous bioreactors.

Unit III:

Ethanol Production by Fermentation using Molasses, Starchy Substances. Production of Alcoholic Beverages like Beer and Wine. Production of Citric Acid by Submerged and Solid State Fermentations.

Unit IV:

Sources of Industrial Enzymes, Production of Microbial Enzymes like Amylase and protease. Backer's Yeast and SCP Production. Production of Antibiotics : Penicillin .

Unit V:

Biotechnology Products- Production of recombinant proteins having therapeutic and diagnostic applications(Insulin, Growth Hormone, Recombinant vaccines, Monoclonal Antibody).

PRACTICALS BTP: 606 Industrial Biotechnology (Lab)

1. Isolation of industrially important microorganisms from soil.
2. Isolation of amylase producing organisms from soil.
3. Production of α – amylase from *Bacillus Spp.* by shake flask culture.
4. Production of alcohol or wine using different substrates.
5. Estimation of alcohol by titrimetry.
6. Estimation of alcohol by calorimetric method .
7. Production of citric acid.
8. Citric acid production by submerged fermentation.
9. Estimation of citric acid by titrimetry.

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CLUSTER ELECTIVE - 3

BTT- 607: GENETICS (Theory)

UNIT I

Mendels Laws and Inheritance: Mendel experiments, Mendel Laws and deviations: incomplete dominance and Co dominance Penetration and pleiotropism, Recessive and Dominant epistatic gene interactions. Concept of multiple alleles

UNIT II

Genes and their variations: Structure of gene, gene and environment, gene copies of prokaryotic and Eukaryotic chromosomes. Eukaryotic chromosome organization, histone proteins.

Unit III:

Gene mutations: Mutagenesis - Spontaneous and induced (Chemical and physical) mutations; Natural and induction of mutations, point mutations, frameshift mutations, auxotrophic conditional and suppressor mutations.

UNIT IV:

DNA Damage and DNA Repair: Light induced repair, Excision repair and mismatch repair, Post replication repair, Rec gene and its role in DNA repair, SOS repair and SOS response

Unit V:

Transposable elements: Structure and Molecular basis of AC-DS transposition in maize, “P” element of Drosophila and hybrid dysgenesis, Yeast “T₇” elements, Retroposans

PRACTICALS BTP 608: GENETICS (Lab)

- 1.** Study of different phases of mitosis in onion root tips and meiosis in *Allium cepa* flower buds.
- 2.** Karyotyping in *Allium* or *Drosophila*.
- 3.** Determination of multiple allele frequencies of leaf scars in *Trifolium*.
- 4.** Problems and assignments in Mendelian genetics.
- 5.** Determination of linkage and calculation of recombination frequencies (maize/
Drosophila).
- 6.** Induction of chromosomal aberrations by chemical mutagenesis in *Allium* (or any plant).
- 7.** Isolation of auxotrophic mutants (plants or insects).
- 8.** Repair of DNA by Photo activation of Photolyase in bacteria.
- 9.** Mutation of bacteria by UV.
- 10.** Chemical induced mutation in bacteria