

BOTANY

B. Sc. III (Semester V) THEORY

Plant Physiology and Ecology

UNIT I: Plant Water Relations

- 1.1 Importance of water to plant life. Imbibition , Diffusion, Osmosis, Plasmolysis.
- 1.2 Active and passive Absorption of water.
- 1.3 Ascent of sap - Root Pressure and Transpiration Pull Theory.
- 1.4 Transpiration - Types of transpiration, Stomatal movements, Mechanism of transpiration (Starch) sugar hypothesis), Significance. Antitranspirant, Guttation.
- 1.5 Mineral uptake - Active uptake - Carrier Concept, Passive up take – Ion Exchange.

UNIT II: Metabolism

- 2.1 Photosynthesis - Introduction, Role of Light, Photosynthetic Apparatus and Pigments, Two Pigment Systems, Photophosphorylation, C3 and C4 cycle, CAM Pathway.
- 2.2 Respiration - Introduction, Mitochondria as a Respiratory centre, Types of Respiration - Aerobic and Anaerobic, Mechanism of aerobic respiration- Glycolysis, Krebs cycle, Electron transport system and Chemiosmotic ATP generation, Respiratory Quotient.

UNIT III: Metabolism and growth

- 3.1 Nitrogen Metabolism- Sources of nitrogen, Symbiotic nitrogen fixation, Role of Nitrate reductase.
- 3.2 Growth - Phases of growth, Growth curve, Physiological role of growth hormones (Auxins, Gibberellins, Cytokinins, Abscisic acid, and Ethylene).
- 3.3 Physiology of Senescence and Abscission.

UNIT IV: Plant responses

- 4.1 Photoperiodism - Concept of Florigen, Role of Phytochrome,
- 4.2 Vernalization- Concept and Significance.
- 4.3 Plant movement- Tropic (Phototropic and Geotropic) and Nastic (Epinasty, Hyponasty and Seismonasty)
- 4.4 Stress physiology- Concept, Types of stress, Water and Salinity stress.

UNIT V: Ecology and Environment

- 5.1 Concept of environment, Concept and scope of ecology.
- 5.2 Ecological factors- Climatic- Light, Temperature and Water.
- 5.3 Atmosphere and its composition.
- 5.4 Edaphic factor- Process of soil formation, soil profile, soil biota and their role.
- 5.5 Ecological Adaptations - Morphological and Anatomical adaptation in Hydrophytes, and Xerophytes.

UNIT VI: Ecosystem

- 6.1 Population Ecology- Natality and Mortality, Community characteristics – Frequency, Density and Abundance
- 6.2 Ecological Succession - Hydrosere and Xerosere
- 6.3 Ecosystem – Definition, Structure and Function, Food chain, Food web, Energy flow model (Single channel model)
- 6.4 Types of Ecosystem- Pond ecosystem, Desert ecosystem

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PRACTICAL

LABORATORY EXERCISE :

Plant Physiology: Major experiment (Any Seven)

1. To study the effect of temperature and organic solvent on permeability of plasma membrane.
2. To study osmotic pressure of cell sap by plasmolytic method.
3. To determine water potential of plant tissue.
4. To determine the path of water (ascent of sap)
5. To determine the rate of transpiration by Ganongs photometer.
6. To determine rate of photosynthesis under varying quality of light and CO₂ concentration.
7. To study the rate of photosynthesis in terrestrial plants with the help of Ganongs Photosynthometer.
8. Separation of chloroplast pigments by paper chromatography/solvent extraction method.
9. Separation of amino acids by paper chromatography method.
10. To determine R.Q. using different substrates.
11. To determine the rate of respiration by Ganongs respirometer.
12. To study antagonism of salts.
13. To study phenomenon of adsorption.
14. To study effect of IAA and Gibberellins on seed germination.
15. Test for secondary metabolites- Alkaloid, Phenolics, Tannin, Flavonoids and Lignin
16. To study Endo and Exo-osmosis by egg membrane osmoscope

Plant Physiology: Minor experiment- (Any Three)

1. To demonstrate fermentation.
2. To demonstrate exo and endosmosis
3. To demonstrate transpiration by Bell jar.
4. To demonstrate light is necessary for photosynthesis
5. To demonstrate anaerobic respiration in germinating seeds.
6. To demonstrate the evolution of CO₂ in respiration.

7. To demonstrate the phenomenon of nastic movement with help of *Mimosa pudica* / or *Biophytum sensitivum*.

Ecology: Major experiment (Any Three)

1. Study of morphological and anatomical adaptations in hydrophytes – *Hydrilla*, *Eichhornia*, *Typha*, *Vallisneria* and *Nymphaea* (any two)
2. Study of morphological and anatomical adaptations in xerophytes -*Asparagus*, *Nerium*, *Casuarina*, *Euphorbia*, *Cycas*, *Opuntia* (any two)
3. Study of community characteristics by quadrat method.
4. Determination of water holding capacity of different soils.
5. To determine the texture of different soils by sieve method.

Ecology: Minor experiment (Any Two)

1. To determine the porosity of soil.
2. To determine the transparency and temperature of water bodies.
3. Estimation of salinity of different water samples
4. Determination of pH of different soils and water samples by pH papers/ pH meter.
5. Study of meteorological instruments -Rain gauge, Hygrometer, Barometer

B. Sc. III (Semester VI)
THEORY

Molecular Biology and Biotechnology

UNIT I: DNA the genetic material

- 1.1 Historical account – Giffith's Expt, Hershy and Chase Expt.
- 1.2 DNA– Chemical composition and Double Helical model,
- 1.3 DNA replication in Eukaryotes;
- 1.4 DNA Packaging - Nucleosome and Solenoid
- 1.5 Satellite, Repetitive DNA and Transposable element in plants (AC-DS system)

UNIT II: Gene Structure and Expression

- 2.1 Concept of gene, Fine structure of Gene
- 2.2 Gene Expression – Central Dogma, Types of RNA, Genetic code, Ribosome as a translation machine
- 2.3 Transcription in Eukaryotes – Mechanism of Transcription and RNA Processing
- 2.4 Translation in Eukaryotes.
- 2.5 Endomembrane system (Flow of Peptide)

UNIT III: Regulation of Gene Expression

- 3.1 Regulation of Gene Expression in Prokaryotes – Operon concept with special reference to Lac Operon
- 3.2 Regulation of gene expression of Eukaryotes – Britton Davidson Model
- 3.3 Protein Folding Mechanism and Structure (Primary, Secondary, Tertiary and Quaternary)
- 3.4 Protein Sorting – Targeting to proteins to organelles
- 3.5 Protein Trafficking

UNIT IV: Genetic Engineering

- 4.1 Tools and techniques of recombinant DNA technology
- 4.2 Restriction Enzymes – Nomenclature and Types
- 4.3 Cloning vectors – Plasmids, Phages, Cosmids
- 4.4 Gene Source- Genomic and c-DNA library
- 4.5 Gene Transfer Techniques: Direct (1) Chemical method, (2) Electroporation, (3) Gene gun method; Indirect – Agrobacterium mediated gene transfer
- 4.6 Gene Amplification - _Polymerase Chain Reaction (PCR)

UNIT V: Plant Tissue Culture

- 5.1 Basic aspects of plant tissue culture
- 5.2 Laboratory Requirement – Infrastructure, Instruments (laminar air flow, autoclave, growth chamber), Culture Media (MS Media), Growth Hormone (Auxin, Cytokinin and Gibberellins) Sterilization Techniques.

5.3 Tissue Culture Technique - Cellular totipotency, differentiation and morphogenesis; Callus Culture; Micro propagation

UNIT VI: Applications of Biotechnology

6.1 Agriculture – Haploid plant production (Anther and Pollen Culture); Protoplast Culture and Somatic Hybridization; Transgenic Plant - BT Cotton, Synthetic seed. Salient achievements of crop biotechnology

6.2 Industry – Fermentation Technology- Bakery Products and Alcohol Productions.

6.3 Health Care – Edible Vaccines

6.4 Conservation – Cryopreservation, Genetically Modified Organisms: - Pros and Cons

B.Sc. III (Semester VI)

PRACTICAL

LABORATORY EXERCISE

1) Molecular biology (Major) (Any One)

1. Isolation of DNA by crude method
2. Estimation of DNA by Diphenylamine method
3. Estimation of RNA by Orcinol method

2) Molecular biology (Minor) (Any One)

1. Demonstration of DNA Electrophoresis,
2. Demonstration of double helical model of DNA
3. Demonstration of AC-DS System in Maize kernel
4. Demonstration of Centrifugation

3) Biotechnology (Any Six)

1. Working Principle and application of Autoclave
2. Working Principle and application of Laminar Air Flow
3. Cleaning and Sterilization of Glassware
4. Sterilization of Explant
5. Inoculation of Explant
6. Demonstration of in vitro culture techniques – anther and
 1. pollen culture
7. Isolation of Protoplast by Mechanical Method
8. Isolation of Protoplast by Enzymatic Method
9. Demonstration of technique of Micropropagation
10. Preparation of Artificial Seed
11. Demonstration of hardening of tissue culture plant
12. Preparation of Tissue culture media
13. Pollen viability test.

Note: Visit to molecular biology, biotechnological research institute/industry