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Core course 7 Code: BO5CRT07

PLANT PHYSIOLOGY AND BIOCHEMISTRY

(Theory 54 hrs; Practical 45 hrs; Credits 3 + 1)

Objectives:

- Acquire basic knowledge needed for proper understanding of plant functioning.
- Familiarize with the basic skills and techniques related to plant physiology.
- Understand the role, structure and importance of the bio molecules associated with plant life.

PLANT PHYSIOLOGY (Theory 36 hrs; Practical 27 hrs)

Module 1: Water relations (6 hrs)

Plant water relations - diffusion, imbibition, osmosis, OP, DPD, TP; water potential - concepts and components (pressure potential, gravity potential, osmotic potential and matric potential). Absorption of water - active and passive, pathway of water movement - apoplastic and symplastic pathway. Ascent of sap - cohesion-tension theory. Transpiration - types, mechanism, theories (Starch-sugar, Proton-K+ ion exchange), significance; antitranspirants. Guttation.

Module 2: Mineral nutrition (3 hrs)

Role of major and minor elements in plant nutrition, deficiency symptoms of essential nutrients; mineral uptake - passive (ion exchange) and active (carrier concept).

Module 3: Photosynthesis (12 hrs)

Photosynthetic pigments, photo excitation - fluorescence, phosphorescence; red drop and Emerson enhancement effect. Photosystems - components and organization; cyclic and non-cyclic photophosphorylation; carbon assimilation pathways - C3, C4 plants - kranz anatomy, CAM. Photorespiration. Factors affecting photosynthesis - Blackmann's law of limiting factors.

Translocation of solutes: pathway of phloem transport, mechanism - pressure flow, mass flow hypothesis; phloem loading and unloading.

Module 4: Respiration (8 hrs)

Respiration: anaerobic and aerobic; glycolysis, Kreb's cycle, mitochondrial electron transport system - components, oxidative phosphorylation, ATPase, chemiosmotic hypothesis. RQ - significance. Factors affecting respiration.

Module 5: Plant growth and development (5 hrs)

Plant hormones: their physiological effect and practical applications - auxins, gibberellins, cytokinins, ABA, and ethylene. Plant movements: tropic movements - geotropism and phototropism; nastic movements - seismonastic and nyctinastic movements. Physiology of flowering - phytochrome, photoperiodism, vernalization.

Module 6: Stress physiology (2 hrs)

Concepts of plant responses to abiotic stresses (water, salt, temperature), biotic stress (pathogens). Allelopathy.

PRACTICAL (27 hrs)

Core Experiments (any four compulsory):

1. Determination of osmotic pressure of plant cell sap by plasmolytic/weighing method.
2. Compare the stomatal indices of hydrophytes, xerophytes and mesophytes (any two).
3. Separation of plant pigments by TLC/Paper chromatography.
4. Measurement of photosynthesis by Wilmott's bubbler/any suitable method.
5. Estimation of plant pigments by colorimeter.

Demonstration experiments:

1. Papaya petiole osmoscope.
2. Demonstration of tissue tension.
3. Relation between transpiration and absorption.
4. Necessity of chlorophyll, light and CO_2 in phytosynthesis.
5. Simple respiroscope.
6. Respirometer and measurement of RQ.
7. Fermentation.
8. Measurement of transpiration rate using Ganong's potometer/Farmer's potometer.

BIOCHEMISTRY (Theory 18 hrs; Practical 18 hrs)

Module 4: Water (3 hrs)

Physical and chemical properties of water, acids and bases; pH - definition, significance; measurement of pH – colorimetric, electrometric (brief study only). Buffers: buffer action, uses of buffers.

Module 5: Carbohydrates (3 hrs)

General structure and functions; classification - mono (glucose and fructose), di (maltose and sucrose) and polysaccharides (starch and cellulose).

Module 6: Proteins (4 hrs)

General structure and classification of amino acids - peptide bond; structural levels of proteins - primary, secondary, tertiary and quaternary; functions of proteins.

Module 7: Lipids (2 hrs)

General features and roles of lipids, types of lipids; fatty acids - saturated and unsaturated; fatty acid derivatives - fats and oils; compound lipids (brief study only).

Module 8: Enzymes (6 hrs)

Classification and nomenclature, mechanism of action. Enzyme kinetics, Michaelis-Menten constant (brief study only). Regulation of enzyme action. Factors affecting enzyme action.

PRACTICAL (18 hrs)

1. General test for carbohydrates - Molischs test, Benedicts's tests, Fehling's test.
2. Colour test for starch - Iodine test.
3. Colour tests for proteins in solution – Xanthoproteic test, Biuret test, Million's test, Ninhydrin test.

4. Action of various enzymes in plant tissues: peroxidase, dehydrogenase.
5. Quantitative estimation of protein using colorimeter.

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Core course 8 Code: BO5CRT08
ENVIRONMENTAL SCIENCE AND HUMAN RIGHTS
(Theory 54 hrs; Practical 36 hrs; Credits 3 + 1)

Objectives:

- Acquaint the student with the significance of Environmental Science.
- Make the students aware about the extent of the total biodiversity and the importance of their conservation.
- Help the student to design novel mechanisms for the sustainable utilization of natural resources.
- Enable the students to understand the structure and function of the ecosystems.
- Enable the students to understand various kinds of pollution in the environment, their impacts on the ecosystem and their control measures
- Make the students aware about various environmental laws in India and the role of various movements in the protection of nature and natural resources.

ENVIRONMENTAL SCIENCE (48 hrs)

Module 1: Introduction to ecology (8 hrs)

Ecology: introduction, definition, scope and relevance; sub-divisions of ecology - autecology, synecology and ecosystem ecology**.**

Population: population size, density, natality, mortality, age, rate of natural increase, growth form and carrying capacity, population interactions between species - competition, parasitism, predation, commensalism, protocooperation, mutualism, neutralism.

Community: community concept, biotic community, species diversity, species richness, dominance; growth forms and structure, trophic structure, ecotone, edge effect, habitat, ecological niche, micro-climate, ecological indicators, keystone species**.**