

Dr. YSR Government Degree College, Vedurukuppam

SYLLABUS

IV Semester/ Botany Core Course – 4

TITLE: Plant Physiology and Metabolism

(Total hours of teaching – 60 @ 04 Hrs./Week)

Unit – 1: Plant-Water relations 10 Hrs.

1. Importance of water to plant life, physical properties of water, diffusion, imbibition, osmosis. water potential, osmotic potential, pressure potential.
2. Absorption and lateral transport of water; Ascent of sap
3. Transpiration: stomata structure and mechanism of stomatal movements (K^+ ion flux).
4. Mechanism of phloem transport; source-sink relationships.

Unit – 2: Mineral nutrition, Enzymes and Respiration 14 Hrs.

1. Essential macro and micro mineral nutrients and their role in plants; symptoms of mineral deficiency
2. Absorption of mineral ions; passive and active processes.
3. Characteristics, nomenclature and classification of Enzymes. Mechanism of enzyme action, enzyme kinetics.
4. Respiration: Aerobic and Anaerobic; Glycolysis, Krebs cycle; electron transport system, mechanism of oxidative phosphorylation, Pentose Phosphate Pathway (HMP shunt).

Unit – 3: Photosynthesis and Photorespiration 12 Hrs.

1. Photosynthesis: Photosynthetic pigments, absorption and action spectra; Red drop and Emerson enhancement effect
2. Concept of two photosystems; mechanism of photosynthetic electron transport and evolution of oxygen; photophosphorylation
3. Carbon assimilation pathways (C_3 , C_4 and CAM);
4. Photorespiration - C_2 pathway

Unit – 4: Nitrogen and lipid metabolism 12 Hrs.

1. Nitrogen metabolism: Biological nitrogen fixation – asymbiotic and symbiotic nitrogen fixing organisms. Nitrogenase enzyme system.
2. Lipid metabolism: Classification of Plant lipids, saturated and unsaturated fatty acids.
3. Anabolism of triglycerides, β -oxidation of fatty acids, Glyoxylate cycle.

Unit – 5: Plant growth - development and stress physiology 12 Hrs.

1. Growth and Development: Definition, phases and kinetics of growth.
2. Physiological effects of Plant Growth Regulators (PGRs) - auxins, gibberellins, cytokinins, ABA, ethylene and brassinosteroids.
3. Physiology of flowering: Photoperiodism, role of phytochrome in flowering.
4. Seed germination and senescence; physiological changes.

Practical Syllabus

1. Determination of osmotic potential of plant cell sap by plasmolytic method using *Rhoeo/ Tradescantia* leaves.
2. Calculation of stomatal index and stomatal frequency of a mesophyte and a xerophyte.
3. Determination of rate of transpiration using Cobalt chloride method / Ganong's potometer (at least for a dicot and a monocot).
4. Effect of Temperature on membrane permeability by colorimetric method.

5. Study of mineral deficiency symptoms using plant material/photographs.
6. Demonstration of amylase enzyme activity and study the effect of substrate and Enzymeconcentration.
7. Separation of chloroplast pigments using paper chromatography technique.
8. Demonstration of Polyphenol oxidase enzyme activity (Potato tuber or Apple fruit)
9. Anatomy of C3, C4 and CAM leaves
10. Estimation of protein by biuret method/Lowry method
11. Minor experiments – Osmosis, Arc-auxonometer, ascent of sap through xylem, cytoplasmic streaming.

Botany Core Course –5

PAPER: Cell Biology, Genetics and Plant Breeding

(Total hours of teaching – 60 @ 04 Hrs./Week)

Unit – 1: The Cell 12 Hrs.

1. Cell theory; prokaryotic vs eukaryotic cell; animal vs plant cell; a brief account On ultra-structure of a plant cell.
2. Ultra-structure of cell wall.
3. Ultra-structure of plasma membrane and various theories on its organization.
4. Polymorphic cell organelles (Plastids); ultra structure of chloroplast. Plastid DNA.

Unit – 2: Chromosomes 12 Hrs.

1. Prokaryotic vs eukaryotic chromosome. Morphology of a eukaryotic chromosome.
2. Euchromatin and Heterochromatin; Karyotype and ideogram.
3. Brief account of chromosomal aberrations - structural and numerical changes
4. Organization of DNA in a chromosome (solenoid and nucleosome models).

Unit – 3: Mendelian and Non-Mendelian genetics 14Hrs.

1. Mendel's laws of inheritance. Incomplete dominance and co-dominance; Multiple allelism.
2. Complementary, supplementary and duplicate gene interactions (plant based examples are to be dealt).
3. A brief account of linkage and crossing over; Chromosomal mapping - 2 point and 3 point test cross.
4. Concept of maternal inheritance (Corren's experiment on *Mirabilis jalapa*); Mitochondrial DNA.

Unit – 4: Structure and functions of DNA 12 Hrs.

1. Watson and Crick model of DNA. Brief account on DNA Replication (Semi conservative method).
2. Brief account on Transcription, types and functions of RNA. Gene concept and genetic code and Translation.
3. Regulation of gene expression in prokaryotes - Lac Operon.

Unit – 5: Plant Breeding 12 Hrs.

1. Plant Breeding and its scope; Genetic basis for plant breeding. Plant Introduction and acclimatization.
2. Definition, procedure; applications and uses; advantages and limitations of : (a) Mass selection, (b) Pure line selection and (c) Clonal selection.
3. Hybridization – schemes, and technique; Heterosis (hybrid vigour).
4. A brief account on Molecular breeding – DNA markers in plant breeding. RAPD, RFLP.

Practical Syllabus:

1. Study of ultra structure of plant cell and its organelles using Electron microscopic Photographs/models.
2. Demonstration of Mitosis in *Allium cepa*/*Aloe vera* roots using squash technique; observation of various stages of mitosis in permanent slides.
4. Demonstration of Meiosis in P.M.C.s of *Allium cepa* flower buds using squash technique; observation of various stages of meiosis in permanent slides.
4. Study of structure of DNA and RNA molecules using models.
5. Solving problems monohybrid, dihybrid, back and test crosses.
6. Solving problems on gene interactions (atleast one problem for each of the gene interactions in the syllabus).

7. Chromosome mapping using 3- point test cross data.
8. Demonstration of emasculation, bagging, artificial pollination techniques for hybridization.