



MCC Department of Botany

Paper 9a PLANT PHYSIOLOGY AND BIOCHEMISTRY

M.Sc. va (Candidates admitted from academic year 2008-2009)

Core Theory

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Plant Physiology

UNIT I

Transport Phenomena: Properties of water. Water relations in plants. Mechanism of absorption of water - active and passive transport - Apoplast and Symplast concept. Transpiration - structure of stomata and regulation of stomatal movements. Mineral absorption and nutrition. Phloem transport & translocation - Phloem loading, Short-distance, Long-distance transport and Grain-filling in cereals.

Key words: Water potential, Plasmolysis, Osmosis, Aquaporins, Cohesion-adhesion theory, Stomatal index, Antitranspirants, P-protein.

UNIT II

Regulation of Plant Growth: Growth dynamics. Parameters of growth measurements in plants. Control of vegetative and reproductive growth. Role of Plant Growth Regulators in plant growth. Application of Plant Growth Regulators in agriculture for crop production.

Key words: Bioassay, Biosynthesis, Phototropism, Gravitropism, Bolting, Fruit ripening, Parthenocarpy, Antiauxin, Antigibberellin, Brassins, Methyl Jasmonate, Tricentanol, Morphactins.

UNIT III

Ecophysiology: Plant Morphogenesis. Phytochrome and Photoperiodism. Florigen theory-Chailakhyan concept. Floral initiation, induction- causative factors, role of photoperiod, temperature, hydroperiodic stimulus. *Arabidopsis thaliana* - a case study. Genetic regulation of flowering. Physiology of seed dormancy. Mechanism of seed germination.

Plant responses to cold stress and high temperature-dehydration.
Plant responses to other abiotic stress- salinity.

Key words : Long-day plant, Short-day plant, Day-neutral plant, Phytochrome, Crytochrome, and Vernalization.

Biochemistry

UNIT IV

Biomolecules – Classification, structure, function and properties of primary metabolites -Carbohydrates, Amino acids and Proteins. Secondary metabolites - alkaloids, terpenoids, phenolics and flavonoids.

Plant Membranes. Ultrastructure and function, transport across membrane. Membrane and ATP synthesis. Hormone receptors and cellular communication.

Key words: Reducing sugars and Non-reducing sugars, Isomerism, Enantiomer, Zwitterion, β -oxidation, Schikmic Acid Pathway, Fluid Mosaic Model, Plasmodesmata, Membrane lipids, Calmodulin.

UNIT V

Enzymes - Classification, structure, reaction kinetics, inhibition and regulation of enzyme activity. Interpretation of enzyme kinetics using Michaelis-Menten plots.

Key words: Activation energy, Coenzymes, Isoenzymes, Holoenzyme, Allosteric enzyme, Competitive inhibition, Non-Competitive inhibition, Feed back inhibition, Michaelis constant.

UNIT VI

Photosynthesis: History and evolutionary importance of photosynthesis. Nature of light and its absorption by plant pigments. Chlorophyll-a fluorescence. Molecular structure of chloroplast proteins. Organization of pigments and proteins in membranes. Photosystems I and II. Light reaction, electron flow, ATP production in functional model of chloroplast membrane. and generation of NADPH. Pathways of carbon fixation C_3 , C_4 , C_4 Subtypes-NADP-ME, NAD-ME & PEP-CK and CAM. Photorespiration. Quantum yield, efficiency of energy transfer and crop productivity.

Respiration: Ultrastructure of mitochondria, importance of glycolysis and Krebs's cycle in biosynthesis of molecules and chemiosmotic hypothesis. Respiration of pentose and lipids and cyanide resistant respiration.

Nitrogen and Sulfur Cycle and Metabolism. Introduction to nitrogen fixation. Nitrogen fixing organisms. Nitrate and ammonia assimilation.

Key words: Quantasomes, Absorption spectrum, Action spectrum, Red drop & Emerson effect, Photosynthetically Active Radiation (PAR), Net Compensation Point, Photophosphorylation, Photolysis, Kranz anatomy, RUBISCO, Anaerobic respiration, Acetyl Co A, Cytochromes, Respiratory Quotient, Symbiotic nitrogen fixation, Nif gene, Leghaemoglobin.

Suggested Reading

BIDWELL, R.G.S. 1974. Plant Physiology. Macmillan Pub. Co., N.Y.

BONNER, J. AND J.E. VARNER. 1976. Plant Biochemistry. Academic Press.

BRETT, C., AND K. WALDRON. 1990. Physiology and Biochemistry of Plant Cell Walls. Cambridge University Press. Cambridge.

BROWN, W.H. AND E.P. ROGERS. 1980. General Organic and Biochemistry. Willard Grant Press.

BUCHANAN, B. B., W. REUISSEM AND R. L. JONES. 2000. Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologist, Rockwell, Maryland, USA.

- CASEY, J.E. 1962. Biophysics (Concepts and Mechanisms). Affiliated East West Press.
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- GALEN, W.E. 1960. Instrumental Methods of Chemical Analysis. 2nd Edition. Mc-Graw Hill Book Company, Inc. Tokyo. Japan.
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- MACMILLAN, J. 1980. Hormonal Regulation of Development. I. Molecular Aspects of Plant Hormones. Springer-Verlag. Berlin.
- MOORE, T.C. 1979. Biochemistry and Physiology of Plant Hormones. Springer-Verlag. Berlin.
- RAMAN, K. 1997. Transport Phenomena in Plants. Narosa Publishing House. New Delhi.
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- SHROPSHIRE, W. AND H. MOHR. 1983. Photomorphogenesis. Springer-Verlag. Berlin.
- STRYER, L. 1981. Biochemistry. W.H. Freeman and Company. New York.
- TING, I.P. 1982. Plant Physiology. Addison Wesley Pub. Co.. Philippines.
- VOET, D. AND J.G. VOET. 1990. Biochemistry. John Wiley and Sons. New York.