23SC807 PLANT PHYSIOLOGY AND METABOLISM 4 0 0 4

Course Outcome (COs)

From this course, student will be familiarized with the various concepts related to plant physiology and metabolism

1. To get the student familiarize with different pathways of photosynthesis.
2. To understand the basics of patterns in plant development.
3. To know about the processes of carbohydrate and lipid biosynthesis.
4. To train the student with the various aspects of catabolism of hexoses.
5. To get an overview of the principle, instrumentation and applications of ultra-filtration.

Syllabus

Unit 1: **Water and plant cells:** Properties of water, hydrogen bonding, polarity, cohesion and adhesion. The concept of water potential. Water movements in cells and tissues. Soil-plant atmosphere continuum. Transpiration, stomatal movement, modern theories of stomatal mechanism. The ascent of xylem water and the uptake of water by roots. Absorption of mineral ions- solute absorption.

Unit 2: **Plants and nitrogen**: The nitrogen cycle. Biological nitrogen fixation, symbiotic nitrogen fixation in leguminous plants. Biochemistry of nitrogen fixation. Export of fixed nitrogen from nodules. Genetics of nitrogen fixation. Nitrogen assimilation, assimilation of nitrate. Nitrogen nutrition - agricultural and ecological aspects. Biosynthesis of amino acids-reductive amination and transamination.

Unit 3: Photosynthesis: Absorption and fate of light energy, absorption and action spectra. Photoreceptors-chlorophylls, carotenoids, phycobilin's. Bioenergetics and the light dependent reactions of photosynthesis. Photosynthetic electron transport and photophosphorylation. The two pigment systems, Z-scheme, water oxidizing clock. The photosynthetic carbon reduction cycle, C3, C2, C4 and CAM metabolism and ecological significance.

Unit 4: Patterns in plant development: Growth, differentiation, and development. Genetic control and hormonal regulation of plant development. Seed germination- physiology of hormones in plant development-auxins, gibberellins, cytokinin's, abscisic acid and ethylene. Role of vitamins and nutrients. Photomorphogenesis: Phytochrome: chemistry and physiological effects. Mechanism of phytochrome and gene action. Cryptochromes and blue light effect. Stress Physiology: Types of stress-water, temperature, salt, stresses caused by pests and pathogens and pollutants.

Unit 5: Enzymes: Mechanism of enzyme action, co-enzymes, inhibition, regulation, allosteric enzymes, covalently modulated enzymes. Kinetics of enzyme catalysis. Isoenzymes. Intermediary metabolism: Anabolism, catabolism, amphibolic pathways and antipleuritic reactions. Link between primary metabolism and secondary metabolism. Bioenergetics and thermodynamics.

Unit 6: Catabolism of hexoses: Glycolysis- two phases, overall balance sheet, regulation; fate of
pyruvate under aerobic and anaerobic conditions. Pentose phosphate pathway-multifunctional pathway Tricarboxylic acid cycle: Formation of acetate, reaction of citric acid cycle, antipleuritic reactions of citric acid cycle. Regulation of citric acid cycle. Glyoxylate cycle. Amphibolic nature of TCA cycle.
Carbohydrate biosynthesis: Gluconeogenesis, biosynthesis of starch, glucose and other carbohydrates. Involvement of NDP- sugars. Regulation. Oxidation of fatty acids. Activation and entry of fatty acids, Beta oxidation of saturated and unsaturated fatty acids. Regulation.
Oxidation of amino acids and entry to TCA cycle.

Lipid biosynthesis: Biosynthesis of fatty acids. Triacyl glycerols, phospholipids and isoprenoids. Biosynthesis of nucleotides: PRPP and its significance. Purine and pyrimidine biosynthesis.

REFERENCES

1. William G. Hopkins. Introduction to Plant Physiology. John Wiley & Sons Inc.

2. Lincoln Taiz, Eduardo Zeiger (2002). Plant physiology (II Edn). Sinaeur Associates, Inc. Publishers.

3. Frank B Salisbury, Cleon W Ross (1992). Plant Physiology (IV Edn). Wadsworth Publishing Company.

3. Voet D. & Voet J. G. (2004). Biochemistry. John Wiley & Sons

4. Nelson D.L. & Cox M.M. (2013). Lehninger Principles of Biochemistry. McMillian Publishers

5. Geoffrey Zubay. Biochemistry. Macmillan Publishing Company, New York.

6. Trevor Palmer. Enzymes- Biochemistry, Biotechnology and Clinical Chemistry. Norwood Publishing, Chichester.

EVALUATION AND GRADING

Internal *(Weightage = 50%)*		**External** *(Weightage = 50%)*	**Total**
Components	*Weightage*	Examination = 100 Marks	Internal+ External = 100

Midterm Exam	30%		
Assignments / seminar / class test	20%		

ACTIVITIES/ CONTENT WITH DIRECT BEARING ON EMPLOYABILITY/ ENTERPRENEURSHIP/ SKILL DEVELOPMENT (based on NAAC Criteria):

The learner will get a clear understanding of the concepts and ideas regarding the technical and theoretically relevant area which is explored in the course. This course will equip the learner to build a career as a researcher and academician in Chemical/Environmental Sciences.