

(Semester VI)

## **Paper 15: PLANT METABOLISM**

### THEORY

#### **Unit 1: Concept of metabolism**

Introduction, anabolic and catabolic pathways, regulation of metabolism, role of regulatory enzymes (allosteric, covalent modulation and Isozymes). **(4 lectures)**

#### **Unit 2: Carbon assimilation**

Historical background, photosynthetic pigments, role of photosynthetic pigments (chlorophylls and accessory pigments), antenna molecules and reaction centres, photochemical reactions, photosynthetic electron transport, PSI, PSII, Q cycle, CO<sub>2</sub> reduction, photorespiration, C<sub>4</sub> pathways; Crassulacean acid metabolism; Factors affecting CO<sub>2</sub> reduction. **(13 lectures)**

#### **Unit 3: Carbohydrate metabolism**

Synthesis and catabolism of sucrose and starch. **(2 lectures)**

#### **Unit 4: Carbon Oxidation**

Glycolysis, fate of pyruvate, regulation of glycolysis, oxidative pentose phosphate pathway, oxidative decarboxylation of pyruvate, regulation of PDH, NADH shuttle; TCA cycle, amphibolic role, anaplerotic reactions, regulation of the cycle, mitochondrial electron transport, oxidative phosphorylation, cyanide-resistant respiration, factors affecting respiration. **(10 lectures)**

#### **Unit 5: ATP-Synthesis**

Mechanism of ATP synthesis, substrate level phosphorylation, chemiosmotic mechanism (oxidative and photophosphorylation), ATP synthase, Boyers conformational model, Racker's experiment, Jagendorf's experiment; role of uncouplers. **(5 lectures)**

#### **Unit 6: Lipid metabolism**

Synthesis and breakdown of triglycerides,  $\beta$ -oxidation, glyoxylate cycle, gluconeogenesis and its role in mobilisation of lipids during seed germination,  $\alpha$  oxidation. **(6 lectures)**

#### **Unit 7: Nitrogen metabolism**

Nitrate assimilation, biological nitrogen fixation (examples of legumes and non-legumes); Physiology and biochemistry of nitrogen fixation; Ammonia assimilation and transamination. **(6 lectures)**

#### **Unit 8: Integration of metabolic pathways**

Interrelations of carbohydrate, lipid and protein metabolism. **(2 lectures)**

## PRACTICALS

1. Chemical separation of photosynthetic pigments.
2. Experimental demonstration of Hill's reaction.
3. To study the effect of light intensity on the rate of photosynthesis.
4. Effect of carbon dioxide on the rate of photosynthesis.
5. To compare the rate of respiration in different parts of a plant.
6. To demonstrate activity of Nitrate Reductase in germinating leaves of different plant sources.
7. To study the activity of lipases in germinating oilseeds and demonstrate mobilization of lipids during germination.
8. Demonstration of fluorescence by isolated chlorophyll pigments.
9. Demonstration of absorption spectrum of photosynthetic pigments.

## ESSENTIAL READINGS

1. Hopkins, W.G. and Huner, A. (2008). Introduction to Plant Physiology. John Wiley and Sons. U.S.A. 4<sup>th</sup> edition.
2. Taiz, L. and Zeiger, E. (2006). Plant Physiology. Sinauer Associates Inc. USA. 5<sup>th</sup> edition.
3. Harborne, J.B. (1973). Phytochemical Methods. John Wiley & Sons. New York.