Bot-309A & 310L **PLANT BIOCHEMISTRY (STRUCTURE AND CATALYSIS)** **Credit Hours 3(2+1)**

THEORY

Course Outline:

Introduction to Biochemistry, Structure and Catalysis; Carbohydrates; Lipids; Proteins; Nucleic Acids; Enzymes.

Introduction of the Course:

The course is organized to provide an adequate knowledge about selected cellular macromolecules and the underlying concepts in catalysis. It focuses not only on the individual molecules that form the backbone of these diverse molecules but also the structural role they play with particular reference to higher plants. In addition, the biological role of these macromolecules is also the focus of this course. Hierarchical levels of organization of certain complex macromolecules such as proteins and their myriad roles in structure and function of plant cells are discussed. Key concepts are included to understand the basis of catalysis.

Course Objectives:

The course is designed:

1. To provide an adequate knowledge of Carbohydrates, Lipids, Proteins, Nucleic Acids and Enzymes with reference to their role in higher plants.
2. To give an insight into various catalytic processes that are so very vital to sustain life.

Course Detail:

1. **Introduction to Biochemistry, Structure and Catalysis.**
2. **Carbohydrates:** Occurrence, Classification, Structure and Chemical properties, Mono, Di, Oligo and Polysaccharides, Glycoconjugates.
3. **Lipids:** Occurrence, Classification. Structure and chemical properties of Fatty acids, Triglycerides, Phospholipids, Glycolipids, Sulpholipids, Waxes, Carotenoids and Sterols.
4. **Proteins:** Amino acids, structure and classification, electro-chemical properties and reactions of amino acids. Classification of proteins. Primary, Secondary, Tertiary and Quaternary structure of proteins. Protein targeting, folding and unfolding, transport, storage, regulatory and receptor proteins. Protein purification and sequencing.
5. **Nucleic Acids:** Introduction. Purine and Pyrimidine bases, Nucleosides, Nucleotides. Structure and properties of DNA and RNA. Types and functions of RNA. DNA sequencing.
6. **Enzymes:** Nature and functions, Classification. Principles of enzyme action. Enzyme specificity. Transition state. Binding energy. Isozymes, ribozymes, Abzymes. Enzyme kinetics. Allosteric enzymes.

Practicals:

1. Determination of R_f value of Monosaccharides on a Paper Chromatogram.
2. Estimation of Reducing and Non-reducing sugars in plant material titrimetrically/spectrophotometrically.
3. Extraction and estimation of oil from plant material.
4. To determine Saponification number of fats.
5. Analysis of various lipids by TLC method.
6. Determination of R_f value of Amino Acids on a Paper Chromatogram.
7. To determine pKa and Isoelectric point of an amino acid.
8. Estimation of soluble proteins.
9. Extraction of Nucleic acids from plant material and their estimation by UV absorption or colour reactions.

10. Estimation of catalytic property of enzyme catalase or peroxidase extracted from a plant source.
11. Extraction of genomic DNA from plants by CTAB method.

Teaching-learning Strategies

1. Lectures
2. Group Discussion
3. Lab work
4. Seminars/ Workshop
5. Assignments

Learning Outcome:

1. Students are expected to get themselves familiarized with the molecular/macromolecular organization of plant cells in general.

2. They should be able to understand almost infinite possibilities of structural organization, molecular backbones and the myriad roles or functions they can take or perform.

3. How catalysis takes place? Students should be able to understand the basic concepts with regard to configurational as well as conformational changes in enzyme catalysis.

Assessment Strategies:

1. Lecture Based Examination (Objective and Subjective)
2. Assignments
3. Classroom discussion
4. Quizzes and Tests
5. Self-assessments

Recommended Readings:

1. Abdes, R. H., Frey, P. A. and Jencks W. P. (2004). Biochemistry, Jones and Bartlet, London.
2. Buchanan B. B, Gruissem W and Jones R. L. (2015). Biochemistry and Molecular Biology of Plants. John Wiley and Sons.
3. Bowsher, C., Steer, M., Tobin, A. (2008). Plant Biochemistry. - Garland Science, Taylor and Francis Group, New York.
4. Campbell, M. K. and F. Shawn. (2008). Biochemistry 6th Edition.
5. Chesworth, J. M., Strichbury T. and Scaife J. R. (1998). An introduction to agricultural biochemistry. Chapman and Hall, London.
6. Conn E. E. and Stumpf, P. K. (2009). Outlines of Biochemistry, John Wiley and Sons Inc. New York.
7. Dey, P. M. and Harborne, J. B. (1997). Plant Biochemistry. Harcourt Asia PTE Ltd. Singapore.
8. Goodwin T. W. and Mercer, E. I. (1997). Introduction to Plant Biochemistry. Pergamon Press, Oxford.
9. Heldt, H. W. (2008). Plant Biochemistry. 3rd Edition, Academic Press, U. K.
10. Lea, P. J. and Leegood, R. C. (1993). Plant Biochemistry and Molecular Biology. Wiley and Sons, New York.
11. Nelson, D. L and Cox M. M. (2017). Lehninger Principles of Biochemistry. 7th edition. W. H. Freeman and Company. New York.
12. Mckee, T. and Mckee, J. R. (1999). Biochemistry – An Introduction. WCB/McGraw-Hill, New York, Boston, USA.
13. Voet, D. Voet J. G. and Pratt, C. W. (2016). Fundamentals of Biochemistry: Life at the Molecular level, 5th Edition. John Wiley and Sons, New York.
14. Zubay G. (2003). Biochemistry, MacMillan Publishing Co., New York.

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