



**Institute of Botany**  
**Faculty of Life Sciences**  
**University of the Punjab, Lahore**  
**Course Outline**  
**Semester – IV**



<b>Programme</b>	<b>BS Botany</b>	<b>Course Code</b>	<b>Bot-211</b>	<b>Credit Hours</b>	<b>2</b>
<b>Course Title</b>	<b>Principles of Plant Biochemistry (Theory)</b>				
<b>Introduction</b>					
<p>The course is organized to provide an adequate knowledge of the key principles of Biochemistry using 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 and the underlying principles are included to understand the basis of catalysis.</p>					
<b>Learning Outcomes</b>					
<p>Students are expected to get themselves familiarized with:</p> <ul style="list-style-type: none"> <li>• the principles governing molecular/macromolecular organization of plant cells in general.</li> <li>• infinite possibilities of structural organization, molecular backbones and the myriad roles or functions they can take or perform.</li> <li>• How catalysis takes place?</li> <li>• the basic concepts and guiding principles with regard to configurational as well as conformational changes in enzyme catalysis.</li> </ul>					
<b>Course Contents</b>					
<ul style="list-style-type: none"> <li>• <b>Introduction to Biochemistry, Underlying principles, Structure and Catalysis.</b></li> <li>• <b>Carbohydrates:</b> Occurrence, Classification, Structure and Chemical properties, Mono, Di, Oligo and Polysaccharides, Glycoconjugates.</li> <li>• <b>Lipids:</b> Occurrence, Classification. Structure and chemical properties of Fatty acids, Triglycerides, Phospholipids, Glycolipids, Sulpholipids, Waxes, Carotenoids and Sterols.</li> <li>• <b>Proteins:</b> Amino acids, structure and classification. Diversity of structure and function. Primary, Secondary, Tertiary and Quaternary structure of proteins. Protein targeting, folding and unfolding. Principles of protein purification.</li> <li>• <b>Nucleic Acids:</b> Introduction. Purine and Pyrimidine bases, Nucleosides, Nucleotides. Underlying principles governing structure and role of DNA and RNA. DNA sequencing.</li> <li>• <b>Enzymes:</b> Nature and functions, Classification. Principles of enzyme action. Enzyme specificity. Transition state. Binding energy. Isozymes, Ribozymes. Enzyme kinetics. Allosteric modulation.</li> </ul>					

<b>Programme</b>	<b>BS Botany</b>	<b>Course Code</b>	<b>Bot-212</b>	<b>Credit Hours</b>	<b>1</b>
<b>Course Title</b>	<b>Principles of Plant Biochemistry (Lab)</b>				
<b>Lab Course Contents</b>					
<ul style="list-style-type: none"> <li>• Determination of <math>R_f</math> value of Monosaccharides on a Paper Chromatogram.</li> <li>• Estimation of Reducing and Non-reducing sugars in plant material titrimetrically/spectrophotometrically.</li> <li>• Extraction and estimation of oil from plant material.</li> <li>• To determine Saponification number of fats.</li> <li>• Analysis of various lipids by TLC method.</li> <li>• Determination of <math>R_f</math> value of Amino Acids on a Paper Chromatogram.</li> </ul>					

- To determine pKa and Isoelectric point of an amino acid.
- Estimation of soluble proteins.
- Extraction of Nucleic acids from plant material and estimation by UV absorption or colour reactions.
- Estimation of catalytic property of enzyme catalase or peroxidase extracted from a plant source.

### **Textbooks and Reading Material**

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 6<sup>th</sup> 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. 3<sup>rd</sup> 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. (2021). Lehninger Principles of Biochemistry. 8<sup>th</sup> 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, 5<sup>th</sup> Edition. John Wiley and Sons, New York.
14. Zubay G. (2003). Biochemistry, MacMillan Publishing Co., New York.

### **Teaching Learning Strategies**

- Lectures
- Group Discussion
- Lab work
- Seminars/ Workshop
- Assignments

### **Assignments: Types and Number with Calendar**

- Lecture Based Examination (Objective and Subjective)
  - Assignments
  - Classroom discussion
  - Quizzes and Tests
- Self-assessments

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