UNIVERSITY OF MADRAS

M.Sc. DEGREE PROGRAMME IN BOTANY

SYLLABUS WITH EFFECT FROM 2023-2024

Title of the Course	**PLANT BIOCHEMISTRY AND BIOPHYSICS**						
Paper Number	**CORE XIII**						
Category	Core	**Year**	II	**Credits**	5	**Course Code**	523C4B
		Semester	IV				

Instructional Hours per week	**Lecture**	**Tutorial**	**Lab Practice**	**Total**
	4	1	-	5

Pre-requisite	Basic knowledge on primary and secondary plant metabolites and enzymes.
Learning Objectives	
C1	Emphasize functions of plants biomolecules and their metabolism.
C2	Learn structural and functional properties of carbohydrates, proteins and lipids.
C3	Study about the mechanism of enzyme action and inhibition.
C4	Provide specific knowledge of compounds and biochemical pathways that occur in plants.
C5	Gain awareness about the various process involved in the energy production in plants and metabolic pathways.

UNIT	**CONTENTS**
I	**BASICS OF BIOCHEMISTRY** Atomic structure, Chemical bonds - Ionic bond, covalent bond, coordination bond, hydrogen bond; Hydrogen ion concentration (pH), buffers. Biomolecules: Carbohydrates - properties of mono, oligo and polysaccharides, pectin-glycosidic linkage, glycoproteins, isomerism and mutarotation.
II	**AMINO ACIDS AND PROTEINS** Biomolecules: Amino acids and proteins, ionic forms of amino acids, General reactions of amino acid metabolism. Zwitterion, isoelectric pH, optical isomers of amino acids, physical properties of amino acids. Formation of peptide bond - peptides – structure of polypeptides - primary, secondary, tertiary and quaternary structures. Ramachandran plot.
III	**LIPIDS** Biomolecules: Plant Lipids- Classification, structure and properties - Fatty acids (saturated and unsaturated). Structure and function of cholesterol, phospholipids, glycolipids, steroids. Biosynthesis and Oxidation of fatty acid - Glyoxalate cycle, â - Gluconeogenesis.

IV	**ENZYMES** Enzymes- Nomenclature, Classification, Mechanism of enzyme action (Lock and key and induced fit model), Enzyme Kinetics: Michaelis-Menton constant, Properties- Factors affecting enzyme action, enzyme inhibition, isoenzymes – Cofactors, coenzymes. Multienzyme complex – Enzyme immobilization, Application of enzymes in industry and medicine.
V	**BIOPHYSICS** Bioenergetics - Laws of thermodynamics – Concepts of enthalpy, entropy and free energy. Exergonic and endergonic reactions. Redox potential. Structure and hydrolysis of high energy. Application of first and second law of thermodynamics in biological systems.

Course outcomes: CO	**On completion of this course, the students will be able to:**	**Programme outcomes**
CO1	Describe the catabolic and anabolic pathway of primary metabolites of the plants.	K1
CO2	Learn the structure and functions of carbohydrates, lipids, proteins.	K2
CO3	Validate the biochemical hypothesis by using various experiments.	K3
CO4	Get familiarized in the various mechanisms of enzyme action and interpret the plots of enzymatic kinetics.	K4
CO5	Gain awareness about the various process involved in the energy production in plants and metabolic pathways..	K5

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Recommended Text:

1. Cotterill,R. 2011. Biophysics: An Introduction, John Wiley & Sons Bidwell. R. G. S. 1979. Plant Physiology. Macmillon Delhi.
2. Satyanarayana, U. and Chakrapani, U. 2005. Biochemistry, Books and Allied (P) Ltd. Calcutta.
3. A.L.Lehninger, D.L.Nelson & M.M.Cox. 1993. Principles of Biochemistry. Worth Publishers, New York.
4. Stryer, L. 1994. Biochemistry. Freeman & Co, New York.
5. Zubay, G. 1988. Biochemistry. 1988 Macmillan Publishing Co, New York.
6. F.M.Harold. 1986. The vital force: A study of Bioenergetics by Freeman & Co, New York.
7. Banerjee, PK. 2008. Introduction to Biophysics, S. Chand, New Delhi
8. Jain, J.L. 2005. Fundamentals of Biochemistry. S. Chand & Co. New Delhi.

9. Gupta, S.N. 2016. Biochemistry Rastogi Publications, Meerut.

Reference Books

1. Buchanan, B.B., Gruissem, W. and Jones, R.L. 2015.Biochemistry and Molecular Biology of Plants. John Wiley and Sons Ltd., UK
2. McKee, T. and McKee, J. R. 2012. Biochemistry: The Molecular Basis of Life. 7th ed. Oxford University Press, US.
3. Nelson,D.L.Cox,M. 2017. Lehninger Principles of Biochemistry WH Freeman Voet and Voet, 1992. Biochemistry, John Wiley & Sons, Inc., New York, USA.
4. Jeremy M. Berg, John L. Tymoczko and Lubert Stryer. Biochemistry. Seventh Edition, 74 Publisher: W. H. Freeman; Seventh Edition (December 24, 2010).
5. Wilson, K. and Walker, J. 2010. Principles and Techniques of Biochemistry and Molecular Biology. 7th ed. Cambridge University Press, USA.
6. Garrett, R. G. and. C. M. Grisham, 2010. Biochemistry. Mary Fimch Puhlishers, Boston.
7. Harold, F.M. 1986. The vital force: A study of Bioenergetics. Freeman & Co, New York.
8. Salil Bose, S. 1982. Elementary Biophysics. Vijaya Printers, Madurai.
9. Bonner, J. and Warner, W.H. 1961. Plant Biochemistry. Academic Press. Inv. New York.
10. Satyanarayana, U. and Chakkrapani, U. 2013. Biochemistry. Elsevier India Pvt Ltd & Books Allied Pvt.Ltd, New Delhi.
11. Heldt, H-W. 2005. Plant Biochemistry, 3rd Edition. Elsevier Academic Press.
12. Jain, J.L., Jain, S. and Jain, N. 2016. Fundamentals of Biochemistry. Chand Publishing, New Delhi.

Web sources:

1.http://priede.bf.lu.lv/grozs/AuguFiziologijas/Augu_biokimija/Plant%20Biochemistry%204.pdf
2.http://www.brainkart.com/subject/Plant-Biochemistry_257/
3.https://swayam.gov.in/nd2_cec20_bt12/preview 4
4.https://www.biorxiv.org/content/10.1101/660639v2
5.https://www.scribd.com/document/378882955/
6.https://nptel.ac.in/courses/102/107/102107075/
7.https://plantae.org/plant-physiology-top-articles-of-2020-based-on- altmetric-scores/
8.https://blog.aspb.org/best-of-2016-top-topics-in-plant-physiology-jounal/

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	2	1	3	2	3	1
CO2	3	3	2	2	3	3	2	3	2	3
CO3	3	2	3	3	1	2	1	3	2	1
CO4	3	3	3	3	3	2	2	1	3	3
CO5	3	3	2	3	2	3	3	1	2	2

S-Strong (3) M-Medium (2) -Low(1)