

UNIVERSITY OF MADRAS
M.Sc. DEGREE PROGRAMME IN BOTANY
SYLLABUS WITH EFFECT FROM 2023-2024

Title of the Course	PROFESSIONAL COMPETENCY SKILL ENHANCEMENT						
Paper Number	SKILL ENHANCEMENT						
Category	SE-Skill Enhancement	Year	II	Credits	2	Course Code	523S4A
		Semester	IV				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		3	1	-	4		
Pre-requisite		To understand the concept of skill enhancement.					
Learning Objectives:							
C1		Understand the molecules and their interaction relevant to biology.					
C2		To gain knowledge about the cell, organelles and physiology.					
C3		To understand the biodiversity DNA recombination technology.					
C4		Describe the basic signal transduction pathway and to recognize the overarching principles of prokaryotic and eukaryotic cellular communication.					
C5		Understand the mechanism underlying the shift from vegetative to reproductive phase.					
UNIT	CONTENTS						
I	MOLECULES AND THEIR INTERACTION RELEVANT TO BIOLOGY Structure of atoms, molecules, and chemical bonds. Composition, structure, and function of biomolecules (carbohydrates, lipids, proteins). Stabilizing interactions (Van der Waals, electrostatic, hydrogen bonding, etc.). Principles of biophysical chemistry (pH, buffer, thermodynamics). Bioenergetics, glycolysis, oxidative phosphorylation, coupled reaction, biological energy transducers. Enzymes and enzyme kinetics, mechanism of enzyme catalysis, isozymes.						
II	CELLULAR ORGANIZATION Membrane structure and function: structure of model membrane, lipid bilayer, and membrane protein diffusion, osmosis; ion channels; active transport; membrane pumps. Structural organization and function of intracellular organelles (cell wall, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles). Organization of genes and chromosomes: The structure of chromatin and chromosomes, heterochromatin, euchromatin, transposons. Cell division and the cell cycle: mitosis and meiosis.						
	FUNDAMENTAL PROCESSES DNA replication, repair: Unit of replication, Enzymology. replication the fidelity of replication, extrachromosomal replicons, DNA damage and repair mechanisms, homologous and site-specific recombination.						

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III	<p>RNA synthesis and processing: Transcription factors and machinery, a formation of initiation complex, transcription activator and repressor, RNA polymerases, capping, elongation, and termination, RNA processing, RNA editing, splicing, and polyadenylation, structure, and function of different types of RNA, RNA transport.</p> <p>Protein synthesis and processing: Ribosome, the formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, aminoacylation of tRNA, tRNA-identity, aminoacyl tRNA synthetase, Post-translational modification of proteins. Genetic code.</p> <p>Control of gene expression at transcription and translation level: Regulating the expression of phages, viruses, prokaryotic and eukaryotic genes, the role of chromatin in gene expression and gene silencing.</p>	
IV	<p>CELL COMMUNICATION AND CELL SIGNALING:</p> <p>Cell signaling: Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, signal transduction pathways, second messengers, regulation of signaling pathways, light signaling in plants, bacterial chemotaxis, and quorum sensing.</p> <p>Cellular communication: Regulation of hematopoiesis, general principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins, neurotransmission and its regulation.</p> <p>Cancer: Biology of cancer cells; Oncogenes. Genetic rearrangements in progenitor cells, oncogenes, tumor suppressor genes, cancer and the cell cycle.</p>	
V	<p>DEVELOPMENTAL BIOLOGY</p> <p>Basic concepts of development: Potency, commitment, specification, induction, competence, determination, and differentiation; morphogenetic gradients; cell fate and cell lineages; stem cells; genomic equivalence and the cytoplasmic determinants; imprinting; mutants and transgenics in the analysis of the development.</p> <p>Gametogenesis, fertilization: Production of gametes, embryo sac development and double fertilization in plants; embryogenesis, establishment of symmetry in plants; seed formation and germination.</p> <p>Morphogenesis and organogenesis in plants: Organization of shoot and root apical meristem; shoot and root development; leaf development and phyllotaxy; transition to flowering, floral meristems and floral development in Arabidopsis, Programmed cell death, aging, and senescence.</p>	
Course outcomes: CO	On completion of this course, the students will be able to:	Programme outcomes
CO1	To learn about the structure of atoms, molecules, and chemical bonds.	K1
CO2	Demonstrate both the theoretical and practical knowledge in cell biology and molecular biology.	K2

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CO3	Explain the methods of recombinant technology.	K3
CO4	Compare and contrast the physiological functions and metabolism.	K4
CO5	Discuss and develop skills for effective comprehension and communication.	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:		
<ol style="list-style-type: none"> 1. Bhojwani, S.S. Bhatnagar, S.P and Dantu, P.K. 2015. The Embryology of Angiosperms (6th revised and enlarged edition). Vikas Publishing House, New Delhi. 2. Maheshwari, P. 1963. Recent Advances in Embryology of Angiosperms. Intl. Soc. Plant Morphologists, New Delhi. 3. Roy, S.C and Kumar, K.D.C. 1977. Cell Biology, New Central Book Agency, Calcutta. 4. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments.6th edition. John Wiley & Sons. 5. Ramavat, K.G. 2006. Plant Biotechnology. S. Chand and Co. Ltd., New Delhi. 6. Trivedi, P.C. 2000. Plant Biotechnology-Recent Advances. Panima Publication Corporation, New Delhi. 7. Chawla, H.S. 2009. Introduction to Biotechnology. 2nd edn. Oxford IBH, ISBN: 978-81-204-1732-8. 		
Reference books:		
<ol style="list-style-type: none"> 1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc. 2. Gupta. P.K. 2000. Cell and Molecular Biology, Rastogi Pub. Meerut. 3. Ignacimuthu, S. 2005. Basic Bioinformatics, Narosa publishing house. 4. Lesk, A.M. 2002. Introduction to Bioinformatics. Oxford University press. 5. Rastogi. 1996. Cell and molecular biology. New age international publishers. 6. Elliott, W.H. and Ellioff. 1997. Biochemistry and molecular biology. Oxford. 7. Freifelder D., 1987. Molecular Biology. Narosa publishing house. 8. Rastoji, S.C., Mendiratta,N., Rastogi, P. 2009. Bioinformatics : Methods and Applications, PHI, Third Edition. 		
Web resources:		
<ol style="list-style-type: none"> 1. https://www.nature.com/scitable/topic/cell-biology 2. https://plato.stanford.edu/entries/molecular-biology/ 3. https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/bioinformatics 4. https://.britannica.com/technology/biotechnology/ 		

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| 5. https://nptel.ac.in/courses/102/107/102107075/ |
| 6. https://plantae.org/plant-physiology-top-articles-of-2020-based-on-altmetric-scores/ |

Mapping with Programme Outcomes:

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

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