Name of the Programme: M.Sc. Part-I (Biochemistry)

Course Code: CHB-503 **Title of the Course:** Cell and Developmental Biology

Number of Credits: **4**

Effective from AY: 2022-23

Pre-requisites for the Course:	Students should have graduate level knowledge either in chemical or life sciences or should have qualified change of discipline test.	
Course Objectives:	1. The objective is to offer detailed knowledge about cell biology, various cellular organelles, the communication pathways associated with cellular processes. 2. Introduction of the fundamental concepts of organismal developmental biology. 3. The course aims to provide the students insights on basic cell culture techniques and their current applications.	
Content:		No of hours
	1. Structural organization of the cell a. Prokaryotic and eukaryotic cells. b. Animal and plant cells. c. Structure and functions of cellular and subcellular organelles.	10
	2. Biological membrane structure and function a. Structure and functions of membrane. b. Transport across cell membrane. c. Passive and active transport of molecules across biological membranes. d. membrane pumps.	5
	3. Cell division and cell cycle a. Mitosis. b. Meiosis. c. Regulation of the cell cycle.	5
	4. Cellular communication and Cell signalling a. Signal transduction pathway. b. Signalling molecules and their receptors. c. G-Protein Coupled receptors. d. Receptor Tyrosine Kinases. e. MAP kinase pathway and JAK-STAT pathway. f. Light signalling in plants. g. Bacterial chemotaxis and quorum sensing. h. Programmed cell death (Apoptosis).	10
	5. Fundamentals of organismal development a. Potency, commitment, specification, induction, competence. b. Determination and differentiation, morphogenetic gradients. c. Cell fate and cell lineages. d. Stem cells, genomic equivalence. e. Cytoplasmic determinants, imprinting and mutants.	6

	6. Early organismal development a. Gametogenesis. b. Cell surface molecules in sperm-egg recognition in animals. c. Embryo sac development and double fertilization in plants. d. Zygote formation, cleavage, blastula formation, embryonic fields gastrulation. e. Formation of germ layers in animals, embryogenesis. f. Establishment of symmetry in plants. g. Seed formation.	6
	7. Plant tissue culture: techniques and applications a. Introduction to plant tissue culture and various requirements. b. Preparation for tissue culture. i. Surface sterilization of plant tissue material. ii. Basic procedure for aseptic tissue transfer. c. Tissue culture methodologies. i. Callus Culture. ii. Cell Suspension Culture, protoplast culture and hybridization. iii. Organogenesis. iv. Plant micropropagation. v. Somatic Embryogenesis. vi. Incubation and maintenance of culture. d. Applications of PTC.	6
	8. Animal tissue culture: techniques and applications a. Introduction to animal tissue culture and various requirements. b. Typical cell lines, growing mammalian cells and general maintenance of cells. c. Applications of ATC.	6
	9. Microbial culture techniques a. *In vitro* culture techniques. b. Nutrient requirements. c. Applications in industry.	6
Pedagogy:	Mainly lectures and tutorials. Seminars / term papers /assignments / presentations / self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.	
References/ Readings:	1. Karp, G.; Cell and Molecular Biology: Concepts and experiments; John Wiley and Sons Inc., 2015; 8th Edition. 2. Lodish, H.; Berk A.; Kaiser, C. A; Krieger, M.; Bretscher, A.; HiddePloegh, Amon A.; Martin, K. C.; Molecular Cell Biology; W.H. Freeman and Company; 2016; 8th Edition. 3. Freshney, I.; Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications; Wiley-Blackwell; 2016; 7th Edition. 4. DeRobertis, E.D.P.; DeRobertis Jr. E.M.F; Cell and Molecular Biology; Saunders; 2017; 8th Edition.	

	5. Pelczar, M.; Reid, R.D.; Chan E.C.S.; Microbiology. MacGraw-Hill; 2001; 5th Edition. 6. Smith, R.H.; Plant tissue culture: technique and experiments; Academic Press; 2012; 3rd Edition. 7. Gilbert, S.F.; Barresi M. J.; Developmental Biology; Oxford University Press; 2020; 12th Edition.
Course Outcomes:	1. Students will be able to describe the cell structure, cell division and cell cycle mechanisms, various cellular organelles and their functions. 2. Students will be able to explain the processes of transport across cell membranes, various cellular communication pathways along with their significance and understand the fundamentals of developmental biology. 3. The students will be able to apply the basic cell culture techniques needed to work in a biological research laboratory. 4. The students will be prepared for advanced courses in life science such as Cancer biology, Neurochemistry, etc.