Name of the Programme: M.Sc. Biotechnology

Course Code: GBT–510

Title of the Course: CELL AND DEVELOPMENTAL BIOLOGY

Number of Credits: 3

Effective from AY: 2022-23

Pre-requisites for the Course:	No prerequisite is required.	
Course Objectives:	The cells being "the fundamental building blocks of all organisms", a comprehensive understanding of the cell and cellular function is essential for all biologists. This course will hence provide 1) a conceptual overview of a cellular system and its functioning in animals. 2) a conceptual outline of developmental patterns using examples from different model systems regulatory networks involved are highlighted, aiming to project the molecular basis of developmental patterns.	
Content:	**MODULE I** • Biochemical organization of the cell; diversity of cell size and shape; cell theory, and the emergence of modern Cell Biology. • Principles underlying microscopic techniques for the study of cells. • Structure and diversity of biological membranes; mechanisms of membrane transport. Self-assembly of lipids, micelle, biomembrane organization - sidedness and function; membrane assembly. • The plant cell wall; extracellular matrix in plants and animals • Cell lysis and subcellular fractionation • Structural organization and functions of cell organelles: nucleus, mitochondria, Golgi bodies, endoplasmic reticulum, lysosomes, Chloroplast, peroxisomes, vacuoles. Cytoskeletons structure and motility function	**No. of hours** 15

	• Cellular communication: General principles of cell communication, cell adhesion and roles of different adhesion molecules, tight junctions, communicating junctions, integrins, neurotransmission, and its regulation.	
	MODULE II • Protein localization – synthesis of secretory and membrane proteins, import into nucleus, mitochondria, chloroplast, and peroxisomes, receptor-mediated endocytosis. • Proteasomes; structure and function • Cell division and cell cycle: Mitosis and meiosis, their regulation, Cell cycle, and its regulation, Apoptosis, Necrosis, and Autophagy. • Cell signalling • Cell fusion techniques • Molecular chaperones: types, characteristics, and functional significance • Cell transformation and cancer, oncogenes and proto-oncogenes, tumor suppressor genes, metastasis.	15
	MODULE III • 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 analysis of development. • Production of gametes, cell surface molecules in sperm-egg recognition in animals; zygote formation, cleavage, blastula formation, embryonic fields, gastrulation, and formation of germ layers in marine animals. • Cell aggregation and differentiation in *Dictyostelium*; axes and pattern formation in *Drosophila*, amphibia; organogenesis – vulva formation in *Caenorhabditis elegans*, eye lens induction, limb development and regeneration in vertebrates; differentiation of	15

	neurons, post-embryonic development- larval formation, metamorphosis; environmental regulation of normal development; sex determination.	
Pedagogy:	Lectures, tutorials, assignments	
References/ Readings:	1. A. Amon, M. Krieger, H. Lodish, , A. Bretscher , C. A. Kaiser, A.Berk , K. C. Martin, H. Ploegh, Molecular Cell Biology. United Kingdom: W. H. Freeman, 2016. 2. C. Smith, Wood Cell Biology, Chapman Hall, 2005. 3. G. M. Cooper and R. E. Hausman, The Cell: A Molecular Approach. United States: Sinauer Associates, 2013. 4. S. F. Gilbert, Developmental biology. Sinauer Associates, Inc, 2010. 5. J.D. Watson, M. Levine, T. A. Baker, A. Gann, S. P. Bell, R.L. Watson, Molecular Biology of the Gene, Pearson Education, 2014. 6. G. Karp, J. Iwasa, W. Marshall, Cell Biology Global Edition. United States: Wiley, 2018. 7. S. T. Kilpatrick, Krebs, J. E., Goldstein, E. S., Lewin, GENES XII. Japan: Jones; Bartlett Learning, 2017. 8. H. Lodish, and B. Arnold, Molecular Cell Biology, W.H. Freeman & Company, 2000. 9. T. D.Pollard, , W. C. Earnshaw, J. Lippincott-Schwartz, G. Johnson , Cell biology E-book. Elsevier Health Sciences, 2016. 10. J. M. W. Slack, Essential Developmental Biology. Germany: Wiley, 2009. 11. Smith & Wood., Cell Biology, Chapman & Hall London, 2005. 12. M. A. Subramanian, Developmental Biology. India: MJP Publisher, 2022. 13. B. M. Turner, Chromatin and gene regulation: molecular mechanisms in epigenetics. John Wiley; Sons, 2008. 14. L. Wolpert, Developmental Biology: A Very Short Introduction. OUP Oxford, 2011.	
Course Outcomes:	1. Students will be able to understand major concepts in cell and Developmental biology with an awareness of experimental approaches and how they are applied in cell biology research. 2. Students will be able to understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles. 3. Students will be able to summarise how these cellular components are used to generate and utilize energy in cells.	

	4. Students will be able to summarize the molecular and genetic background of animal developmental biology.

(Back to top)