



Course Title: Molecular Cell Biology
Course Code: GCMB612
Credit Units: 4

L	T	P/S	Lab	TOTAL CREDIT UNITS
3			2	4

Course Objectives:

This course provides a contemporary view of molecular mechanisms controlling complex cell functions. It helps to understand how ensembles of molecules within the cell perform complex functions. Emphasis is placed on mechanisms of transmembrane transport, cellular control, and intracellular signaling at the molecular level and their implication in diseases like cancer and diabetes.

Pre-requisites: Graduate in Life Sciences

Student Learning Outcomes:

Upon completion of this course, the student will be able to:

- Describe the relationship between the structure and function of cellular components on the molecular scale.
- Critically analyze concepts of intra cellular transport and cell cycle regulation.
- Describe the relationship between extracellular signaling and genetic control of cellular behavior.
- Define the role of biomarkers as important tools for molecular diagnosis.

Course Contents/Syllabus- Theory:

	Weightage (%)
Module I Descriptors/Topics: Membrane Biology Chemical and physical properties of cell membranes and their major components, significance of these properties to membrane structure with experimental support. Membrane transport of molecules: classes of membrane transport proteins-channels and carriers including pumps and ionophores. Mechanism of transport of small molecules across membranes: simple diffusion, facilitated diffusion, primary and secondary active transport, role of ion gradients in active transport. Nuclear organization including nuclear envelope, nuclear pore complex and Transport across the nuclear envelope; regulation of nuclear import.	20
Module II Descriptors/Topics: Protein trafficking and vesicular transport Protein Sorting to Endoplasmic Reticulum (ER) - Role of signal recognition particle (SRP) in co-translational/post-translational translocation across the ER membrane; Protein Processing and Folding in ER: quality control and unfolded protein response (UPR). Import and sorting across: Chloroplast membrane (TOC and TIC complex), mitochondrial membrane (TOM TIM complex), Golgi Complex, SNARE hypothesis. Membrane Dynamics: Secretory Pathway, Membrane folding, vesicle budding and fusion.	20
Module III	20

Descriptors/Topics: Cell Cycle and Regulation of Cell Division Cell cycle, check-points and regulators of cell cycle progression: role of the cyclins and cyclin-dependent kinases, mechanisms of Cdk regulation, Inhibitor of cell cycle progression.	
Module IV	20
Descriptors/Topics: Cell signaling Principles of cell signaling, components of cell signaling : Ligands (steroid and peptide hormones, growth factors), receptors (steroid receptor, G-protein coupled receptors, receptor –protein tyrosine kinase), signaling pathways : c- AMP pathway , phosphoinositides and calcium ions , Ras, Raf , MAP kinase pathway , JAK –STAT pathway .	
Module V	20
Descriptors/Topics: Cancer Biology Types of cancer, Proto-oncogenes and oncogenes , Tumor suppressor genes (TSGs), Function of pRb, p53 asTSGs. Cancer epigenetics: MicroRNAs in cancer development.	

Pedagogy for Course Delivery:

Lectures: 42
Home Assignment 1
Class Test: 2
Total: 45

Lab/ Practical details, if applicable:

Practical: 13
Class Test: 02
Total: 15

List of Experiments:

- Isolation of cell organelles by differential and/or density-gradient centrifugation.
- Microscopic observation of chloroplast from the isolated cell organelle fraction.
- Estimation of chlorophyll content of isolated cell chloroplast fraction to confirm the presence of chloroplasts.
- MTT assay to confirm the presence of mitochondria from the isolated cell organelle fraction.
- Study of cell viability / death assay by use of trypan blue , MTT assay
- Study of apoptosis through analysis of DNA fragmentation patterns (TUNNEL Assay method)

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
75	25	70

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment						End Term Examination
Components (Drop down)	Class Test 1	Class Test 2	Home Assignment	Presentation/ Seminar	Attendance	
Weightage (%)	5	15	5	0	5	70

Lab/ Practical/ Studio Assessment:

	Continuous Assessment/Internal Assessment				End Term Examination			Total
Components (Drop down)	Performance	Lab record	viva	Attendance	Lab record	Performance	Viva	
Weightage (%)	10	10	5	5	10	50	10	100

Text:

- The Cell: A Molecular Approach, Vth Edition, by Geoffrey M. Cooper and Robert E. Hausman. (2013) published by ASM Press and Sinauer Associates. ISBN-13: 978-0763739058
- Cell and Molecular Biology: Concepts and experiments 7th edition, Gerald Karp. (2013) John Wiley and Sons Inc. ISBN-13: 978-1118206737
- Becker's world of the Cell 8th edition, Harden, Kleinshmith, Bertoni, (2011), Pearson Education Cell. ISBN-13:9788184734508

References:

- Molecular Biology of the Cell : 5th (E) , B. Alberts, D. Bray, A. Johnson, J. Lewis, M. Raff. (2008), Garland Publishing Company. ISBN-13: 978-0815316206
- Molecular Cell Biology, 7th edition, H. Lodish, A. Berk, S.L. Zipursky, P. Matsudaira, D. Baltimore and J. Darnell. (2013) W.H. Freeman and Company. ISBN-13: 978-0716737063

Any other Study Material:

Research papers