

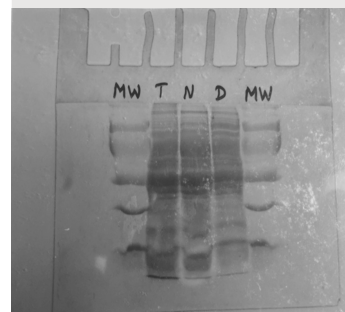
19BT202 CELL AND MOLECULAR BIOLOGY

Hours Per Week :

L	T	P	C
3	-	2	4

Total Hours :

L	T	P	WA/RA	SSH/HSH	CS	SA	S	BS
45	-	30	5	50	-	12	2	3



COURSE DESCRIPTION AND OBJECTIVES:

This course helps to know different cell components and their functions like transport of material, signaling etc. This course also imparts knowledge on cell division and cancer. To acquaint the student about the structure, synthesis and processing of nucleic acids and protein synthesis in prokaryotes and eukaryotes. Also to make the students aware about the classification and types of mutations and how they effect the gene and its expression and how DNA will repair the damage.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes	POs
1	Understand the concepts of gene expression and regulation.	1,2
2	Analyze different mechanisms of cell signalling and role of secondary messenger pathways.	1,3
3	Apply the knowledge of cell cycle and its regulation.	1,3
4	Evaluate the leads of cancers through the activity of oncogenes, tumor suppressors, apoptosis, angiogenesis, and DNA repair.	1,3,4
5	Design experiments incorporating the principles of Microscopy and Identification of different Cell Types.	1,3

SKILLS:

- ✓ *Understand how Biochemistry, Genetics and Molecular biology are used to elucidate both the function of cells and their organization into tissues.*
- ✓ *Describe how scientific method is used to explain natural phenomena.*
- ✓ *Understand safe laboratory practices and perform basic cell and molecular biology techniques.*
- ✓ *Generate hypothesis, evaluate data, and design experiments to investigate a scientific problem.*
- ✓ *Present advanced knowledge in the specialized fields of molecular and cell biology.*

UNIT - I**L-9**

CELL STRUCTURE AND FUNCTION, CYTOSKELETON: Plasma membrane organization; Cell organelles - Nucleus (chromatin and chromosome organization), Mitochondria, Chloroplast, Endoplasmic Reticulum, Golgi bodies, Lysosomes; Cytoskeletal elements - Microtubules, Microfilaments and intermediate filaments.

UNIT - II**L-9**

MEMBRANE TRANSPORT, INTRA-VESICULAR TRAFFIC AND CELL-CELL CONNECTIONS: Principles of membrane transport, Types of carrier proteins and active membrane transport ($\text{Na}^+ - \text{K}^+$ pump, Ca^{++} pump, H^+ pump), Ion channels, Family of membrane transport proteins; Molecular basis of endocytosis and exocytosis; Cell Junctions, Cell-Cell adhesion and Extra Cellular Matrix (ECM).

UNIT - III**L-9**

CELLULAR COMMUNICATION, CELL CYCLE AND APOPTOSIS: Types of extra cellular signal molecules and their binding mechanisms; Secondary messengers; Types of signaling pathways - G-protein linked cell surface receptor mediated system, Enzyme-linked cell surface receptors; Cell Cycle- Mitosis and Meiosis, Molecular regulation of cell cycle (check points), Mechanisms of cellular death, Regulation of programmed cell death.

UNIT - IV**L-9**

NUCLEIC ACIDS STRUCTURE AND DNA REPLICATION: DNA discovery and structure; DNA models (A, B, Z models); DNA denaturation and melting curves; Semiconservative DNA replication of prokaryotes and eukaryotes; Rolling circle replication; Replication in bacteriophages; Inhibitors of DNA replication; DNA damage and repair mechanisms; Site directed mutagenesis and reverse genetics.

UNIT - V**L-9**

Transcription and translation in prokaryotes and eukaryotes: Transcription machinery; RNA polymerases; Mechanism of transcription in prokaryotes and eukaryotes; Post-transcriptional modifications; Inhibitors of transcription; Genetic code and Wobble hypothesis; Mechanism of translation in prokaryotes and eukaryotes; Post-translational modifications.

LABORATORY EXPERIMENTS

LIST OF LAB ACTIVITIES

TOTAL HOURS: 30

1. Media Preparation for *in vitro* animal cell culture and propagation.
2. *In vitro* primary cell culture and maintenance.
3. Microscopic analysis of cells and cell organelles.
4. Differential cell count by staining to differentiate between cell types.
5. Smear preparation for microscopy.
6. Quantitative assessment of cell attachment to different surfaces.
7. Trypsinization of cells from cell culture plates.
8. Cell Counting by Haemocytometer.
9. Passaging of cells for further culturing of cells *in vitro*.
10. Isolation of genomic DNA from bacteria
11. Isolation of genomic DNA from plants.
12. Isolation and quantification of genomic DNA from animal cells.
13. Isolation and quantification of RNA by UV Spectrophotometer.
14. Agarose gel electrophoresis to visualize and quantify DNA.

TEXT BOOKS:

1. G. M. Malacinski, "Essentials of molecular biology", 4th edition, Jones & Bartlett Learning, 2005.
2. G. Karp, "Cell and molecular biology: concepts and experiments", John Wiley & Sons, 2009.
3. P. S. Verma and V.K. Agarwal, "Cell Biology, Genetics and Molecular Biology", S. Chand & Company, 2000.
4. E.D.P. De Robertis and E.M.F. De Robertis, "Cell and Molecular Biology", 8th edition, B.I. Waverly Pvt. Ltd., 2006.
5. G.M. Cooper, "The Cell-A Molecular Approach", 3rd edition, Sinauer Publications, 2004.
6. D. Freifelder, "Molecular Biology", 2nd edition, Narosa Publishing Home, 1987.
7. Channarayappa, "Molecular Biotechnology: Principles and Practices", 1st edition, Universities Press, 2006.
8. M.R. Green and J. Sambrook. "Molecular Cloning: A Laboratory Manual", 4th edition, Cold Spring Harbor Laboratory, 2013.

REFERENCE BOOKS:

1. G. Karp, "Cell and Molecular Biology", 5th edition, Wiley Publishers, 2008.
2. B. Alberts, A. Johnson, J. Lewis, M. Raff, K. Roberts and P. Walter, "Molecular Biology of the Cell", Reference edition, Garland Science Publishers, 2007.
3. H. Lodish, A. Berk, S.L. Zipursky, P. Matsudaira, D. Baltimore and J. Darnell, "Molecular Cell Biology", 6th edition, W.H. Freeman & Company, 2007.
4. J.E. Krebs, E.S. Goldstein, S.T. Kilpatrick, "Lewin's Genes XI", 1st edition, 2015.