CELL AND MOLECULAR BIOLOGY

Semester	Subject Code	Category	Lecture		Theory		P	C
I	21CPBT1A	Core - I	5hrs per week	75	5 hrs per week	75	0	5

COURSE OBJECTIVE: In this course, students will

- Understand the basics, concepts in cell biology including characteristics, functions of cell types, cell organelles and identify cell division, cell motility, cell interaction, cell signaling and recognize fundamentals of molecular biology covering structures of nucleic acids, chromosomes and most elaborately the central dogma of molecular biology and study tools used to study cell biology and molecular biology.

COURSE OUTCOMES: Up on successful completion of course, students will be able to

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL (K1-K6)
CO1	Understand the basic unit of life, the Cell and biological activities and functions carried out by the cell and its organelles.	K2
CO2	Understand cell communication and various cell signaling pathways.	K2
CO3	Apply their knowledge in classifying types of nucleic acids and describe DNA replication, repair, recombination, and Transposition etc.	K3
CO4	Determine the fundamentals of gene expression including transcription, translation, post transcriptional and post translational modifications.	K4
CO5	Demonstrate the methods used in cell and molecular biology and innovate and evaluate a new techniques for studying cell and molecular biology.	K3, K5, K6

Knowledge level: K1- Remember; K2- Understand; K3- Apply; K4- Analyze; K5- Synthesize; K6- Evaluate

MAPPING WITH PROGRAMME OUTCOMES:

COS	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	S	M	M	M
CO2	S	M	S	M	M	M
CO3	M	S	M	M	M	S
CO4	M	M	S	M	M	M
CO5	M	M	S	S	S	S

S-strong; M- medium;

UNIT I

Cell, organelles, cell division and cell death **13 Hours**

Cell as basic unit of life, types of cells- prokaryotes and eukaryotes, viruses, structure and functions of cell organelles- plasma membrane- transport of small molecules, cell wall, mitochondria, cytoplasm, golgi complex, lysosomes, vacuoles, peroxisomes, endoplasmic reticulum, ribosomes, chloroplast, nucleus, Cell cycle, mitotis, meiosis, cell death and apoptosis.

UNIT II

Cellular motility, cellular interaction and cell signaling **15 Hours**

Cytoskeleton structures and functions- microtubules, microfilaments and intermediate filaments, extracellular matrix, cell- extracellular matrix interaction, cell- cell interaction, Signaling molecules and their receptors, functions of cell surface receptors, pathways of intracellular transduction-cAMP pathway, CGMP, phospholipids and Ca, PI3- kinase/Akt and mTOR pathways, MAP kinase pathways, JAK/STAT and TGF-β/Smad pathways, NF-κB Signaling, Hedgehog, Wnt, and Notch pathways.

UNIT III

Nucleic acids and chromosomes **12 Hours**

Nucleic acids- DNA, RNA –structure and types, chromosome and its organization, types of chromosomes, DNA replication in prokaryotes and Eukaryotes, enzymes and accessory proteins involved in DNA replications, mutations and types, DNA repair, homologous recombination, site specific recombination and transposition –transposable elements and its regulation.

UNIT IV

Gene expression and regulation **15 Hours**

RNA synthesis, post transcriptional modification, splicing, alternate splicing, RNA editing and RNA degradation, Genetic code, Wobble hypothesis, Translation, post translational modifications, RNA interference- siRNA, microRNA, Lac operon, his operon, trp operon, ara operon, Gene silencing by modifications of histones and DNA, alteration of gene expression by DNA sequence rearrangements in Salmonella and Trypanosoma.

UNIT V

Tools used in Molecular Biology **15 Hours**

Gel retardation assay, Foot printing assay, nuclease protection foot printing, modification protection foot printing, fluctuation test, replica plating, Ames test, Complementation test.

Distribution of Marks: Theory 80% and Problems 20%

TEACHING METHODOLOGY:

- Class room teaching
- Assignments
- Discussions
- Homework
- PPT presentations
- Seminars
- Models and charts

TEXT BOOKS:

S.no.	Authors	Title	Publishers	Year of publication
1.	Harvey Lodish, Arnold Berk, Chris A. Kaiser, Monty Krieger	Molecular Cell biology	W.H. Freeman and Company, New York, USA	2004
2.	P.S. Verma & V K Agarwal	Cytology	S.Chand Publishing, New Delhi, India.	2014
3.	Geoffrey M Cooper, E. Robert Hausman,	Cell: a molecular approach	Sinauer Associates Inc, Publishers Sunderland, Massachusetts U.S.A	2013
4.	James D. Watson	Molecular Biology of Gene	W. A. Benjamin publishers, USA.	2017

REFERENCE BOOKS:

S.no.	Authors	Title	Publishers	Year of publication
1.	Gerald Karp	Cell and Molecular Biology: concepts and experiments:	John Wiley and sons, Inc., NJ.	2015
2.	Harvey Lodish, Arnold Berk, Chris A. Kaiser, Monty Krieger, Anthony Bretscher,HiddePloegh; Angelika Amon; Kelsey C. Martin	Molecular cell biology	W.H. Freeman publishers & Co.	2016
3	Micheal M Cox and David Nelson	Lehninger Principles of biochemistry	W.H. Freeman and company	2008

Web Sources

1. https://www.khanacademy.org/science/high-school-biology/hs-cells/hs-introduction-to-cells/a/microscopy
2. https://www.ncbi.nlm.nih.gov/books/NBK9851/
3. https://www.youtube.com/watch?v=zf7tbymrv9o
4. https://www.youtube.com/watch?v=gZAw7pahzMM
5. https://www.youtube.com/watch?v=Ikq9AcBcohA

Syllabus Designer:

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