MOLECULAR BIOLOGY

Sem	Subject Code	Category	Lecture		Theory		Practical		Credits
			Hrs/ week	Hrs/sem.	Hrs/ week	Hrs/ sem.	Hrs/ week	Hrs/ sem.	
I	21CPBC1D	Elective	3	45	3	45	-	-	3

COURSE OBJECTIVE

To enable the students to learn about the synthesis and functions of molecules that make up living organisms, their mutation and identification of mutants. Also learn about the mechanism of synthesis of DNA, RNA and proteins, gene regulation and gene mutation. Techniques used in molecular biology.

COURSE OUTCOMES:

On the successful completion of the course, the students will be able to,

CO Number	CO Statement	Knowledge Level ($K_1 – K_4$)
CO1	To understand the types, models and synthesis of genetic materials both in prokaryotes and eukaryotes.	**K1**
CO2	To know the mechanism of RNA synthesis both in prokaryotes and eukaryotes.	**K2**
CO3	Explains the steps involved in protein synthesis both in prokaryotes and eukaryotes .	**K2**
CO4	Describes the gene expression concepts.	**K3**
CO5	Explains gene repair mechanism and gene mutation.	**K4**

(*CO – Course Outcomes

Knowledge Level: K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze).

MAPPING WITH PROGRAMME OUTCOMES:

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

(S- Strong; M-Medium; L- Low)

Total Hours: 45

UNIT I

DNA Replication **10 Hours**

Types of replication, evidence for semiconservative replication - Meselson and Stahl experiment, replications in circular chromosomes - Cairns model, rolling circle model. Replication in prokaryotes, replication bubble, bidirectional replication, replicon, action of SSB, primase, DNA gyrase, topoisomerases, DNA polymerase I, II, and III, lagging and leading strand synthesis, Okazaki fragments, inhibitors of replication, replication in RNA virus, plasmid replication, reverse transcriptase, retroviruses. Eukaryotic replication.

UNIT II

Transcription **10 Hours**

Transcription - definition, coding strand, template strand, sense strand and antisense strand, promotor, foot-printing experiment, DNA- dependent RNA polymerase role of Prinbnow box, template binding, prokaryotic transcription, Rho - dependent and independent ternination, posttranscriptional processing in prokaryotes. Eukaryotic transcription, split genes, overlapping genes, housekeeping genes, biosynthesis of rRNA and tRNA, RNA editing - post-transcriptional modifications of eukaryotic RNAs, RNA splicing, introns and splicing reactions, self-splicing introns - group I and group II, exons, spacer sequences, enhancers, inhibitors of transcription.

UNIT III

Genetic Code and Translation **10 Hours**

Genetic code - definition, deciphering of the genetic code, codon dictionary, salient features of genetic code - wobble mechanism and its significance. structure of tRNA, activating enzymes, binding of amino acids to tRNA, composition of prokaryotic and eukaryotic ribosomes, leader region, Shine-Dalgarno sequence, prokaryotic and eukaryotic protein biosynthesis - initiation, elongation, and termination, polysomes, post-translational modifications in prokaryotes and eukaryotes, inhibitors of protein synthesis.

UNIT IV

Protein Transport and Gene Expression **8 Hours**

Protein targeting, translocation, heat shock proteins, glycosylation, SNAPs and SNAREs, bacterial signal sequences, mitochondrial, chloroplast and nuclear protein transport, endocytosis-viral entry, ubiquitin TAG protein destruction, gene expression and regulation, molecular mechanism of regulation, prokaryotes - operon model, lac, trp, arabinose operons, repression and attenuation, eukaryotes - C value paradox, repetitive DNA, gene dosage and gene amplifications.

UNIT V

Mutagenesis, DNA Damage and Repair **7 Hours**

Mutagenesis and replication fidelity, misincorporation of nucleotides during DNA synthesis, transient and spontaneous chemical changes in DNA, frameshift mutagenesis, DNA damage - different types, DNA repair - direct reversal repair, direct repair of nicks, excision repair, nucleotide excision repair, SOS repair, mismatch repair.

DISTRIBUTION OF MARKS: Theory - 100% and Problems – Nil

TEACHING METHODOLOGY:

- Black Board
- Power Point Presentations
- Assignments
- Models
- Demonstrations

TEXT BOOKS:

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1	Robert F. Weaver	Molecular biology	McGraw-Hill	2007
2	R. M. Twyman	Advanced molecular biology	Narosa Publications	1998

REFERENCE BOOKS:

S. NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1	Robert E Harsman	The Cell- A Molecular Approach Geoffrey Cooper	ASM Press	2004
2	Lodish *et al.,*	Molecular Cell Biology	WH Freeman & Company	2003
3	De Robertis and De Robertis	Cell and Molecular Biology	WoltersKluwer India Pvt Ltd	2001
4	Alberts*et al.,*	Molecular Biology of the Cell	Garland Science Inc	2002
5	David Freifelder	Molecular Biology	Narosa Publications	2000
6	Jocelyn E. Krebs, Elliott S. Goldstein , Stephen T. Kilpatrick	Genes II	Navigate Publication	2017

WEB SOURCES:

- http://www.biology.arizona.edu/cell_bio/cell_bio.html
- https://ecok.libguides.com/biology/web_sources
- https://www.nicholls.edu/biol-ds/biol155/Lectures/Cell%20Biology.pdf
- http://www.bio-nica.info/Biblioteca/Bolsover2004CellBiology.pdf

SYLLABUS DESIGNER:

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