GUJARAT TECHNOLOGICAL UNIVERSITY
Master of Science (Integrated-Biotechnology)
Semester: 2
Subject Name: Molecular Biology
Subject Code: 1320403

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	8	8	70	30	30	20	150

Prerequisite:
Students in previous classes must studied about the different kinds of nucleic acid. They have basic knowledge about the fundamentals of biochemistry and genetics **Rationale:**

Molecular biology is the branch science that deals with the molecular basis of living cells. This will allow students to understand the molecules present in living cells and their role in the functioning of life.

Course Content:

Unit No.	Content	No. of Hours	Weightage (%)
1	**Genome organization** Structure of DNA, various forms of DNA (A, B & Z forms of DNA) denaturation, and renaturation of DNA, melting Temperature (Tm), Definition of geneclusters, mobile DNA, unique and repetitive DNA, C-value paradox, DNA topology, super-coiling and topoisomerases, gene clusters, continuous, interrupted and overlapping genes, gene mutation RNA - Eukaryotic genome organization. Chromosome structure, types and banding (G,C,Q,R,T)- Nucleosome, chromatin, DNA binding proteins Histones & Non-histones, , mRNA, rRNA, tRNA and miRNA structure,	13	22
2	**DNA Replication** DNA replication in prokaryotes: Models of DNA replication (Semi -conservative, semi discontinuous, bidirectional replication) Origin of DNA replication, enzymes and proteins in DNA ,replication, stages of replication of *E. coli* chromosome (Initiation, Elongation and Termination), Function and properties of DNA polymerase I, II and III. Supercoiling of DNA and its importance, topoisomerases. DNA replication in eukaryotes: Mechanism and Stages of Eukaryotic chromosome replication (Initiation, Elongation and Termination). Enzymes and proteins involved in replication, Importance of Cyclin dependent kinase (Cdk and Ddk), Telomere end replication, End replication problem in disease, Comparison of prokaryotic and eukaryotic replication.	13	21

3	**Genetic Recombination, mutation Repair mechanism** Homologous recombination, Types of Recombination, Models of Homologous recombination (Holliday model) proteins and enzymes in recombination, Transposon and Retro transposons, Mechanism of Transposition, Mutation and its type, Ames test, Replica plating technique, Mutagen, Chemical and physical mutagen and its types. Replication errors and mismatch repair system, direct damage reversal, base excision repair, nucleotide excision repair, and Photo reactivation. SOS response system for repair.	13	21
4	**Transcription and Translation** Types of RNA polymerases, genetic code and wobble hypothesis, transcription unit, fundamentals of transcription in prokaryotes and eukaryotes, post-transcriptional modifications, role of ribosome and tRNA in protein synthesis, basics of translation in prokaryotes and eukaryotes, post-translational modifications. Translation initiation, elongation, and termination in prokaryotes. Translation in eukaryotes. Post-translational modifications. Antibiotics inhibitors of protein synthesis.	13	22
5	**Regulation of Gene expression** Operon concept, lac and trp operons, promoter, operator and enhancer sequences, repressor and activator proteins, overview of regulation of gene expression by miRNA, Molecular switch of Phage lambda.	8	14
	Total Hours:	60	

Textbook:

1. Molecular Biology of the Gene 6th ed., Watson, J.D., Baker, T.A., Bell, S.P.2008.
2. Lehninger: Principles of Biochemistry 6th ed., Nelson, D.L. and Cox, M.M., W.H. Freeman & Company (New York), 2013.
3. Genetics.P. K. Gupta, Rastogi Publications. ISBN: 81-7133-779-1. Shivaji Road Meerut, India.

Reference Books:

1. The Cell – A Molecular Approach, Geoffrey M. Cooper And Robert E. Hassman. 3rd Edition, 2004, ASM Press, Sinauer Associates, Inc.ISBN:0-87893-214-3.
2. Gene (Latest edition) by B. Lewin. Pearson Education Ltd. London.

Course Outcomes:

No.	Course Outcomes	RBT Level*
1	Understand the transcription of different types of RNA in both prokaryotes and eukaryotes	RM,UN
2	Students will learn Post transcriptional and post translation modification.	RM,UN

3	Biosynthesis of protein by translation mechanism.	UN,RM
4	Regulation of gene expression, RNA Interference (SiRNAs and miRNAs).	UN,RM,AP

*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create

Suggested Course Practical List:

1. Extraction of DNA from microbes
2. Extraction of DNA from Plant sample
3. Extraction of DNA from Soil/Blood
4. Agarose Gel Electrophoresis
5. Quantification of DNA
6. Importance of 260/280 ratio
7. RNA isolation
8. DNA melting temperature

List of Laboratory/Learning Resources Required

1. https://onlinecourses.swayam2.ac.in/cec20_ma13/preview
2. https://onlinecourses.swayam2.ac.in/cec20_ma13/preview