JYOTI NIVAS COLLEGE AUTONOMOUS BANGALORE – 560 095
DEPARTMENT OF GENETICS
B.Sc. III SEMESTER GENETICS PAPER III SYLLABUS (2024 SEP BATCH)
MOLECULAR GENETICS

COURSE TITLE	**MOLECULAR GENETICS**
COURSE CODE	**24IIIGT3T**
COURSE CREDITS	**3**
TOTAL CONTACT HOURS	**56 HOURS**
DURATION OF ESA	**3 HOURS**
FORMATIVE ASSESSMENT MARKS	**20 MARKS**
SUMMATIVE ASSESSMENT MARKS	**80 MARKS**

Course Objectives:

- Understand concepts of biomolecules and gene organization
- Comprehend the central dogma of molecular biology.
- Understand gene structure and expression
- Appraise DNA repair mechanism.

Course Outcomes (COs): After the successful completion of the course, the student will be able to:
CO1: Describe the structure and function of biomolecules.
CO2: Appreciate and illustrate the chemical composition of the genetic material and its replication.
CO3: Describe the process of gene expression in prokaryotes and eukaryotes.
CO4: Explain the concept of transposition, mutation.

Content	56 Hrs
Unit-I	**14 hrs**
DNA as genetic material: Proof of transformation: Griffith's experiment on transformation; Transforming principle: Avery, McLeod, McCarty & Hershey and Chase experiments; RNA as genetic material-Fraenkel and Singer experiment. **Structure and Functions of Nucleic Acids:** Structure of DNA (Watson-Crick model); Chargaff's rule, Different forms of DNA-A, B and Z; Denaturation and renaturation of DNA**.** Types and structure of RNA: mRNA, tRNA (Clover leaf model), and rRNA. **DNA replication**: **Prokaryotic replication**: Enzymes and proteins involved in replication; Initiation: Origin of replication, Replication fork, Primosome, Replisome; Elongation- Synthesis of leading and lagging strands; Termination. Types of Replication- Rolling circle and theta mode of Replication. **Eukaryotic replication**: Enzymes and proteins involved in replication; Mechanism- Initiation, elongation, termination and telomeric replication.	
Unit-II	**14 hrs**
Central Dogma of Molecular Biology **Transcription in Prokaryotes**: RNA Polymerase; Role of sigma factors, Promoter region; Mechanism of transcription- Initiation, Elongation, Termination (rho dependent and independent) **Transcription in Eukaryotes**: Eukaryotic RNA Polymerases; Transcription factors; Promoters and enhancers. Mechanism of transcription- Initiation, Elongation and Termination. Post-transcriptional modifications- Methylation, polyadenylation, and splicing, rRNA and tRNA transcription. **Translation:** Genetic code and its general characteristics, Wobble hypothesis, Components of translation machinery- mRNA, tRNA (charging of tRNA, aminoacyl tRNA synthetases); ribosome structure and assembly. Mechanism of translation in Prokaryotes and Eukaryotes. Post-translational modification of proteins.	
Unit-III	**14 hrs**
Gene expression in Virus and Prokaryotes: Lytic and lysogenic cell cycles in Phages, genetic switch in lambda phage. Inducible operon Structure, mechanism and catabolite repression of Lac Operon. Repressible operon, Structure, mechanism and Attenuation of Trp Operon. Catabolite repression, attenuation **Regulation of Gene Expression in Eukaryotes at transcription level:** Role of chromatin and euchromatin conformation in gene expression, Covalent histone modifications, Nucleosome remodelling, gene regulation through DNA methylation and hemi methylation **Post-transcriptional gene regulation** - RNA editing, RNAi, siRNA, miRNA, and gene silencing by knockdown	
Unit-IV	**14 hrs**

Transposable Elements: Introduction, types and classification; Class I (Retrotransposons-LINES AND SINES), Class II (DNA transposons), Autonomous vs non autonomous TEs, Mechanism of transposition- DNA transposon transposition and retrotransposon – transposition, controlling elements in Bacteria (IS elements), *Drosophila* (p elements), Maize (Ac-Ds elements), Evolutionary role of transposable elements.	

References:

- Becker,W.M.&Kleinsmith,L.J.(2017),Worldofthecell(9thEd.),Benjamin Cummings, Washington DC.
- Cooper,G.M.(2013),TheCell(6thEd.).SinauerAssociates,Sunderland.
- Griffiths,A.J.F.,Miller,J.H.,Suzuki,D.T.,Lewontin,R.C.&Gelbart,W.M.(2007 AnIntroduction to Genetic Analysis (9th Ed.), Freeman, New York.
- Hames,B.D.&Hooper,N.M.(2011). InstantNotesinBiochemistry(4thEd.).Viva Books.
- Hartwell,L.H.,Hood,L.,Goldberg,M.L.,Reynolds,A.E.,Silver,L.M.&Veres,R.C.(2016) Genetics: From Genes to Genomes,Tata McGraw Hill, New Delhi.
- Harvey,L.,Arnold,B.,Lawrence,S.,Zipursky,Paul,M., David,B.,&James,D.(2018). Molecular Cell Biology (6th Ed.). Freeman. New York.
- Lodish,J.H&Baltimore,D.(2016).MolecularCellBiology(8thEd.),ScientificAmericanBooks , NewYork.

Formative Assessment for Theory	
Assessment Occasion/type	**Marks**
CI: House Examination/Test	10
C2: Written Assessment/Presentation/Project/Term Papers/Seminars	05
Attendance	05
Total	20

BLUEPRINT FOR QUESTION PAPER
Paper III

Unit	**Teaching (hrs)**	**Number of Questions**			**Total Marks**
		12 (3 Marks)	08 (5 Marks)	04 (10 Marks)	
Unit 1	14	3	2	1	29
Unit 2	14	3	2	1	29
Unit 3	14	3	2	1	29
Unit 4	14	3	2	1	29
Total	**56 hrs**	**12x3=36**	**8x5=40**	**4x10=40**	**116**

III SEMESTER GENETICS PAP ER-III

Molecular Genetics

PRACTICAL

COURSE TITLE	**MOLECULAR GENETICS**
COURSE CODE	**24IIIGT3P**
COURSE CREDITS	**2**
TOTAL CONTACT HOURS	**48 HOURS**
DURATION OF ESA	**3 HOURS**
FORMATIVE ASSESSMENT MARKS	**10 MARKS**
SUMMATIVE ASSESSMENT MARKS	**40 MARKS**

Course Objectives:

- Qualitative analysis of biomolecules
- Understand the principle and working of different laboratory instruments.
- Extract genomic DNA and run the DNA in a gel through gel electrophoresis. Perform paper chromatography and thin layer chromatography
- Study effects of mutations and molecular markers.

Course Outcomes: After the successful completion of the course, the student will be able to:

CO1: Understand the working principle and handling of instruments.
CO2: Perform the isolation of DNA from various sources.
CO3: Characterize the eye pigments in Drosophila using paper chromatography.
CO4: Demonstrate the effects of mutation and appraise the applications of molecular markers.

Sl. No.	Practical Contents	15 Units
1.	Instrumentation Micropipette, Glass Homogenizer, Glass bead sterilizer,	2
2.	Extraction of genomic DNA from coconut endosperm.	2
3.	Extraction of genomic DNA from liver tissue.	2
4.	Extraction of genomic DNA from bacteria.	2
5.	Chromatography Technique: Separation of eye pigments in wild type and mutant *Drosophila*.	2
6.	Paper chromatography: Separation of chlorophyll from leaf.	2
7.	Study of replication/transcription/translation through charts and models.	2
8.	Study of transposable elements through charts.	1

Pedagogy: Lectures, Presentations, Videos, Assignments and Weekly Formative Assessment, Test

Formative Assessment for Practical	
Assessment Occasion/type	**Marks**

House Examination/Test	05
Class Room Performance/Attendance	05
Total	10

Scheme of Practical Examination

III Semester Genetics Paper III

Molecular Genetics

Duration:3 hours **Max.Marks:**40

1.	Isolation of DNA from coconut endosperm/Bacteria/liver	12 marks
2.	Separate the chlorophyll from leaf pigment/Drosophila eye pigments by using ascending paper Chromatography	09 marks
3.	Identify and Comment on Spotter A replication/transcription/translation/instrumentation	08 marks
4.	Identify and comment on Spotter B (Transposable elements).	06 marks
5.	Record	05 marks
	Total	**40 marks**