

**JYOTI NIVAS COLLEGE AUTONOMOUS
SYLLABUS FOR 2018 BATCH AND THEREAFTER**

Programme: B.Sc.

Semester: IV

**GENETICS PAPER IV
MOLECULAR GENETICS**

Course Code: 18IVGT4

No. of Hours: 60

COURSE OBJECTIVES:

- To provide with the core principles of molecular genetics and to develop higher scientific skills
- To understand the chemical nature of biological macromolecules and the chemical basis of heredity and the process of mutations
- To obtain a clear understanding of the facts of protein synthesis

LEARNING OUTCOMES:

- Students understand the central dogma of molecular biology
- Students are able to understand the relationship between genes and expression of proteins

UNIT I CHEMICAL BASIS OF HEREDITY 11 HRS

Nucleic Acids:

DNA: DNA as genetic material; Experiment of Griffith, Avery, MacLeod and McCarty, Hershey – Chase experiment. 3 HRS

Double helix model of DNA, supercoiling of DNA; types of DNA 2 HRS

RNA: RNA as genetic material; Experiment of Fraenkel-Conrat-Singer 2 HRS

Types of RNA, its structure and functions 2 HRS

Extrachromosomal DNA: Mitochondrial & Chloroplast DNA 2 HRS

UNIT II GENE STRUCTURE AND DNA REPLICATION 9 HRS

Gene structure: Basic concept of gene; Cistron, Recon and Muton 1 HR

rII locus in T4 phage; 2 HRS

Lozenge eye locus in Drosophila 1 HR

DNA replication mechanisms: Prokaryotes (rolling circle model), 2 HRS

Eukaryotes and telomere replication 2 HRS

Viral replication 1 HR

UNIT III GENE EXPRESSION **19 HRS**

Genetic code: Triplet codon, wobble hypothesis, Universality, degeneracy and non-overlapping; initiation and termination codons **1 HR**

Protein synthesis:

Central Dogma **1 HR**

Transcription in Prokaryotes and Eukaryotes: initiation, elongation and termination.(Transcription of rRNA and tRNA also included); **5 HRS**

mRNA processing in eukaryotes-formation of 5'cap, addition of poly-A tail and RNA splicing. **2 HRS**

Differences between transcription in prokaryotes and eukaryotes. **1 HR**

Translation in prokaryotes-initiation (including amino-acylation), elongation and termination. **2 HRS**

Translation in eukaryotes- initiation (including formation of ternary complex, pre-initiation complex and formation of complete initiation complex), elongation and termination.**3 HRS**

Differences between translation in prokaryotes and eukaryotes. **1 HR**

Regulation of gene expression: Lac Operon, Tryptophan and Galactose **3 HRS**

UNIT IV GENETICS OF BACTERIA **9 HRS**

Transformation **3 HRS**

Transduction – generalized and specialized; **3 HRS**

Conjugation: F factor mediated, Hfr mediated and Sexduction **3 HRS**

UNIT V MUTATIONS **12 HRS**

General History; gene mutation and chromosome mutation, General characteristics of mutations **1 HR**

Types of mutations – forward and reverse mutations, dominant and recessive mutations, somatic and germinal mutations, lethal mutations, morphological and biochemical mutations, micro and macro mutations, chromosomal, gene and cytoplasmic mutation, base substitution, deletion, addition, missense, nonsense and frameshift mutations. **3 HRS**

Spontaneous and induced mutations; Physical mutagens – ionizing and non-ionizing radiations. **1 HR**

Chemical mutagens – base analogues, alkylating agents, deamination agents, acridine dyes. **1 HR**

Detection and measurement of mutations in bacteria (auxotrophic mutations, Ames test, reverse mutations) Drosophila (CIB, Muller stock). **3 HRS**

DNA repair mechanisms: Photoreactivation, Excision repair, recombination repair.**3 HRS**

II B. Sc. Genetics-IV Semester Practical IV

DURATION 3 HRS/UNIT

NO. OF UNITS: 15

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| 1. Instrumentation: | 4 UNITS |
| Ultracentrifuge, pH meter, Electrophoretic unit (horizontal and vertical), Micropipette, BOD Incubator, Laminar Air Flow, Autoclave, Gel rocker, Cyclo mixer | |
| 2. Extraction of DNA: | 3 UNITS |
| i) Cauliflower/Coconut endosperm | |
| ii) Bacteria | |
| iii) Animal tissue (chicken liver) | |
| 3. Paper Chromatography | 3 UNITS |
| i) Separation of leaf pigments | |
| ii) Separation of Drosophila eye pigments | |
| iii) Separation of amino acids | |
| 4. Spotters | 2 UNIT |
| i) Protein Profile | |
| ii) DNA Profile | |
| 5. Mutagens: Physical and Chemical | 1 UNIT |
| i) EMS | |
| ii) MMS | |
| iii) UV ray | |
| Practical tests/repetition | 2 UNITS |
| Note: 13 Practical + 2 units for practical tests/repetition | |

REFERENCES

1. David Clarke, Nanette Pazdernik (2012) Molecular Biology 2nd edition
2. Karp G. (2018) Cell & Molecular Biology, 3rd Edition, John Wiley and Sons, Inc
3. Oliver Brandenberg et al (2011) Introduction to Molecular Biology & Genetic Engineering
4. P.S.Verma and V.K.Agarwal (2009) Genetics- Chand Publishing, 9th edition

5. B.D.Sing (2009) Fundamentals of Genetics, Kalyani Publishers