

Semester – IV

EC – 1A Elective paper: Cell and Molecular Biology

Full Marks – 70

Time: 3 hrs

Questions to be set in three parts representing all the five units. Part A will consist of 10 objective questions of 2 marks each. Part B will consist of five short questions (Four to be answered) of 5 marks each. Part C will consist of five long questions (three to be answered) of 10 marks each.

Unit I: (A) Regulation of gene expression in bacteria

- 1.1 Concept and basic mechanism
- 1.2 Inducible system: Lac operon with negative control and Positive control (CAP/cAMP regulation)
- 1.3 Repressible system: Tryptophan operon and mechanism of attenuation in *E.coli*

(B) Levels of gene regulation in eukaryotes

- 1.4 Transcriptional control involving chromatin remodelling and genome imprinting
- 1.5 Post – transcriptional control involving alternate polyadenylation and alternate splicing
- 1.6 Translational control involving Ribosome selection, translation inhibition, mRNA degradation and gene silencing (RNA interference)

Unit II: (A) Cancer Biology

- 2.1 Cytology of cancer cells and types of cancer
- 2.2 Genetic basis: Oncogenes and tumour – suppressor genes
- 2.3 Chromosomal anomalies associated with cancer

(B) Apoptosis

- 2.4 Machinery of programmed cell death
- 2.5 Extrinsic and intrinsic pathways
- 2.6 Control of programmed cell death

Unit III: (A) Nucleus

- 3.1 Functional architecture of interphase nucleus and nuclear envelope
- 3.2 Ultra structure of nucleolus: organization of rDNA
- 3.3 Nucleolar function: synthesis of rRNA, its processing and biogenesis of ribosomes
- 3.4 Mechanism of nuclear cytoplasmic exchange

(B) Cell – Cell signaling

- 3.5 Signaling from plasma membrane to nucleus: Type of signal (G protein and protein kinases), target cells and effector organs
- 3.6 Cell surface receptors of signaling molecules
- 3.7 Signal transduction pathways and their regulation Second messenger system

Unit – IV: (A) Genomics

- 4.1 Functional genomics: Predicting gene and protein function by sequence analysis
- 4.2 Genome organization in humans: The Human Genome Project, Main features of human genome
- 4.3 Gene therapy: Prospects and application

(B) Recombinant DNA Technology

- 4.4 Tools and techniques (enzymes, vectors, cloning strategies)
- 4.5 Construction and screening of DNA libraries
- 4.6 Application of recombinant DNA technology

Unit – V : Transposable genetic elements

- 5.1 Discovery and definition: Ac/Ds elements in maize
- 5.2 Prokaryotic elements: Insertion sequences and transposons
- 5.3 Retrotransposons and DNA transposons in eukaryotes
- 5.4 Mechanism of transposition (conservative and replicative)

SEMESTER - IV

EC – 2A Elective paper (Practical): Cell and Molecular Biology
Time: 6 hrs

Full Marks – 70

1st Sitting

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|---|----|
| 1. Cytochemical demonstration of protein/lipid/carbohydrate/nucleic acids | 15 |
| 2. Vital staining of mitochondria | 10 |
| 3. Identify and comments upon spots (1-5): Cytological slides | 10 |

2nd Sitting

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| 4. Any one of the following | 10 |
| (a) Estimation of sperm count from epididymal wash of laboratory mammals | |
| (b) DNA separation by agarose gel electrophoresis (demonstration only) | |
| 2. Practical records (including slides, charts, model, field work) | 05 |
| 3. Dissertation and Viva-Voce | 20 |