

(ii) Cis-regulatory elements like promoters, enhancers, and insulators play key roles in eukaryotic gene regulation. Create a detailed diagram of a eukaryotic gene showing these elements and explain how they work together to regulate transcription.

(iii) Describe the process of nonsense-mediated mRNA decay (NMD) in eukaryotes and its role in quality control of mRNA. Use a diagram to show how premature stop codons trigger the decay process and prevent the production of faulty proteins.

(b) How does the ubiquitin-proteasome system ensure selective protein degradation, and why is this important for cellular function? (3)

6. Comment on the following (**any three**): ( $3 \times 5 = 15$ )

(i) Nonsense mediated decay

(ii) CRISPR-CAS as gene editing system

(iii) tmRNA

(iv) X-inactivation

[This question paper contains 4 printed pages.]

**Your Roll No.....**

**Sr. No. of Question Paper : 1054**

**I**

Unique Paper Code : 3182013501

Name of the Paper : Genome Organization and Function

Name of the Course : **B.Sc. (H) Biomedical Sciences (NEP)**

Semester : V

Duration : 3 Hours

Maximum Marks : 90

**Instructions for Candidates**

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **Five** questions in all.
3. Question no. 1 is compulsory.
4. Subparts of the questions should be attempted together.
5. Draw illustrations or diagrams wherever necessary.

1. (a) Define (**any four**) :

(4x2=8)

(i) Macrosatellite (ii) Inducer

(iii) RNAi (iv) Combinatorial Control

(v) Cooperativity

(b) Justify as true or false (**any five**) : (5×3=15)

(i) Ara is an inducible operon.

(ii) Gene density is directly proportional to the complexity of an organism.

(iii) Pre-miRNAs are present only in introns.

(iv) Ribosomal Proteins are translational repressors of their own synthesis.

(v) Genes that are continually being expressed in most cells are referred to as inducible genes.

(vi) DNA foot printing can be used to detect protein binding site.

(c) Expand the following : (7×1=7)

(i) RdRP (ii) UAS

(iii) LINES (iv) HLH

(v) LTR (vi) MAPK

(vii) ESE

2. Distinguish Between (**any three**) : (3×5=15)

(i) STAT vs MAPK signal transduction pathway

(ii) Heterochromatin and Euchromatin

(iii) Cis-acting regulatory sequences and Trans-acting factors

(iv) Inducible and Repressible operon

3. (a) How is translation of iron binding protein Ferritin regulated? (7)

(b) Describe how bacterial genes are regulated by riboswitch that responds to metabolites like S-adenosylmethionine. (8)

4. What is the functional significance of the following (**any five**) : (5×3=15)

(i) Spacer in CRISPR (ii) Xist

(iii) Drosha (iv) OxyS

(v) IRE (vi) CpG island

5. (a) Discuss in detail with examples and diagrams (**any two**) : (2×6=12)

(i) Histone modifications, such as acetylation and deacetylation, regulate chromatin structure and gene expression. Illustrate the role of HATs and HDACs in transcriptional regulation, and explain how these modifications influence chromatin remodelling.