RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. FOURTH SEMESTER EXAMINATION, MAY 2025

SECOND YEAR [BATCH 2023-27]

Date : 08/05/2025 **ZOOLOGY**

Time : 11 am – 1 pm **Paper : 4ZOOMJC3** Full Marks : 50

1. Answer **any five** questions **:** [5 × 2]

   a) Explain the role of the Shine-Dalgarno sequence in prokaryotic translation initiation.

   b) How does the presence or absence of tryptophan influence the activity of the trp operon?

   c) State the role of FEN1 in long patch BER.

   d) Explain processivity with respect to DNA polymerases.

   e) What is Coolye's Anaemia?

   f) What is Element in prokaryotic organism?

   g) How is a 'Ternary Complex' formed?

   h) What is ρ (rho) factor?

Answer **any four** questions **:** [4 × 10]

2. a) Describe the process of homologous recombination and its role in facilitating crossing over between homologous chromosomes.
   b) Provide examples of human genes that undergo genomic imprinting and describe the specific parental origin-specific expression patterns observed. [5+2+3]

3. a) Describe the structure and function of lactose operon.
   b) How does histone acetylation contribute to the epigenetic control of gene expression, add a note on its mechanism. [5+5]

4. a) i) A dsDNA is 100kb long.
      ii) How many nucleotides does it contain?
      iii) How many complete turns are present?
      iv) State the distance between two adjacent nucleotides.
   b) Linking number of a relaxed DNA molecule is 20. If 2 turns are removed from this DNA molecule, what will be the linking difference of this DNA molecule? Calculate the superhelical density of this molecule and comment on it.
   c) A culture of E. *coli* was incubated in a medium containing heavy nitrogen (^{15}N). After continued growth for several hours the culture was transferred to a medium containing light nitrogen (^{14}N). After three generations of sequential division of the bacterial cells, what percentage of DNA strands in progeny cells will remain heavy? (*Show the calculation*)
   d) Illustrate the composition of the DNA Pol III holoenzyme. [(1+1+1)+(1+1+1)+2+2]

5. a) What are Okazaki fragments? Illustrate the pulse chase experiment to confirm discontinuous strand replication.
   b) Mention the steps of UvrABC system mediated DNA repair in bacteria. Provide a labelled diagram.

[(2+3)+(3+2)]

6. a) Define Hybrid Dysgenesis?

   b) With a suitable genetic explain existence of transposable element is responsible for hybrid dysgenesis in *Drosophila*.

   c) Define Class I and Class II transposable genetic elements. [2+5+3]

7. a) What is the basic differences between alpha thalassemia and beta thalassemia?

   b) "Base substitution contributs to sickle cell anemia"- justify the statement.

   c) Illustrate why haemophilia is the most common in men than in women. [3+5+2]

8. a) What is oriC? State briefly its structure.

   b) "Sigma factor in *E. coli* is instrumental in unwinding DNA helices" – justify with reasons (add figure). [(2+4)+(3+1)]

9. a) Enumerate (with a diagram) how the RNA polymerase covers -55 to +20 distance?

   b) Why is 'Supercoiling' considered important in termination process?

   c) What is meant by 'Intrinsic Terminators?' [(3+2)+(3+2)]

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