Introduction to Biology

End Semester Examination Monsoon'25

1. Explain why linear chromosomes present a replication problem compared to circular chromosomes. [2]
2. A researcher wants to study how human liver cells respond to a drug. How to identify the genes affected? [2]
3. How does one tRNA recognize multiple codons? [2]
4. Predict what would happen if the direction of polymerization and proofreading were interchanged. How would it affect DNA replication? [2]
5. How are mRNA modifications [2]
6. You are sequencing a gene with highly repetitive regions. What challenges might you face, and how can they be overcome? [2]
7. How does promoter orientation affect the direction of transcription? [2]
8. A plot of V/[S] versus V is generated for an enzyme catalysed reaction, and a straight line is obtained. Indicate the information that can be obtained from the plot. [3]
9. In response to hypoxia (lack of oxyeen), mammalian cells induce expression of group of genes. How will you identify the transcription factor regulating them? [3]
10. Which of the following mutational changes would you predict to be the most deleterious to gene function? Explain your answer. Rank them. [3]

    a) Insertion of a single nucleotide near the end of the coding sequence.

    b) Removal of a single nucleotide near the beginning of the coding sequence.

    c) Deletion of three consecutive nucleotides in the middle of the coding sequence.

    d) Deletion of four consecutive nucleotides in the middle of the coding sequence.

    e) Substitution of one nucleotide for another in the middle of the coding sequence.
11. Design a strategy to isolate a gene responsible for a metabolic defect from a genomic library. [3]
12. How would you use DNA sequencing to determine which of two similar bacterial strains carries an antibiotic resistance gene? [3]
13. A researcher wants to study the inheritance of methylation marks across generations. Suggest a strategy [3]
14. How do the small and large ribosomal subunits assemble at the beginning of translation? [3]
15. Describe the sequence of molecular events at the replication fork, including the roles of different enzymes. Draw the replication fork, label the relevant regions, and explain their functions. [5]

16. How do cells detect and regulate the proper bipolar attachment of chromosomes during mitosis to ensure accurate chromosome segregation? [5]

17. What molecular mechanisms regulate the periodic switch-like activation and inactivation of Cdks? [5]

18. Look at the diagram of a ribosome translating an mRNA. [5]

    a) Label the tRNAs, anticodon, codons, peptide, and the mRNA.

    b) Describe the sequence of events that happens when the next tRNA enters the ribosome.

    c) Redraw the diagram to show the positions of tRNAs and the peptide chain immediately after the next peptide bond forms.