2021

MICROBIOLOGY — HONOURS

Paper : CC-7

Full Marks : 50

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer ***question no.* 1** and ***any three*** from the rest.

1. Answer ***any ten*** questions : 2×10

(a) What is the role of H1 histone in chromatin structure?

(b) Analysis of a DNA sample from a bacterium shows 20% of the bases are T. What percentage is G? Explain the rule from which you deduced your answer.

(c) Name any two modified bases found in tRNA.

(d) Write down two unique features of the mitochondrial DNA.

(e) What is C-value paradox?

(f) What role does DNA gyrase play in bacteria?

(g) What is meant by semi-discontinuous DNA replication?

(h) What function does DNA ligase have in DNA replication?

(i) Name a disease associated with defects in nucleotide excision repair.

(j) What are the essential components of a bacterial promoter?

(k) What are wobble base pairs? How are they significant?

(l) What is meant by melting temperature of DNA? Write down its significance.

(m) What will be the effects of partial RNase and DNase treatments on bacterial nucleoid structures?

(n) How does mismatch repair system recognise newly synthesized daughter DNA strands during replication?

(o) What is catabolite repression? — Explain with the help of an example.

2. State whether the following statements are true or false with proper justification. 2×5

(a) Each time the genome is replicated, half of the newly synthesized DNA is made discontinuously.

(b) The σ subunit is a permanent component of RNA polymerase from *E. coli*, allowing it to initiate at appropriate promoters in the bacterial genome.

(c) Exons in pre-mRNA are spliced to give rise a single mRNA transcript.

(d) The 3' end of a mRNA molecule specifies the N-terminal end of a polypeptide.

(e) Genome size always correlates linearly with the organism complexity.

3. (a) What will be the fate of a replicating DNA in *E. coli* if the following proteins are mutated?

(i) Dna A

(ii) DNA Liguse

(iii) Dna B

(iv) RNA polymerase.

(b) Why uracil is never incorporated in DNA though both TTP and dUTP are present in cell?

(c) Compare and comment on the processivity of bacterial DNA Polymerase I and III with explanations. (1×4)+3+3

4. (a) Describe briefly how DNA footprinting helps to identify protein binding site on DNA. Answer with the help of a schematic representation.

(b) What is abortive transcription?

(c) What is the difference between attenuator and terminator sequence?

(d) Indicate with proper justification whether the *lac* operon will be constitutive, inducible or non-inducible for the following partial diploids.

(i) $F'I^+O^+Z^+Y^+/I^+O^cZ^+Y^-$

(ii) $F'I^sO^+Z^+Y^+/I^-O^+Z^+Y^+$

(iii) $F'I^-O^+Z^+Y^-/I^+O^cZ^+Y^+$ 3+2+2+3

5. (a) Explain how tyrosyl-tRNA synthetase distinguishes tyrosine from phenylalanine to avoid mischarging?

(b) Explain how t-RNA charging occurs in prokaryotes.

(c) Methionine is one of the two amino acids with only one codon. How does the single codon for Methionine specify both the initiating residue and interior Methionine residues of polypeptides synthesized by *E. coli*?

(d) EF-Tu, a member of G-protein family, plays a crucial role in the elongation process of translation. Suppose that a slowly hydrolyzable analog of GTP were added to an elognating system. What would be the effect on rate of protein sythesis?

(e) Mention two differences between prokaryotic and eukaryotic translation. 2+2+2+2+2

6. Write short notes on ***any four.*** Give suitable diagrams wherever needed. 2½×4

(a) tRNA structure

(b) Rolling circle replication

(c) 5'cap of eukaryotic mRNA

(d) Role of Elongation Factor G (EF-G) in translation

(e) Specificity of mating type switching in haploid yeast cell.

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