

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. FOURTH SEMESTER EXAMINATION, AUGUST 2021

SECOND YEAR [BATCH 2019-22]

ZOOLOGY (HONOURS)

PAPER : VIII [CC8]

Date : 07/08/2021

Time : 11 am – 1 pm

Full Marks : 50

Answer all the questions:

Group A

1. a) A culture of *Escherichia 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)
- b) State the reasons behind the formation of major and minor groove in DNA.
- c) A topoisomer of covalently closed supercoiled circular plasmid DNA of 10.4 kb pair exhibiting the writhing number of four. What are the linking number of relaxed and supercoiled form? [2+2+1]
2. a) How can the genome size of any organism be known from the Cot analysis? (Given, *E.coli* $\text{Cot}_{1/2} = 4$ and genome size = 4.6 Mb)
- b) How is the processivity of DNA polymerase III of *E.coli* altered during replication?
- c) RNA undergoes alkaline hydrolysis but not DNA. Why? [2+2+1]

Group B

3. a) Compare transposons and retrotransposons.
- b) What is Hybrid Dysgenesis?
- c) What are the autonomous and non-autonomous controlling elements described by Barbara McClintock? [2+2+1]

Group C

4. a) Explain how the N-terminal region (1.1) of the Sigma factor facilitates to form an “Open Complex” during transcription in bacteria.
- b) What will be the consequence if the -35 region lacks in a bacterial promoter? [4+1]

Group D

5. How do the DNA methylation and acetylation impact gene expression and cellular functioning? What are the CpG islands and why is it important? [3+2]
6. a) How can you detect and differentiate between the alpha and beta thalassemia?
- b) How can you use the concept of inducible lac operon concept in regulation of gene expression in medical research? [2.5+2.5]

Group E

7. a) Differentiate between BER and NER.
b) How does the basic level of SOS repair system initiates?
c) State the role of FEN1 in long patch BER. [2+2+1]

Group F

8. a) What is alternative splicing?
b) Draw and describe the formation of eukaryotic transcription preinitiation complex?
c) How eukaryotic RNAs are protected at their 5' and 3' ends? [1+3+1]
9. a) Schematically draw and describe the cloverleaf structure of an initiator tRNA.
b) Comment on the nature of the genetic code. [3+2]
10. a) Describe the formation of the Holliday junction.
b) What are amber, ochre and opal? [3+2]

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