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Roll No. | | | | | | | | | | | |

S. No. of Question Paper : **5661**

Unique Paper Code : **2492012403**

Name of the Paper : **Gene Organization, Replication and Repair**

Name of the Course : **B.Sc. (Hons.) Biochemistry (NEP)**

Semester : **IV**

Duration : **2 Hours** Maximum Marks : **60**

(Write your Roll No. on the top immediately on receipt of this question paper.)

There are *six* questions in this question paper.

Attempt *four* questions in all.

All questions carry equal marks.

Question No. **1** is compulsory.

1. (*a*) Comment on the following :

   (*i*) Prokaryotes have a special type-II topoisomerase that introduces, rather than removes, negative supercoils.

   (*ii*) Methylated cytosines are hotspots for mutations.

   (*iii*) There is an inverse relationship between organism complexity and gene density.

   (*iv*) RNase H plays a critical role in DNA replication.

   (*v*) DNA polymerase I is no suitable for replication of *E. coli* genome.

P.T.O.

(*b*) Name the following :

(*i*) Decondensed/relaxed form of genome

(*ii*) Enzyme that replicates the ends of eukaryotic chromosomes.

(*iii*) Two ends of the broken DNA are joined to each other by misalignment between single strands protruding from the broken ends.

(*iv*) Sequences that are hotspots for recombination in *E. coli.*

(*v*) Replication inhibitor used as an antiviral agent. 10,5

2. (*a*) (*i*) What do you understand by superhelical density ? Discuss with respect to positive and negative supercoiling of DNA.

(*ii*) Discuss the Trombone model for coordinating replication.

(*iii*) Elucidate a biological role of site-specific recombination.

(*b*) Discuss the role of the following proteins in DNA replication (any *two*) :

(*i*) Topoisomerase

(*ii*) Helicase

(*iii*) Primase

(*c*) Elaborate on the mode of action of these drugs :

(*a*) Cisplatin

(*b*) Cytosine Arabinoside

(*c*) 5-FU

(*d*) Azidothymidine. 9,2,4

3. (*a*) What is the replicon model of Replication Initiation ? Discuss the key features of initiator sequences of Prokaryotes.

(*b*) Predict whether the loss of the following *E. coli* genes would lead to lethality. Justify your answer :

(*i*) dnaB

(*ii*) recBCB

(*iii*) ruvC.

(*c*) A relaxed circular double stranded DNA molecule of 1600 bp is in solution where it has 10 bp per turn. Calculate the linking number (L_0) of this DNA. A DNA topoisomerase introduces 12 negative supercoils in this DNA. What are the values of L, W and T ?

(*d*) What are split genes ? What are the advantages of split genes in the eukaryotic genome ? 4,4,3,4

4. (*a*) Explain the following :

(*i*) Direct reversal of DNA damage

(*ii*) The proper structure of the double helix depends on an aqueous environment, but DNA undergoes spontaneous damage from the hydrolytic action of water.

(*b*) It is likely that the linear genomes might get shorter after every round of replication. How is this problem overcome in eukaryotes ?

(*c*) What are transposable elements ? Comment on different classes of transposable elements. 6,5,4

5. (*a*) Differentiate between the following :

(*i*) Type-I and Type-II topoisomerases

(*ii*) B-DNA and Z-DNA.

(*b*) Elaborate the key steps in homologous recombination, eleborating the functions of different participating proteins in a prokaryote.

(*c*) Explain how the mismatch repair system operates in prokaryotes.

6,5,4

6. (*a*) Write short notes on the following :

(*i*) Chi sites

(*ii*) SOS response

(*iii*) Ames Test

(*b*) What is a replication fork ?. Draw a well labelled diagram of the same, highlighting the function of the major proteins. 9,6