CS/B.Tech/BT (NEW)/SEM-4/BT-401/2013

2013

MOLECULAR BIOLOGY

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

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

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

i) In the Hershey and Chase experiment designed to determine the molecule of heredity, what was radiolabeled with ^{35}S ?

a) DNA b) Protein

c) RNA d) both (a) & (b).

ii) To help elucidate the double helix structure of DNA, ... used information provided by ..... that certain bases are always present in a 1 : 1 ratio.

a) Watson and Crick, Franklin

b) Watson and Crick, Meselson and Stahl

c) Meselson and Stahl, Chargaff

d) Watson and Crick, Chargaff.

iii) During DNA synthesis, the leading strand is synthesized ..... and the lagging strand is synthesized ..... .

a) 3’ to 5’ ; 5’ to 3’ b) 3’ to 5’ ; 3’ to 5’

c) 5’ to 3’ ; 3’ to 5’ d) 5’ to 3’ ; 5’ to 3’.

iv) Which of the following sugars is found in RNA ?

a) 2-deoxy Ribose b) 3-deoxy Ribose

c) D-Ribose d) D-Xylulose.

v) All are nucleosides *except*

a) Cytosine b) Guanosine

c) Inosine d) Adenosine.

vi) What is added to the 3'-end of many eukaryotic tRNAs after transcription ?

a) Introns

b) Cap of modified G nucleotide

c) Poly A tail

d) Trinucleotide CCA

vii) HRE is a

a) Piece of DNA b) Piece of mRNA

c) Protein d) Piece of rRNA.

viii) Which of the following DNA is a Left handed helical structure ?

a) A – DNA b) Z – DNA

c) B – DNA d) all of these.

ix) There is more than one DNA Polymerases that are identified in E. coli; but one of these polymerases has replicative function. Identify this DNA polymerase from the following :

a) DNA polymerase I b) DNA polymerase II

c) DNA Polymerase III d) Kleno Polymerase.

x) Enzyme system responsible for post-transcriptional modification of hnRNA is

a) Ribosome b) Ribozyme

c) Splisosome d) Mesosome.

xi) Lac operon genes of *E. coli* will be activated when the

bacteria are grown in

a) High glucose, low lactose

b) High lactose, low glucose

c) Low glucose, low lactose

d) All of these.

xii) Okazaki fragments are formed in

a) the synthesis of mRNA

b) the synthesis of protein

c) the synthesis of leading strand of DNA

d) the synthesis of lagging strand of DNA.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Write the functions of the following enzymes : 5 × 1

(i) Topoisomerase, (ii) DNA ligase, (iii) β sliding clamp,

(iv) Helicase and (v) Primase.

3. What is genetic code ? What are the characteristics of genetic code ? Discuss the universality of genetic code. 1 + 2 + 2

4. What do you mean by telomere ? How is this synthesized ? Describe this process in short. 1 + 1 + 3

5. State briefly the steps through which a eukaryotic mRNA processed before maturation.

6. What is SOS repair ? Describe the process of SOS repairing in short. 1 + 4

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. The *E. coli* chromosome contains 4.64×10^6 bp.

a) How many turns of the double helix must be unwound

during replication of the *E. coli* chromosome ?

b) From the given data, how long would it take to replicate the *E. coli* chromosome at 37°C, if two replication forks proceeded from the origin ? Assume replication occurs at a rate of 1,000 bp/s. Under some conditions *E. coli* cells can divide every 20 min. How might this be possible ?

c) In the replication of the *E. coli* chromosome, about how many Okazaki fragments would be formed ? What factors guarantee that the numerous Okazaki frogments are assembled in the correct order in the new DNA ?

d) Write all the steps of DNA replication of *E. coli* with labeled diagram. 2 + (2 + 2) + (2 + 2) + 5

8. a) A segment of DNA in *E. coli* has the following sequence of nucleotide pairs :

\+ 1

5’ TATAATGACGTTACCCGACATAGCTACGATCACGATAAGCGACATAG 3’

3’ ATATTACTGCAATGGGCTGT ATCGATGCTACTGC TATTCGCT GTATC 5’

When this segment of DNA is transcribed by RNA polymerase, what will be the sequence of nucleotides in the RNA transcript ?

b) What is meant by abortive initiation ? Why it happens in prokaryotes ?

c) Give an account of structure and function of different subunits of *E. coli* RNA polymerase.

d) What is the role of σ factor in prokaryotic transcription initiation ?

e) Describe the two different modes of transcription termination in *E. coli.* 2 + 2 + 4 + 3 + 4

9. a) What is operon ? Name two inducers of lac operon.

What are the full forms of "Z", "Y" & "a" genes for lacoperon ?

b) Discuss negative control of transcription with special

reference to lactose operon. 7 + 8

10. Explain the mechanism of recycling of EF-Tu during bacterial

protein synthesis ? Describe the structure of Nucleosome.

What happens when nucleosome is treated with Micrococcal

nuclease and the digest is run on agarose gel ? Describe the

role of Rifampicin and Puromycin. 5 + 3 + 3 + 2 + 2

11. a) Describe the process of assembly of eukaryotic

transcription initiation complex.

b) What is the significance of CTD of RNA pol II in the

transition of the enzyme from the initiation to elongation

phase ?

c) Describe the molecular mechanism of eukaryotic mRNA

modification at the 5' and 3' ends. Why is this necessary

in eukaryote but not in prokaryote ?

d) Mention the mechanism of transcription inhibition by

the following :

Rifampicin, α-amanitin.

4 + 2 + (4 + 2) + 3