(iv) All of the following are examples of housekeeping genes except ____.
(a) beta galactosidase (b) ribosomal protein genes,
(c) RNA polymerase (d) rRNA genes.

(v) Which is NOT a DNA-binding domain?
(a) leucine zipper (b) helix-turn-helix,
(c) zinc finger (d) intron-exon-intron.

(vi) Order the following events of eukaryotic mRNA synthesis:
A: 3'-polyadenylation
B: termination
C: splicing
D: 5'-capping
E: initiation
(a) ABCDE; (b) BCDEA; (c) DEBCA; (d) EDBAC.

(vii) Genes coding for *E. coli* RNA polymerase β subunit is
(a) rpo A (b) rpo B (c) rpo C (d) rpo D.

(viii) Ribozyme is
(a) Ribosomal RNA (b) Catalytic RNA
(c) Type of lysozyme (d) RNA polymerase.

(ix) Translation in animal cells takes place
(a) in the cytoplasm only
(b) in the nucleus only
(c) in the cytoplasm and the mitochondrial matrix
(d) in the nucleolus only

(x) Which of the following statements is/are correct?
(a) Telomeres become shorter as cells age.
(b) Somatic cells have very little telomerase.
(c) Immortal cancer cell lines always have high levels of telomerase.
(d) Telomeres become longer as cells age.

Group - B

2. (a) Describe the Nucleotide excision repair system in *E.coli,*

(b) What is Xerodermapigmentosum? Why does it occur?

(b) Define the following with labelled diagram:
(i) silencer, (ii) enhancer, (iii) insulator.

(c) What is HRE. Describe the role of HRE in eukaryotic gene regulation.

1 + 5 + 6 = 12

9. (a) Write **short notes** on **any three** of the following:
(i) antitermination in lambda phage,
(ii) gene regulation in eukaryote by looping model,
(iii) gene silencing.
(iv) the regulation of trp operon.

4 × 3 = 12

B.TECH/BT/4TH SEM /BIOT 2203/2016
2016

MOLECULAR BIOLOGY
(BIOT 2203)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

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

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following: **10 x 1=10**

   (i) Which of the following reactions is required for proofreading (i.e. correcting replication errors) during DNA replication by DNA polymerase III?
   (a) 3'- 5' exonuclease activity (b) 5'-3' exonuclease activity
   (c) 3'- 5' endonuclease activity (d) 5'-3' endonuclease activity.

   (ii) How does the mismatch repair system distinguish between the parental (i.e. correct) DNA strand and the newly synthesised strand containing the mismatched base?
   (a) thymine in the parental strand of the helix is methylated at GATC.
   (b) thymine in the new strand of the helix is methylated at GATC.
   (c) guanine in the parental strand of the helix is methylated at GATC.
   (d) guanine in the new strand of the helix is methylated at GATC.

   (iii) Which of the following is the name of the human genetic disorder resulting from defects in nucleotide excision repair?
   (a) hereditary nonpolyposis colorectal cancer (HNPCC),
   (b) xeroderma pigmentosum (XP)
   (c) lynch syndrome
   (d) diabetes.

(c) What is end problem of DNA replication and how it occurs?

(d) In what types of cells end problem of DNA replication is absent? By what mechanism the end problem is solved in these types of cells?

3 + 2 + 3 + 4 = 12

3. (a) Describe the mechanism of termination of DNA replication in *E.coli*.

(b) Describe the following with a labeled diagram**:**
(i) mismatch repair mechanism of damaged DNA;
(ii) replication of mtDNA

(c) The *E. coli* chromosome contains 4.64 X10^6 bp. In the replication of the *E. coli* chromosome, about how many Okazaki fragments would be formed? What factors guarantee that the numerous Okazaki fragments are assembled in the correct order in the new DNA?

3 + 6 + (2+1) =12

Group - C

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

+1
5′ TATAATGACGTTACCCGACATAGCTACGATGACGATAAGCGACATAG 3′
3′ ATATTACTGCAATGGGCTGT ATCGATGCTACTGC TATTCGCT GTATC 5′

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

(b) What is the +1 site?

(c) Show the conserved sequence and mention its significance in prokaryotic transcription initiation.

(d) Describe the two different modes of transcription termination in *E. coli*.

2 + 2 + 2 + 3 + 3 = 12

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5. (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'end. Why this is necessary? Why this is not needed in prokaryote?

5 + 3 + 4 = 12

Group - D

6. (a) What is genetic code? Briefly mention its characteristics.

   (b) (i) Calculate the number of nucleotides that will be present in an mRNA coding sequence specifying a single polypeptide with a molecular mass of 27 kDa.
   (ii) What is the smallest number of molecules of ATP and GTP consumed in the synthesis of a 300 amino acid residue protein, starting from amino acids? Assume that the hydrolysis of PPi is equivalent to the hydrolysis of ATP for this calculation.

   (c) State and explain Wobble hypothesis.

(1+3) + (2+3) + 3 = 12

7. (a) What are the common post–translational modification of eukaryotic proteins?

   (b) Write the detailed molecular mechanism for prokaryotic translation initiation. Mention the role of different translational factors in it.

   (c) Where it differs from eukaryote?

3 + 4 + 3 + 2 = 12

Group - E

8. (a) Describe the following with labelled diagram in prokaryote:
   (i) negative regulation of gene expression;
   (ii) positive regulation of gene expression.

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