



Name :

Roll No. :

Invigilator's Signature :

**CS/M.TECH (BT) INT.PhD (MOL.BIO./MICRO.BIO)/
SEM-1/MBT/PHMB/PHMC-103/2011-12
2011
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.*

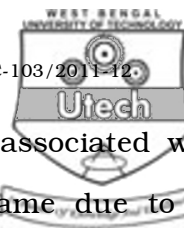
GROUP – A

(Objective Type Questions)

1. Answer *all* questions : 10 × 1 = 10

A) Choose the correct alternatives for the following :

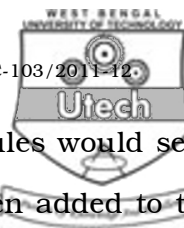
- i) Which is a characteristic of a rho-independent terminator ?
 - a) rho protein
 - b) Hairpin loop followed by a string of U's
 - c) Hairpin loop without a string of U's
 - d) A string of U's without a hairpin loop.



- ii) The gene prolactin in turkeys is associated with maternal behaviour. It has its name due to its similarity to the mammalian prolactin gene, also associated with maternal behaviour. The relationship between the turkey and the mammalian genes is likely to be one of
- a) identity over the entire genomic sequence
 - b) homology over the entire genomic sequence
 - c) homology among introns
 - d) homology among exons.
- iii) In genetics, suppression of a mutation refers to
- a) restoration of original phenotype due to a second mutation
 - b) restoration of original DNA sequence by mutation
 - c) prevention of expression of the mutant gene by metabolic regulation
 - d) appearance of the recessive phenotype in a heterozygous diploid
 - e) inactivation of the gene by methylation.



- iv) Which of the following processes leads to the formation of polytene chromosomes?
- a) Nondisjunction of chromatids during meiosis
 - b) Recombination between adjacent chromosome segments
 - c) Sister chromatid exchange
 - d) Inactivation of one chromosome of each homologous pair
 - e) Repeated replication without the separation of chromatids.
- v) An *E. coli* strain lacking DNA polymerase would be deficient in DNA
- a) Methylation
 - b) repair
 - c) splicing
 - d) degradation
 - e) transcription.
- vi) Which of the following mutations would be likely to have the largest effect on the protein involved?
- a) A missense mutation of the last amino acid of the protein.
 - b) A nonsense mutation of the 8th amino acid (assuming the protein is more than 200 amino acids long)
 - c) A single base-pair change in an intron.
 - d) A single base-pair change after the stop codon.
 - e) None of these.



vii) Which of the following DNA molecules would serve as template for DNA synthesis when added to this solution ?

- a) A single-stranded closed circle
- b) A single-stranded closed circle base paired to a shorter linear strand with a 3' -terminal hydroxyl
- c) A single-stranded closed circle base paired to a shorter linear strand with a 3' -terminal phosphate.
- d) A double-stranded closed circle.
- e) A blunt-ended, double stranded linear molecule with a 3' -hydroxyl at each end.

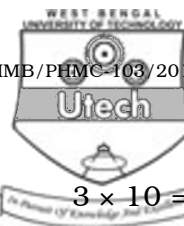
B) State *True* or *False* :

viii) Melting point or T_m is the temperature at which the entire DNA is denatured.

ix) Another name for replisome is replication fork.

C) Answer very briefly :

x) Name the most abundant protein associated with eukaryotic DNA.



GROUP – B

Answer any *three* of the following. $3 \times 10 = 30$

2. a) In humans and other animals, cellular senescence has been attributed to the shortening of telomeres. Explain. 5
- b) Differentiate between replicator and initiator during replication. $2\frac{1}{2}$
- c) List some of the important cellular functions associated with repetitive DNA. $2\frac{1}{2}$
3. a) What are the different types of modifications of the histone *N*-terminal tails that take place to alter DNA accessibility ? Explain in brief how these modifications are associated in transcriptional silencing. 4
- b) What is the biological importance of negative supercoiling of DNA in cells ? 2
- c) Explain very briefly how eukaryotic replication is tightly regulated to ensure a single round of replication during each cell cycle. 4
4. a) If the *lacI* gene is deleted, what will be the effect on the lac operon ? 1
- b) What is *lac* operon ? What would be the fate of the operon if high concentration of lactose and a low concentration of glucose are present simultaneously ? 6
- c) What is DNase Footprinting ? 3



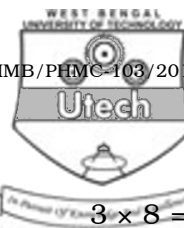
5. a) Explain why *Trp* operon is an example of negative regulation of gene expression. 5
- b) Elucidate the roles of *Rec A* and *Lex A* proteins in inducing SOS response in bacteria. 5
6. a) Genome size does not correlate with organismal complexity. Explain with special reference to C-value paradox. 5
- b) Briefly discuss how the arabinose operon is controlled by a positive and negative regulatory system. 5
7. a) Alternative patterns of gene expression control lytic and lysogenic growth of bacteriophage lambda (λ). Elaborate this statement giving special emphasis to the λ repressors. 5
- b) Eukaryotic activators have separate DNA binding and activating functions. Describe the roles of yeast *Gal4* protein in this context. 5

GROUP – C

SECTION – I

Answer any six of the following. 6 × 1 = 6

8. What is Philadelphia chromosome ?
9. What is missense mutation ?
10. What is the function of Shine-Dalgarno sequence ?
11. What is isoaccepting *t*-RNA ?
12. What is catalytic RNA ?
13. What is meant by RNA stability ?
14. What is oncogene ?



SECTION – II

Answer any *three* of the following. $3 \times 8 = 24$

15. State the important differences between post-transcriptional modifications of *m*RNA, *t*RNA and *r*RNA. 8
16. What is wobble hypothesis ? Explain the mechanism of deciphering of genetic code. 1 + 7
17. Illustrate and explain the mechanism of initiation, elongation and termination in protein synthesis. 8
18. What is the difference between tumour suppressor gene and oncogene ? Illustrate the pathways of action of p53 gene. 2 + 6
19. What is transposon ? What are the types of transposons ? Explain the molecular mechanism of transposon in *Tn3* element. 1 + 1 + 6
20. What is tautomerism ? Design an experiment to prove that X-rays produce mutation. 2 + 6

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