2015

BIOTECHNOLOGY

[**Honours**]

PAPER – III

Full Marks : 90

Time : 4 hours

The figures in the right-hand margin indicate marks

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

Illustrate the answers wherever necessary

GROUP – A

[*Marks* : 30]

Answer any **two** questions from the following : 15×2

1. (*a*) What is Ori C ? Why is it important for replication ? 4

(*b*) Why is it necessary to regulate the events of DNA replication ? 5

(*c*) If the size of *E coli* DNA is with $4{\cdot}8\times10^6$ base pair, how long would it take to replicate this DNA at the rate of 1000 bases/second ? 3

(*d*) Why the mutations in following genes are lathal to *E coli* : DNA B, DNA G, DNA A ? 3

2. (*a*) Under which specific situation, following repair system would remove damage from DNA ? 6

(*i*) NER system

(*ii*) BER system

(*iii*) Mismatch repair system.

(*b*) Why N-terminal tails of histones are important in regulating gene espression ? 3

(*c*) Mitochondria and Chloroplast have evolved from their free living ancestors as endo-symbiont. Justify this hypothesis by analyzing their genomes. 3

(*d*) "The number of genes has not increased proportionately with the increased genome size of organism" – Justify the statement. 3

3. (*a*) Distinguish between pseudo dominance and codominance. Cite examples. 2 + 2

(*b*) Describe different blood groups under 'ABO' system in human being with an interpretation on their genotypes. 4

(*c*) What is 'bead theory' of inheritance ? How does it differ from pseudoallele concept ? 3 + 2

(*d*) Describe Mendel's law of independence. 2

4. (*a*) Distinguish between complete and incomplete linkage. 2

(*b*) The result of a test cross considering three recessive mutants *m*, *n* and *o* in Drosophila are given below :

Phenotype	Number of progenies
m, *n*, *o*	280
wild	300
m, *o*	150
n	130
m	75
o, *n*	65
	Total = 1000

Calculate the map distance between the genes *m*, *n* and *o* on the chromosome. Which expected classes are missing and why ? 4 + 2

GROUP – B

[*Marks* : 40]

Answer any **five** questions from the following : 8 × 5

5. (*a*) What are autotrophs and heterotrops. 3

(*b*) Describe briefly the method for the detection of Biochemical mutants in Neurospora. 5

6. (*a*) What is Okazaki fragment ? 3

(*b*) Mention the role of DNA repair system in maintaining the genomic stability of Eukaryotic system. 5

7. (*a*) You have inserted human insulin cDNA in the cloning vector pBluescript II and transformed the clone into *E.coli* but insulin was not expressed. Explain why. 4

(*b*) Briefly summarise the role of epigenetic control of gene regulation in Eukaryotes. 4

8. (*a*) What is the basic difference between Dideoxy sequencing methods and Maxam Gilbert sequencing Method. 4

(*b*) How is the presence of a gene identified in a given sequence ? 4

9. (*a*) Describe the structure of t-RNA and its role in protein synthesis. 3 + 2

(*b*) State the role of telomerase in preventing chromosome shortening. 3

10. (*a*) Why DNA strands are called antiparallel ? 2

(*b*) Summarise briefly the role of helicase, primase and topoisomerase in replication of DNA. 2 + 2 + 2

11. (*a*) What is the role of glucose in regulating lac operon ? 3

(*b*) What will be the situation in the following mesozygotes for the expression of lac gene *z* in presence and absence of lactose in the culture medium. $2\frac{1}{2} + 2\frac{1}{2}$

(*i*) $i^+ \ O^c \ z^- \ / \ i^- \ O^+ \ z^+$

(*ii*) $i^s \ O^+ \ z^- \ / \ i^+ \ O^+ \ z^+$

12. (*a*) What are snurps ? State their role in splicing. 2 + 4

(*b*) What are the major components of nucleosome core particle ? 2

13. (*a*) What are retrotransposons ? Describe the structure of IS element. 2 + 3

(*b*) What is Holliday structure ? State its importance in molecular recombination. 1 + 2

GROUP – C

[*Marks* : 20]

Answer any **five** questions from the following : 4 × 5

14. What is gain of function and loss of function in mutation ? 4

15. Discuss the expression of human haemoglobin genes during development. 4

16. What is RNAi ? 4

17. Describe the mechanism of Genomic imprinting. 4

18. What is SINEs and LINEs ? 4

19. (*a*) What is split gene ? 2

(*b*) What are 'gene clusters' ? 2

20. What are c-value paradox and cot-curve ? 2 + 2

21. (*a*) What is a 'DNA vaccine' ? 2

(*b*) What are ribozymes ? 2
