UG/II/BIOT/H/III/17 (Old)

2017

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

[OLD SYLLABUS]

GROUP – A

[*Marks* : 30]

Answer any **two** of the following : 15 × 2

1. (*a*) Mendel self-fertilized dihybrid plants (RrYy) with round and yellow seeds and got a 9:3:3:1

ratio in the F2 generation. As a test of Mendel's hypothesis of independent assortment, predict the kinds and numbers of progeny produced in testcrosses of these F2 offspring.

(*b*) True-breeding flies with long wings and dark bodies are mated with true-breeding flies with short wings and tan bodies. All the F1 progeny has long wings and tan bodies. The F1 progeny is allowed to mate and produce : 44-tan, long; 14-tan, short; 16-dark, long; 6-dark, short flies. What is the mode of inheritance ? 9 + 6

2. A bacterial strain that is lys^+ his^+ val^+ is used as a donor, and lys^- his^- val^- as the recipient. Initial transforms are isolated on minimal medium histidine+ valine+. 2 + 2 + 2 + 3 + 3 + 3

(*a*) What genotypes will grow on this medium ?

(*b*) These colonies are replicated to minimal medium+ histidine, and 75% of the original colonies grow. What genotypes will grow on this medium ?

(*c*) The original colonies are also replicated to minimal medium+ Valine, and 6% of the colonies grow. What genotypes will grow on this medium ?

(*d*) Finally, the original colonies are replicated to minimal medium. No colonies grow. From this information, what genotypes will grow on minimal medium+ histidine and on minimal medium + valine ?

(*e*) Based on this information, which gene is closer to lys ?

(*f*) The original transformation is repeated, but the original plating is on minimal medium lysine+ histidine+. Fifty colonies appear. These colonies are replicated to determine their genotypes, with these results :

$val^+ his^+ lys^+ = 0$, $val^+ his^- lys^+ = 37$, $val^+ his^+ lys^- = 3$

Based on all the results, what is the most likely gene order ?

3. (*a*) Describe the gene regulation in eukaryotic organisms by DNA methylation.

   (*b*) What is Gene family and pseudogenes ?

   (*c*) Describe the methods of Nucleosome organization in higher organisms. 3 + (3 + 3) + 6

4. (*a*) What is operon ?

   (*b*) Distinguish between repressible system and inducible system of gene regulation. Why lac operon is considered as an inducible system ?

   (*c*) Mention the positive and negative regulator of Lactose operon. 2 + (4 + 3) + 6

GROUP – B

[*Marks* : 40]

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

5. What is Okazaki fragment ? How replication fork occurs during DNA replication in *E. coli* ? Describe the termination process of replication in *E. coli*. 2 + 3 + 3

6. Describe the features of Genetic code. Briefly describe the activation of amino acids during the initiation of translation. 3 + 5

7. (*a*) What is Expressivity and Pleiotropism ?

   (*b*) What is epistasis ? Give one example of Dominant epistasis. (2 + 2) + (2 + 2)

8. (*a*) Write down the difference between Back cross and Test cross with examples.

   (*b*) A, B, and C are independently assorting Mendelian factors (genes) controlling the production of black pigment in a rodent species. Alleles of these genes are indicated as a, b, and c, respectively. Assume that A, B, and C act in this pathway :

$$\text{colorless} \xrightarrow{\text{Control by A}} \text{red}$$

$$+ \xrightarrow{\text{Control by C}} \text{black}$$

$$\text{colorless} \xrightarrow{\text{Control by B}} \text{red}$$

A black AA BB CC individual is crossed with a colorless aa bb cc to give black F1 individuals. The F1 individuals are selfed to give F2 progeny.

(*i*) What proportion of the F2 generation is colorless ?

(*ii*) What proportion of the F2 generation is red ? 3 + (2 + 3)

9. (*a*) Explain role of DNA helicase and single strand binding protein in DNA replication.

(*b*) Define transcription and what is the role of sigma factor during initiation of translation. 4 + 4

10. (*a*) What are the essential features of a vector ?

(*b*) What is the Ti plasmids ? Describe the TI mediated gene transfer in the Plant. 3 + (2 + 3)

11. (*a*) What is multiple alleles and Pseudoalleles ?

(*b*) Comment on formation of pysimidine dimer. (2 + 2) + 4

12. Explain the role of following factors on translation : 2 + 2 + 2 + 2

(*a*) IF1
(*b*) IF2
(*c*) IF3
(*d*) EF-Tu

13. Write short notes on : 2 + 2 + 2 + 2

(*i*) Southern blot
(*ii*) pBR322
(*iii*) *Erythroblastic featalis*
(*iv*) Cosmid vectors.

GROUP – C

[*Marks* : 20]

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

14. Write the procedure of gene cloning. 4

15. Differentiate between Blunt ends and sticky ends of a cloning vector. Write the process of cDNA library preparation and its application. 1 + 3

16. Distinguish between rho dependent and rho independent methods of termination in transcription. 4

17. What is DNA fingerprinting ? 4

18. Distinguish between Base excision repair and Nucleotide excision repair pathway in prokaryotic organisms. 4

19. Describe the importance of extrachromosomal genetic materials in plants. 4

20. Distinguish between Autoploidy and Alloploidy. 4

21. Distinguish between transversion and transition type of mutation. 4