

U.G. 3rd Semester Examination - 2021
Molecular Biology & Biotechnology
[HONOURS]

Course Code : MBBT-H-301-T-CCR-5

Full Marks : 40

Time : $2\frac{1}{2}$ 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.

1. Answer any **five** questions from the following:

$2 \times 5 = 10$

- a) What is meant by karyotype and idiogram?
- b) Explain the molecular basis underlying triple repeat expansion.
- c) How many barr bodies you may expect in the nuclei of human cells with karyotype XY and XXY?
- d) Delineate the characteristics of any of a model organism, which are required to be used in genetic experimentation.

- e) Distinguish between incomplete dominance and codominance.
- f) Provide karyotype annotation for Turner syndrome and Patau syndrome.
- g) What is genomic imprinting? What is the end product of deamination of 5-methyl cytosine?
- h) Distinguish between cistron and recon.

2. Answer any **two** questions: $5 \times 2 = 10$

- a) If a father and his son both have defective colour vision, is it likely that the son inherited the trait from his father. Explain your answer.
- b) Suppose that a mutation occurred in the SRY gene on human Y chromosome, knocking out its ability to produce TDF. Predict the sexual phenotype of an individual who carried this mutation and a normal X-chromosome. Explain your answer.
- c) If an individual with the genotype AaBb is test crossed, how many different phenotypes can occur in their progeny. Show the cross to prove your point.

- d) Flower colour in snapdragon shows incomplete dominance. Red (WW) and white (ww) true breeding varieties, when crossed, produces all pink flowers in F1 generation. The F1 plants are inter crossed and a total of 300 F2 plants are obtained. Compute the genotypic and phenotypic ratio that might be obtained in F2. Estimate the expected number of individuals in each phenotypic class. 3+2

3. Answer any **two** questions: 10×2=20

- a) Provide a pictorial depiction of the Ames Test for mutagenicity. What should you conclude if at the end of the experiment, you find the same frequency of revertants in the test and control plates? Explain your answer. 5+5
- b) Draw a pedigree to depict the pattern of mitochondrial inheritance in a three -generation family. Enumerate the salient features of extra chromosomal inheritance. Distinguish between homoplasmy and heteroplasmy. 5+3+2
- c) The genes C, M, P, S are linked. Crossover map distances determined by 2-point cross over are P – C = 7, S – M = 10, C – M = 8, S – C = 2 and P – S = 5. Determine the relative order of these

4 loci. If the crossover frequency between 2 genes α and β is 0.18, express the map distance in centimorgan. 8+2

- d) Translate the mRNA 5' – (+1) AUG – UCC – ACA – UGG – 3' into its corresponding polypeptide. If there is A → G base change at position 7, categorize the mutation in terms of nucleotide and amino acid substitution. If G → A change occurs at position 7, what might be the outcome? [Given codon UGG – Trp, ACA – Thr, UCC – Ser, AUG – Met, GCA – Ala, UGA – X]. 2+4+4