

2021

MICROBIOLOGY — HONOURS

Paper : DSE-B-1

(Inheritance Biology)

Full Marks : 50

The figures in the margin indicate full marks.

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

Answer **question no. 1** and **any three** questions from the rest.

1. Answer **any ten** questions :

2×10

- (a) Write down Mendel's principle of independent assortment.
- (b) What is the difference between incomplete dominance and co-dominance?
- (c) What is expressivity? Give example.
- (d) Define epistasis.
- (e) What do you mean by pseudoautosomal gene?
- (f) What is Barr body?
- (g) Differentiate between allopolyploid and autopolyploid.
- (h) Write down the cause of Down syndrome.
- (i) Define isochromosome.
- (j) What kind of pairing configuration would be observed in prophase of meiosis I in (i) an inversion heterozygote. (ii) a translocation heterozygote?
- (k) A woman with no history of colour blindness marries a colour blind man. What is the risk for this couple of having a child with colour blindness?
- (l) Define map unit. What is the centimorgan?
- (m) How does extra nuclear inheritance differ from nuclear inheritance?
- (n) What is philadelphia chromosome?
- (o) Differentiate between multiple alleles and pseudo-alleles.

2. (a) Criss-cross inheritance is shown by sex influence traits. — Justify the statement.

(b) How many chromosomes would be found in somatic cells of an allotetraploid derived from two plants one with $N = 7$ and the other with $N = 10$?

(c) Define dominant epistasis and duplicate recessive epistasis with appropriate example.

3+3+(2+2)

Please Turn Over

3. (a) A *Drosophila* female heterozygous for the recessive X-linked mutation w (for white eyes) and its wild type allele w^+ is mated to a wild type male with red eyes. Among the sons, half have white eyes and half have red eyes. Among the daughters, nearly all have red eyes, however a few have white eyes. Explain the observation.
- (b) The following three recessive genes are found in corn : 6+1 : brittle endosperm; $gl17$: glossy leaf; $rgdl$: ragged seedling A trihybrid of unknown origin is test crossed which produces the following offsprings—
- | | |
|---------------------------|------|
| Brittle, glossy, ragged : | 236 |
| Brittle, glossy : | 241 |
| Ragged : | 219 |
| Glossy : | 23 |
| Wild type : | 224 |
| Brittle, ragged : | 17 |
| Glossy, ragged : | 21 |
| Brittle : | 19 |
| Total : | 1000 |
- (i) If the genes are linked determine the relative order and map distances.
- (ii) Reconstruct the chromosome of the trihybrid.
- (iii) Is there any cross over interference? If yes, how much? 3+(3+2+2)
4. (a) What is cytoplasmic inheritance?
- (b) Why are some *Paramecium* called killer *Paramecium*?
- (c) Write down what you know about maternal effect.
- (d) Briefly explain the endosymbiotic theory. 3+2+3+2
5. (a) Genes a and b are X-linked and are located 7 m.u. apart on the X chromosome of *Drosophila*. A female of genotype $[a^+b / ab^+]$ is mated with a wild type $[a^+b^+ / y]$.
- (i) What are the probability that one of her sons will be either a^+b^+ or ab^+ in phenotype?
- (ii) What is the probability that one of her daughters will be a^+b^+ in phenotype?
- (b) F₂ plants segregate $\frac{3}{4}$ coloured : $\frac{1}{4}$ colourless. If the colour-plant is picked at random and selfed, what is the probability that both coloured and colourless plants will be seen among a large number of its progeny?
- (c) An individual with Turner syndrome would be expected to have how many Barr bodies in the majority of cells? Explain with reason. 4+3+3
6. (a) Describe Holliday model with schematic representation.
- (b) Discuss the role of Rec A protein in genetic recombination.
- (c) What do you mean by karyotyping? Write down any two applications of the method.
- (d) What is microsatellite DNA? Elaborate with example. 3+2+3+2
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