

**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) F<sub>2</sub> 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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