

Group - E

8. (a) What do you mean by genetic drift?
- (b) Cystic fibrosis is a recessive trait disorder with a frequency of 1 in 2500. Calculate the frequency of heterozygotes.
- (c) Grain lengths of two varieties of rice are given below. Calculate the mean, standard error and co-efficient of variation of grain length of two varieties.

Variety A		Variety B	
Grain length (mm)	No of grain	Grain length (mm)	No of grain
9-11	3	9-11	0
12-14	5	12-14	8
15-17	9	15-17	8
18-20	3	18-20	4

$$2 + 2 + 8 = 12$$

9. (a) Prove that the allele frequency remains constant throughout the generations in an ideal population.
- (b) Assuming that half the population are consumers of rice so that the chance of an individual being a rice consumer is $\frac{1}{2}$ and assuming that 100 investigations each take 10 individuals to see whether they are rice consumers. How many investigations would you expect to report that three people or less were consumers?
- (c) The probability that a person A who is now 25 years old, lives for another 30 years is $\frac{2}{5}$; and the probability that the person B who is now 45 years old lives for another 30 years is $\frac{7}{16}$. Find the probability that at least one of these persons will be alive for another 30 years hence.

$$4 + 4 + 4 = 12$$

**GENETICS
(BIOT 3101)****Time Allotted : 3 hrs****Full Marks : 70*****Figures out of the right margin indicate full marks.***

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

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

**Group - A
(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) Sickle cell anaemia is an example of
 (a) frameshift mutation (b) missense mutation
 (c) nonsense mutation (d) deletion mutation.
- (ii) 2n-2 karyotype is an example of
 (a) monosomy (b) nullisomy (c) diploidy (d) tetraploidy.
- (iii) One percent male exhibit sex-linked recessive gene. The frequency of recessive homozygous woman is
 (a) 1% (b) 0.1% (c) 10% (d) 0.01%.
- (iv) Down's syndrome is an example of
 (a) aneuploidy (b) polyteny (c) polyploidy (d) monoploidy.
- (v) Cancer of B lymphocytes is called
 (a) sarcoma (b) melanoma (c) myeloma (d) carcinoma.
- (vi) The transfer of genetic material from one bacterium to another via virus is called
 (a) transformation (b) conjugation
 (c) recombination (d) transduction.
- (vii) Which one is not an example of tumour suppressor gene?
 (a) p53 (b) Rb (c) INK4 (d) Abl.
- (viii) The collection of one or more outcomes from an experiment is called
 (a) probability (b) random variable
 (c) z-Value (d) random experiment.

- (ix) If mode is the most frequently occurring data value, then it
 (a) can never be larger than the mean
 (b) is always larger than the median
 (c) is always larger than the mean
 (d) must have a value of at least two.
- (x) Which of the following is not a correct statement about a probability?
 (a) It must have a value between 0 and 1
 (b) It can be reported as a decimal or a fraction
 (c) A value near 0 means that the event is not likely to occur/happen
 (d) It is the collection of several experiments.

Group - B

2. (a) What do you mean by Bombay Phenotype?
 (b) What do you mean by sex-limited and sex-influenced inheritance?
 (c) Explain the role of Y chromosome in sex determination in humans.

$$4 + (2 + 2) + 4 = 12$$

3. (a) The following genes are linked on chromosome 3 of *Drosophila melanogaster*: Black body (*b*), cinnabar eyes (*cn*), vestigial wings (*vg*). A trihybrid cross between a heterozygous female and a homozygous recessive male produced the following 1000 progeny:

Wild type – 39	Black, cinnabar – 1
Black – 416	Black, cinnabar, vestigial – 48
Cinnabar – 42	Black, vestigial – 50
Cinnabar, vestigial – 402	Vestigial – 2

- i. Which are the n.c.o. and d.c.o. classes?
 ii. Which is the middle gene in the sequence?
 iii. Find out the map distances between the 3 loci and prepare a linkage map.
- (b) Mention the salient features of mtDNA with a diagram.
- (c) Define (**any three**):
 i. Pseudodiploidy
 ii. Autopolyploidy
 iii. Allopolyploidy
 iv. Nullisomy.

$$(2 + 1 + 2) + 4 + 3 = 12$$

Group - C

4. (a) Explain the normal function of Rb gene and state how Rb mutations can cause deregulation of cell cycle.
 (b) What do you mean by transition and transversion?
 (c) Write short notes on **any one**:
 i. Tay-Sachs disease
 ii. Fragile X syndrome
 iii. Huntington's disease.

$$4 + (2 + 2) + 4 = 12$$

5. (a) Mention the pathways by which a proto-oncogene can be converted into an oncogene.
 (b) 'Cancer is a multi-hit, multi-step, multi-mutation process'. Justify the statement.
 (c) Write a brief note on Ames test for detection of mutagenesis.

$$4 + 4 + 4 = 12$$

Group - D

6. (a) Give a comparative analysis between generalized and specialized transduction.
 (b) Describe the life cycle of a T4 Bacteriophage.
 (c) In *E. coli* four Hfr strain donate the following genetic markers shown in the order donated:

Strain 1	M	Z	X	W	C
Strain 2	L	A	N	C	W
Strain 3	A	L	B	R	U
Strain 4	Z	M	U	R	B

All these Hfr strains are derived from the same F⁺ strain. What is the order of these markers on the circular chromosome of the original F⁺?

$$4 + 4 + 4 = 12$$

7. (a) Illustrate briefly the interrupted mating technique adopted for bacterial genetic mapping.
 (b) Explain the role of wnt signaling pathways in *Drosophila* embryonic development.
 (c) What do you mean by Realisator genes?

$$6 + 4 + 2 = 12$$