(iii) Environmental sex determination

(iv) F factor

(v) Lethal alleles

[This question paper contains 8 printed pages.]

01.01.2024(M)

Your Roll No.....

Sr. No. of Question Paper : 4391 **G**

Unique Paper Code : 32231502

Name of the Paper : Principles of Genetics – LOCF

Name of the Course : **B.Sc. (Honours) Zoology**

Semester : V

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **five** questions in all, including question No. 1 which is compulsory.

1. (i) Define any **five** of the following : (5)

(a) Point mutation

(b) Hemizygous

(c) Reciprocal Cross

(d) Allele

(e) Episome

(f) Maternal effect

(ii) Differentiate between the following **(any four)** : (8)

(a) Test cross and Back cross

(b) Pericentric and Paracentric inversion

(c) Sex influenced traits and Sex-limited traits

(d) Incomplete dominance and Codominance

(e) Multiple alleles and Multiple genes

(iii) Justify the following statements : (4)

(a) Only specified genes can be transduced by bacteriophage in specialized transduction.

(b) The *Drosophila* with chromosome combination as XXY is female.

(c) Dominant lethal genes are rare in the population.

Test Pair	Results
1,2	+
1,3	–
1,4	–
1,5	+
2,3	+
2,4	+
2,5	–

(b) Explain the process of transformation with suitable diagrams. How does this process help in the recombination of genes in bacteria? (4)

(c) Discuss how interrupted mating experiments help in gene mapping in bacteria. (5)

7. Write short notes on the following **(any three)** : (3×4=12)

(i) Polygenic inheritance

(ii) Extra chromosome inheritance in Paramecium

P.T.O.

4. (a) Predict the genotypes of the offspring in a trihybrid cross between AaBbCC X AABBCc. (Draw Punnet square or Forked line diagram). What proportion of progeny would be homozygous for all three genes. (5)

(b) How do gene interactions modify the Mendelian dihybrid ratio? Explain with three suitable examples. (7)

5. (a) What are transposable elements? Describe any three types of transposable elements found in the bacteria. (7)

(b) Briefly explain the basis of sex determination in humans. (5)

6. (a) In complementation studies of rII locus of phage T_4, the following pairs of different mutations were tested. From the given data, determine which mutations are in the same cistron assuming mutation 1 is in A cistron and mutation 2 in B cistron. (+) indicates complementation, (–) indicates failure of complementation. (3)

(d) Ds sequences can only move in presence of Ac elements in the maize genome.

(iv) What are the contributions of the following scientists : (4)

(a) A. Sturtevant

(b) Joshua Lederberg

(c) Calvin Bridges

(d) Sutton and Boveri

(v) Give one example each for syndromes associated with the following conditions in humans : (4)

(a) Monosomy

(b) Trisomy

(c) Chromosomal Deletion

(d) Chromosomal translocation

(vi) Write true or false : (2)

(a) Mutations are always harmful.

(b) In humans Sry is the master gene in sex determination.

(c) An X-linked trait will be passed on from the father to all his children.

(d) LINEs are examples of retrotransposons.

2. (a) The data obtained from a three-factor test-cross is as follows : (2+5+2=9)

Genotype	Number of progenies
ABc/abc	367
abC/abc	348
ABC/abc	77
abc/abc	68
aBC/abc	58
Abc/abc	64
aBc/abc	10
AbC/abc	8

(i) Based on the given data, determine the order of the genes.

(ii) Draw a linkage map and calculate the map distance between the genes.

(iii) Calculate the coefficient of coincidence and interference.

(b) A panel of cell lines was created from human-mouse somatic cell fusions. Each line was examined for the presence of human chromosomes and for the production of a human protein thymine kinase. The following results were obtained :

Cell Line	thymine kinase	Human Chromosomes						
		1	5	11	13	17	18	21
K	+	-	+	+	+	+	-	-
L	+	+	+	-	+	+	+	+
M	-	+	+	+	+	-	+	-
N	-	+	-	-	+	-	-	-

Which of the human chromosome carries the gene for the thymine kinase? Explain. (3)

3. (a) Describe the characteristics of maternal inheritance. (4)

(b) Explain the molecular basis of mutations caused by base analogues, nitrous acid, and acridines. (8)

P.T.O.