B.Sc. 5th Semester (Honours) Examination, 2019 (CBCS)

Subject : Zoology

BU

Paper : CC-T-12

(Genetics)

Time : 2 Hours **Full Marks : 40**

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

Group-A

1. Answer *any five* questions: 2×5=10

(a) Compare monoploid with haploid.

(b) Two students, A and B performed test-cross in dihybrid cross. The phenotypic ratio of test cross was 1:1:1:1 for A and 3:1:1:3 for student B. Their teacher accepted both the result as correct. How did he/she explain the result.

(c) Write the role of XIST in X-chromosome inactivation.

(d) You analyse three pieces of double-stranded DNA, viz., A, B and C, with 50%, 40%, and 30% GC content respectively. Which of the DNA is most sensitive to UV-light damage and why?

(e) Explain the following:

(i) 48, XY + #7, #20.

(ii) 2AXXY *Drosophila*

(f) The autosomal recessive *tra*1 mutation converts normal female into sterile male *Drosophila*. A female *Drosophila*, heterozygous for *tra*1 allele is mated with normal male homozygous for *tra*1 (*tra*1/*tra*1). What will be the sex ratio of their offspring?

(g) Differentiate between retroposon and retro-transposon.

(h) What do you mean by hybrid dysgenesis?

Group-B

Answer *any two* questions from the following: 5×2=10

2. What are sex limited traits? How do they differ from sex linked traits? Explain using suitable example. 1+2+2=5

3. With a flow diagram, discuss Holliday model of crossing over. What is interference? 4+1=5

4. Discuss how UV-irradiation causes DNA damage and mutation:

   A double stranded DNA with the sequence of 5' ATTAACGGA3'/3'TAATTGCCT5' is incubated with 2-aminopurine and 5-bromouracil for one round of replication. Assume that 50% base-analogues are incorporated. The base analogues are removed and the DNA is replicated for two more rounds. What final DNA sequences will result? (Use P for 2AP and B for 5-BU). 3+2=5

5. Describe different types of hyperaneuploidy with one suitable example of each. Comment on nullisomy. 3+2=5

Group-C

Answer *any two* questions: 10×2=20

6. Describe in detail the molecular mechanism of sex-determination in *Drosophila*.

   What would be the gender of an XY individual homozygous for non-functional mutant alleles of sox9? Why is SRY, rather than Sox9, considered the male determining factor? 6+2+2=10

7. Construct a cross to prove that shell coiling in gastropoda is determined by the mother genotype. What is cytohet?

   Consider the following cross in *Chlamydomonas reinhardtii*:

   $mt^+a^+b^+c^+d^- X\ mt^-a^-b^-c^-d^+$

   where *a* and *b* are nuclear genes and *c* and *d* are chloroplast genes. What is the genotype of the

   (a) zygote and

   (b) meiotic products?

   7+1+2=5

8. Write general characteristics of transposable element. Discuss McClintok's experiment with conclusion on Ac-Ds element in maize.

   Mention the function of LTR in transposon. Define processed pseudogene. 3+5+1+1=10

9. *Drosophila* the genes *ct* (cut wing margin), *y* (yellow body) and *v* (vermilion eye colour) are *X* linked. Female heterozygous for all three markers were mated with wild type males and the following progenies were obtained. {(+) sign is for wild type allele}:

Wild type female-1024

ct	y	v	4
ct	y	+	93
ct	+	v	54
ct	+	+	349
+	y	v	331
+	y	+	66
+	+	v	97
+	+	+	6
	Total		1000

(a) Construct the cross.

(b) What are the order of genes?

(c) Draw the genetic map of the genes.

(d) Calculate the coefficient of coincidence for these three loci. 4+2+2+2=10