

KATHMANDU UNIVERSITY
End Semester Examination
March/April, 2018

MAR 15 2018

Level : B.Tech
Year : II
Time : 2 hrs, 30 mins.

Course : BIOT 202
Semester: I
F.M. : 55

SECTION "D"

Attempt ALL questions.

1. A man and woman marry. They have five children, 2 girls and 3 boys. The mother is a carrier of hemophilia, an X-linked disorder. She passes the gene on to two of the boys who died in childhood and one of the daughters is also a carrier. Both daughters marry men without hemophilia and have 3 children (2 boys and a girl). [2+2+1]
- Create a pedigree for this family.
 - Determine the genotypes of the family members. List the genotypes on your pedigree.
 - What is the chance the carrier daughter will have a son with hemophilia?

2. In *Drosophila*, *Dichaete* (*D*) is a mutation on chromosome III with a dominant effect on wing shape. It is lethal when homozygous. The genes *ebony* body (*e*) and *pink* eye (*p*) are recessive mutations on chromosome III. Flies from a *Dichaete* stock were crossed to homozygous ebony, pink flies, and the F1 progeny, with a *Dichaete* phenotype, were backcrossed to the ebony, pink homozygotes. Using the results of this backcross shown in the table:

S.N.	Phenotype	Offspring
1.	Dichaete	401
2.	ebony, pink	389
3.	Dichaete, ebony	84
4.	pink	96
5.	Dichaete, pink	2
6.	ebony	3
7.	Dichaete, ebony, pink	12
8.	wild type	13

- What is the sequence and interlocus distance between these three genes? [3]
 - Calculate the interference involved. [2]
3. (a) In a cross of *Limnaea*, the snail contributing the eggs was dextral but of unknown genotype. Both the genotype and the phenotype of the other snail are unknown. All F1 offspring exhibited dextral coiling. Ten of the F1 snails were allowed to undergo self-fertilization. One-half produced only dextrally coiled offspring, whereas the other half produced only sinistrally coiled offspring. What were the genotypes of the original parents? [3]
- (b) Write short note on euphenics. [2]
4. (a) In summer squash, white fruit color (*W*) is dominant over yellow fruit color (*w*) and disk-shaped fruit (*D*) is dominant over sphere-shaped fruit (*d*). A squash plant true-breeding for white, disk-shaped fruit is crossed with a plant true-breeding for yellow, sphere-shaped fruit. Calculate the possible phenotypic ratio for F2 generation [3]

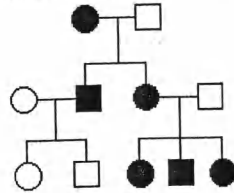
- (b) In mice, a short-tailed mutant was discovered. When it was crossed to a normal long-tailed mouse, 4 offspring were short tailed and 3 were long-tailed. Two short-tailed mice from the F1 generation were selected and crossed. They produced 6 short tailed and 3 long-tailed mice. These genetic experiments were repeated three times with approximately the same results. What genetic ratios are illustrated? Hypothesize the mode of inheritance and diagram the crosses. [2]
5. (a) Consider the problem of comb-shape inheritance in chickens where walnut, rose, pea, and single are observed as distinct phenotypes. Considering the following data, determine how comb shape is inherited and what genotypes are present in the P1 generation of each cross. [3]
- Cross 1: single X single = all single
 Cross 2: walnut X walnut = all walnut
 Cross 3: rose X pea = all walnut
 Cross 4: F1 X F1 of Cross 3 = 93 walnut, 28 rose, 32 pea, 10 single
- (b) In humans, red-green color blindness is inherited as an X-linked recessive trait. A woman with normal vision whose father is color-blind marries a male who has normal vision. Predict the color vision of their male and female offspring. [2]
6. (a) Explain Lyon hypothesis with a suitable example. [3]
- (b) It has been suggested that any male-determining genes contained on the Y chromosome in humans cannot be located in the limited region that synapses with the X chromosome during meiosis. What might be the outcome if such genes were located in this region? [2]
7. (a) Explain partial monosomy with an example. [3]
- (b) Certain varieties of chrysanthemums contain 18, 36, 54, 72, and 90 chromosomes; all are multiples of a basic set of nine chromosomes. How would you describe these varieties genetically? [2]
8. Give *TWO* major differences between *ANY FIVE*. [5×2=10]
- Paracentric and Pericentric inversion
 - Sex linked and Sex influenced inheritance
 - Incomplete dominance and Co-dominance
 - Nuclear inheritance and Organellar inheritance
 - Interference and Epistasis
 - Autotetraploid and Allotetraploid
9. Explain *WHY/HOW* for *ANY FIVE* [5×2=10]
- Autopolyploids are commercially valuable
 - The number of recombinant gametes never exceed 50%
 - Robertsonian translocation can produce trisomy 21 individuals
 - Autosomal recessive traits can skip generation
 - In the yeasts with suppressive petite mutation, the mutation behaves dominantly.
 - mtDNA can be used to trace the maternal lineage of an individual.

6. Which of the following represents a testcross
 $Ww \times WW$ $ww \times WW$ $Ww \times Ww$ $WW \times WW$

7. Hypertrichosis, hairiness of the pinna of the ear, is inherited as a Y-linked recessive in humans. If a man with hypertrichosis marries a normal woman, what types of children may they have?

- All of their children of both sexes have hypertrichosis.
 All the sons have hypertrichosis, but none of their daughters.
 All the daughters have hypertrichosis, but none of their sons.
 None of their children have hypertrichosis

8. What mode of inheritance is suggested by the following pedigree?



- biparental
 uniparental; paternal

- uniparental; maternal
 Y-linked

9. Blue eye colour is recessive to brown eye colour. A brown eyed man whose mother was blue eyed marries a blue-eyed woman. The children will be

- blue eyed and brown eyed 1:1 all brown eyed
 blue eyed and brown eyed 3:1. all blue eyed

10. A gene pair hides the effect of another. The phenomenon is:

- Dominance Recessiveness Epistasis Interference

SECTION "B"

[5 Q × 1 = 5 marks]

Fill in the blanks.

11. An individual with two normal sets of autosomes and a single X chromosome has _____ syndrome.
12. In garden peas, height is determined by a single gene with tall being dominant to short. If two heterozygous plants are crossed, the proportion of the tall progeny that are homozygous dominant is _____.
13. The A and B genes are linked and 20 map units apart. In the cross $Ab/aB \times ab/ab$, the percentage of the progeny that will be AB/ab is _____.
14. The number of linkage groups in a plant species with 18 chromosomes is _____.
15. Mitochondrial disease is transmitted from _____ to offspring.

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SECTION "C"
[5 Q.×1=5 marks]

Define the following:

16. Inversion heterozygotes:
17. Back cross:
18. Complete linkage:
19. Amphidiploids:
20. Holandric genes:

