

KATHMANDU UNIVERSITY
End Semester Examination [C]
June, 2018

JUN 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. An unaffected man marries a woman who is a carrier for Duchenne Muscular Dystrophy, which is attributed to an X-linked gene. They have four children, one son with Duchenne, one carrier daughter and a daughter and son who are unaffected. The child with Duchenne Muscular Dystrophy dies in childhood. The carrier daughter marries and has three children of her own, two of which are carriers and son one of which is unaffected. a. Create a pedigree for the family describe. (Be sure to shade individuals affected with Duchenne Muscular Dystrophy) [2+2+1]
a) Create a pedigree for this family
b) Determine the genotypes of the family members. List the genotypes on your pedigree.
c) What is the most likely sex of these two carrier children given the fact that they are unaffected by the X-linked gene?
2. In *Drosophila*, a cross was made between females—all expressing the three X-linked recessive traits *scute* bristles (*sc*), *sable* body (*s*), and *vermilion* eyes (*v*)—and wild-type males. In the F1, all females were wild type, while all males expressed all three mutant traits. The cross was carried to the F2 generation, and 1000 offspring were counted, with the results shown in the following table. [1+2+2]

Phenotype	Offspring
<i>sc s v</i>	314
<i>+++</i>	280
<i>+ s v</i>	150
<i>sc ++</i>	156
<i>sc + v</i>	46
<i>+ s +</i>	30
<i>sc s +</i>	10
<i>++ v</i>	14

No determination of sex was made in the data.

- a) Using proper nomenclature, determine the genotypes of the P1 and F1 parents.
b) Determine the sequence of the three genes and the map distances between them.
c) Calculate the coefficient of coincidence. Does it represent positive or negative interference?
3. a) Discuss three types of petite mutations seen in *Saccharomyces cerevisiae*. [3]
b) Write short note on eugenics. [2]

4. a) The A and B antigens in humans may be found in water-soluble form in secretions, including saliva, of some individuals (*Se/Se* and *Se/se*) but not in others (*se/se*). The population thus contains "secretors" and "nonsecretors." [1.5+1.5]
- i. Determine the proportion of various phenotypes (blood type and ability to secrete) in matings between individuals that are blood type AB and type O, both of whom are *Se/se*.
- ii. How will the results of such matings change if both parents are heterozygous for the gene controlling the synthesis of the H substance (*Hh*)
- b) In foxes, two alleles of a single gene, *P* and *p*, may result in lethality (*PP*), platinum coat (*Pp*), or silver coat (*pp*). What ratio is obtained when platinum foxes are interbred? Is the *P* allele behaving dominantly or recessively in causing lethality and platinum coat color? [1+1]
5. a) Pigment in mouse fur is only produced when the *C* allele is present. Individuals of the *cc* genotype are white. If color is present, it may be determined by the *A*, *a* alleles. *AA* or *Aa* results in agouti color, while *aa* results in black coats. [1.5+1.5]
- i. What F1 and F2 genotypic and phenotypic ratios are obtained from a cross between *AACC* and *aacc* mice?
- ii. In three crosses between agouti females whose genotypes were unknown and males of the *aacc* genotype, the following phenotypic ratios were obtained:
- (1) 8 agouti 8 white
 (2) 9 agouti 10 black
 (3) 4 agouti 5 black 10 white
- What are the genotypes of these female parents?
- b) In humans, the ABO blood type is under the control of autosomal multiple alleles. Color blindness is a recessive X-linked trait. If two parents who are both type A and have normal vision produce a son who is color-blind and is type O, what is the probability that their next child will be a female who has normal vision and is type O? [2]
6. a) Explain the role of Y chromosome in determining maleness in humans. [3]
- b) Predict the potential effect of the Lyon hypothesis on the retina of a human female heterozygous for the X-linked red-green color-blindness trait. [2]
7. Discuss the mechanism and outcome of crossing over in inversion heterozygotes. [5]
8. Give **TWO** major differences between **ANY FIVE**. [5 × 2 = 10]
- a) Down Syndrome and Familial Down Syndrome
 b) Aneuploidy and Euploidy
 c) Back cross and Test cross
 d) Uniparental and Biparental inheritance
 e) Autosomal dominant and Autosomal recessive traits
 f) Protenor and Lygaeus mode of sex determination
9. Explain **WHY/HOW** for **ANY FIVE**. [5 × 2 = 10]
- a) Temperature can modify the genetic expression of an organism
 b) Despite having only 45 chromosomes, people with Robertsonian translocation are phenotypically normal
 c) Position of a gene in a chromosome affects its expression
 d) The number of Barr bodies in a normal male is zero
 e) Normal females cannot be hemizygous for X-linked traits
 f) Monosomy has lethal effects in humans.