KATHMANDU UNIVERSITY
End Semester Examination
February/March, 2019

Marks Scored:

Level : B. Tech.
Year : II

Course : BIOT 202
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date 08 MAR 2019

SECTION "A"

[10 Q. × 1 = 10 marks]

Choose the correct answer.

1. The area of genetics that links traits, including illnesses, to chromosome variations is
   [ ] population genetics.
   [ ] transmission genetics
   [ ] evolutionary genetics
   [ ] cytogenetics.

2. A man with trisomy 21 could pass Down syndrome to offspring if he
   [ ] produces sperm that have two copies of chromosome 21.
   [ ] produces sperm lacking chromosome 21.
   [ ] also has Turner syndrome.
   [ ] is a carrier of a deletion for chromosome 21.

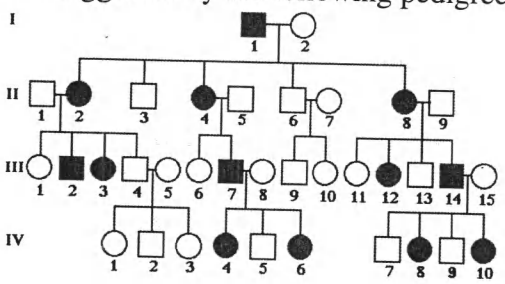
3. Polyploidy can result when
   [ ] a translocation occurs between two chromosomes.
   [ ] one pair of homologous chromosomes does not separate during meiosis.
   [ ] a developing gamete is haploid.
   [ ] a haploid sperm fertilizes a diploid egg.

4. After a test cross if half of the offspring obtained are recessive, then the individual under study was a
   [ ] homozygous dominant
   [ ] heterozygous dominant
   [ ] homozygous recessive
   [ ] heterozygous recessive

5. A mother of known blood type A has a child whose blood turns out to be B. From this it follows that the mother
   [ ] must really have the blood type AB
   [ ] homozygous dominant for the trait
   [ ] is heterozygous for the trait
   [ ] could have several possible genotypes

6. A color blind girl is rare because the condition is possible only when
   [ ] her mother and maternal grandfather are color blind
   [ ] her father and maternal grandfather are color blind
   [ ] her mother is color blind and father has normal vision
   [ ] parents have normal vision but grandparents are color blind

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



[ ] Autosomal dominant
[ ] X-linked dominant
[ ] Autosomal recessive
[ ] X-linked recessive

8. The linked genes do not exhibit
[ ] Cross over
[ ] Linkage
[ ] Segregation
[ ] Independent assortment

9. Which of the following gives information about the phenotype but not the genotype?
[ ] X^HY
[ ] Tall pea plant
[ ] Color blind male
[ ] Female carrier for hemophilia

10. Which of the following is an example of infectious heredity?
[ ] Petite mutations in *Saccharomyces cerevisiae*
[ ] Shell coiling in *Limnaea peregra*
[ ] Prader-Willi syndrome in humans
[ ] High female sex ratio in Drosophila

SECTION "B"
[5Q × 1 = 5 marks]

Fill in the blanks.

11. You cross a p+/v+ p+/v+ male drosophila to a p-/v- p-/v- and obtain the F1 hybrid. Now you cross the F1 male with double recessive female. The recombination phenotype in F2 will be _____.

12. A person with karyotype XXY suffers from _____ syndrome.

13. In tobacco, if the diploid number of chromosomes is 48, the number of chromosomes in pollen grain will be _____.

14. The blood type_____ would not be possible for children of a type AB mother and a type A father.

15. Observable traits/ characteristics of an organism are called _____.

SECTION "C"

[5Q × 1 = 5 marks]

Define the followings:

16. Positive interference:

17. Intercalary deletion:

18. Trisomy:

19. Homozygosity:

20. Uniparental inheritance:

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SECTION "D"

Attempt *ALL* questions.

1. A man and a woman are preparing to have a child. The man finds out that his father has Huntington's disease. Huntington's disease is an autosomal dominant disorder. The man's mother does not have Huntington's disease. The man has a sister who does not have Huntington's disease.
   a. Create a pedigree for the family describe. (Be sure to shade individuals affected with Huntington's disease).
   b. List the genotypes on your pedigree.
   c. What is the probability that the male has Huntington's disease?
   d. If the man has Huntington's disease what is the chance he will pass the disorder to his child? The mother of the child is unaffected. [2+1+1+1]

2. A cross in *Drosophila* involved the recessive, X-linked genes *yellow (y) body, white (w) eye, and cut (ct) wings*. A yellow-bodied, white eyed female with normal wings was crossed to a male whose eyes and body were normal but whose wings were cut. The F1 females were wild type for all three traits, while the F1 males expressed the yellow-body and white-eye traits. The cross was carried to an F2 progeny, and only male offspring were tallied. On the basis of the data shown here, a genetic map was constructed. [1+2+1+1]

Phenotype	Male Offspring
y + ct	9
+ w +	6
y w ct	90
+ + +	95
+ + ct	424
y w +	376
y + +	0
+ w ct	0

   a. Diagram the genotypes of the F1 parents.
   b. Construct a map, assuming that *white* is at locus 1.5 on the X chromosome.
   c. Were any double-crossover offspring expected?
   d. Could the F2 female offspring be used to construct the map? Why or why not?

3. a. Discuss mitochondrial inheritance in yeast with reference to petite mutation. [3]
   b. Write short note on Application of Genetics in Medicine. [2]

4. a. In another cross, involving parent plants of unknown genotype and phenotype, the following offspring were obtained.
   3/8 full, round
   3/8 full, wrinkled
   1/8 constricted, round
   1/8 constricted, wrinkled
   Determine the genotypes and phenotypes of the parents [3]

b. Mendel crossed peas having round green seeds with peas having wrinkled yellow seeds. All F1 plants had seeds that were round and yellow. Predict the results of test crossing these F1 plants. [2]

5. a. In *Drosophila*, the X-linked recessive mutation *vermilion* (*v*) causes bright red eyes, in contrast to the brick-red eyes of wild type. A separate autosomal recessive mutation, *suppressor of vermilion (su-v)*, causes flies homozygous or hemizygous for *v* to have wild-type eyes. In the absence of *vermilion* alleles, *su-v* has no effect on eye color. Determine the F1 and F2 phenotypic ratios from a cross between a female with wild-type alleles at the *vermilion* locus, but who is homozygous for *su-v*, with vermilion male who has wild-type alleles at the *su-v* locus. [3]

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 with normal vision and is type O? [2]

6. a. Explain how non disjunction in human female gametes can give rise to Klinefelter and Turner syndrome offspring following fertilization by a normal male gamete. [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. a. A normal female is discovered with 45 chromosomes, one of which exhibits a Robertsonian translocation containing most of chromosomes 18 and 21. Discuss the possible outcomes in her offspring when her husband contains a normal karyotype. [3]

b. When two plants belonging to the same genus but different species are crossed, the F1 hybrid is more viable and has more ornate flowers. Unfortunately, this hybrid is sterile and can only be propagated by vegetative cuttings. Explain the sterility of the hybrid and what would have to occur for the sterility of this hybrid to be reversed. [2]

8. Give *TWO* major differences between *ANY FIVE*. [5×2=10]

a. *Protenor* and *Lygaeus* modes of sex determination
b. Patau syndrome and Edwards syndrome
c. Extranuclear inheritance and X-linked inheritance
d. Temperature dependent and Chromosome dependent inheritance
e. Transmission genetics and Population genetics
f. Heterozygosity and Hemizygosity

9. Explain *WHY/HOW* for *ANY FIVE* [5×2=10]

a. Double-crossover events occur less frequently than single-crossover events.
b. Y chromosome plays a crucial role in the determination of sex in humans
c. Mammals including humans, have the mechanism to solve the "dosage problem" caused by the presence of an X chromosome in one sex and two X chromosomes in the other sex
d. Autosomal dominant traits don't skip generation
e. Down syndrome is more often the result of nondisjunction during oogenesis rather than during spermatogenesis,
f. People exhibiting Bombay phenotype are genetically blood type B but phenotypically type O