THE OPEN UNIVERSITY OF SRI LANKA
FACULTY OF NATURAL SCIENCES
B.Sc. DEGREE PROGRAMME – LEVEL 04
FINAL EXAMINATION – 2023/2024
BOTANY
BYU4301/BYE4301 – GENETICS and EVOLUTION

DURATION : TWO (02) HOURS

DATE : 23rd October 2023 TIME : 1.30 – 3.30 p.m.

ANSWER FOUR (04) QUESTIONS SELECTING AT LEAST ONE (01) FROM EACH PART (A and B)

Answers to the questions in Part A and Part B should be written in separate answer books

PART A

1.

A) Genes may be linked either in the coupling phase or the repulsion phase. Explain why backcrosses involving parents with genes linked in the coupling and repulsion phases do not yield the same proportions of progeny phenotypes.

B) A wild-type strain of flies was crossed to another strain homozygous for the recessive mutant alleles, *m*, *r* and *v*. The F_1 females were backcrossed to the recessive male strain, and the following types and numbers of progeny were observed.

+	+	+	331
m	+	+	2
+	*r*	+	73
+	+	*v*	14
m	*r*	+	10
m	+	*v*	80
+	*r*	*v*	0
m	*r*	*v*	310
			820

i) What is the correct order of the three genes?

ii) Calculate the map distances between these genes.

2.

A) The term "Mendelian Inheritance" describes inheritance patterns that obey two laws; the Law of Segregation and the Law of Independent Assortment. Based on this definition list out five examples each for the following.

i) The different types of Mendelian inheritance patterns associated with a **single gene** (5 examples).
ii) The different types of Mendelian inheritance patterns associated with two **genes** (5 examples).

B)

i) What is Epistasis?

ii) Explain the difference between Dominance and Epistasis?

iii) Why did the pairs of genes in the dihybrid crosses studied by Mendel not show epistasis?

C) In a plant species three different flower colours occur: red, yellow, and white. A red parent is crossed to a white parent and all the offspring are red. When these are selfed, the following data are obtained:

Red	118
Yellow	32
White	10

Explain the results of this cross indicating the mode of inheritance.

3.

A) Compare and contrast a X–linked recessive trait, X-linked dominant trait and a Y-linked trait.

B) A female fly with orange eyes is crossed with a male fly with short wings. The F_1 females are wild-type with red eyes and long wings, and the F_1 males have orange eyes and long wings. The F_1 flies are inter-mated and yield the following progeny, with no distinction between the sexes.

47 long wings, red eyes
45 long wings, orange eyes
17 short wings, red eyes
14 short wings, orange eyes

Explain the genetic basis of each trait.

D) If following were the sex chromosomes of *Drosophila* flies, what would their sexes be? Justify your answer. (Assume that the number of autosomal chromosome sets (A) are two).

XO XY XXY XX XXX

PART B

4. Describe the process of specialization giving suitable examples.

5. Explain how the process of natural selection operates.

6. Write short notes on any **three** of the following

   a. *Homo erectus*

   b. The Miller Urey Experiment

   c. Body cavities of metazoans

   d. Pleistocene epoch

   e. Evolution of the horse