

THE OPEN UNIVERSITY OF SRI LANKA
 B.Sc. DEGREE PROGRAMME – LEVEL 04
 FINAL EXAMINATION – 2025/2026
 BOTANY
 BYU4301/BYE4301 – GENETICS and EVOLUTION



DURATION: TWO (02) HOURS

DATE: 05. 12. 2025

TIME: 9.30 – 11.30 a.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) Compare recombination and crossover. How are these similar? How are they different? (30 marks)
 - b) Explain briefly why three-point crosses are useful in learning about the nature of gene linkage. (20 marks)
 - c) In a three-point cross, individuals *AAbbcc* and *aaBBCC* are crossed, and their F1 progeny is testcrossed. Answer the following questions based on these F2 frequency data. (50 marks)

<i>aaBbCc</i>	480
<i>AaBbcc</i>	15
<i>AaBbCc</i>	10
<i>aaBbcc</i>	1
<i>aabbCc</i>	13
<i>Aabbcc</i>	472
<i>AabbCc</i>	1
<i>aabbcc</i>	8

- i) Which gene is in the middle?
- ii) Calculate the map distance.
- iii) What were the linkage relationship between alleles at the forked & outstretched, and forked & garnet loci?

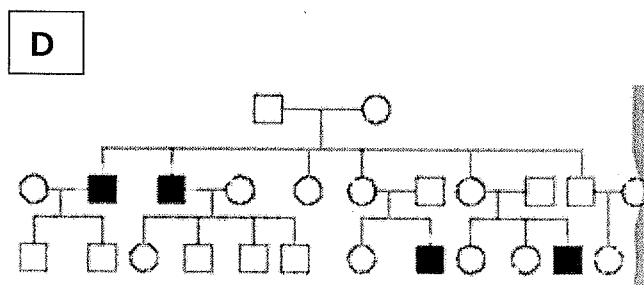
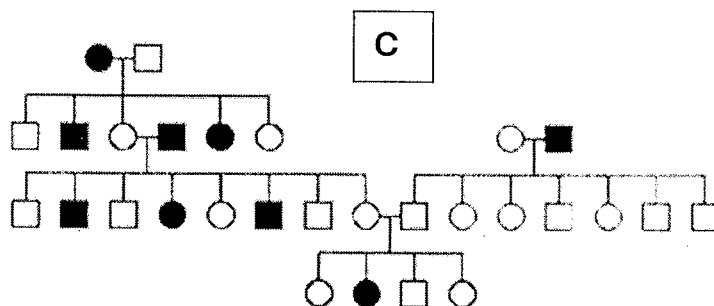
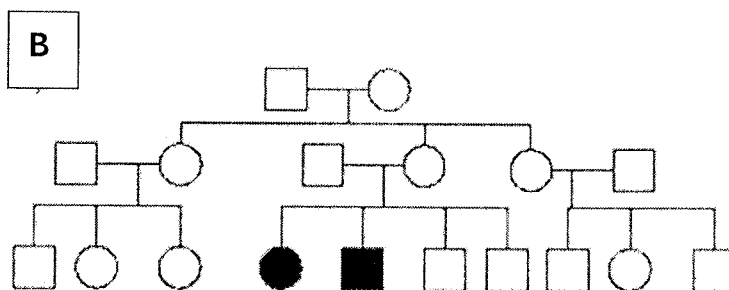
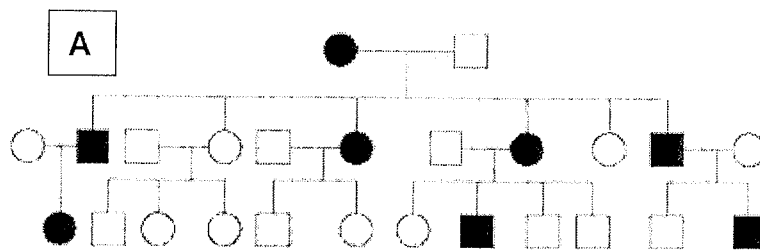
2. Non-Mendelian inheritance is the inheritance of traits that have a more complex genetic basis than one gene with two alleles and complete dominance.

- i) There are various types of non-Mendelian inheritance patterns. Name five (05) of them. (15 marks)
- ii) a) What is co-dominance? (10 marks)
- b) Explain why the human ABO blood group is an example of a multiple allele trait with codominance. (10 marks)
- iii) What is Pleiotropy? Explain giving a human example. (15 marks)
- iv) What is the difference between pleiotropy and epistasis? (15 marks)
- v) a) Compare and contrast epistasis and dominance. (15 marks)
- b) In onions three bulb colours segregate: red, yellow, and white. A red parent is crossed to a white parent and all the offsprings are red. When these are selfed, the following data are obtained. Explain the results. (20 marks)

Red	108
Yellow	28
White	9

3.

- A) i) Briefly explain the importance of Pedigree Analysis. (10 marks)
- ii) For each of the following pedigrees, name the most likely mode of inheritance (AR=autosomal recessive, AD=autosomal dominant, XR=X-linked recessive, XD=X - linked dominant). (40 marks)



- B)
- i) Explain the term "Probability" used in experimental science such as Genetics. (20 marks)
 - ii) Mendal self-fertilized a dihybrid plant that had round, yellow peas. In the offspring generation: (30 marks)
 - a) What is the probability that a pea picked at random will be round and yellow?
 - b) What is the probability that five (05) peas picked at random will be round and yellow?

PART B

4. (i) Briefly describe the agents that can change the gene frequencies in a population. (35 marks)
- (ii) Explain the phenomenon of industrial melanism in terms of Darwin's theory of Natural Selection. (45 marks)
- (iii) DDT was widely used in Sri Lanka successfully for malaria eradication starting in the 1950s. When malaria reappeared in the 1960s, after intensive indoor sprayings, resistance to DDT was detected in *Anopheles culicifacies*. Resistance was primarily due to genetic mutation affecting the mosquito's nervous system, reducing DDT's effectiveness. Explain the development of resistance in *An. culicifacies* in terms of Natural Selection. (20 marks)
5. Describe the different methods of speciation with reference to suitable examples. (100 marks)
6. Write short notes on any three (3) of the following: (33 marks for each)
- (a) Adaptive radiation
 - (b) Post-zygotic isolating mechanisms
 - (c) The Miller - Urey Experiment
 - (d) Cambrian period
 - (e) Neanderthal man

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