The Open University of Sri Lanka
Faculty of Natural Sciences
B.Sc/ B.Ed Degree Programme

Department	: Botany
Level	: Level 4
Name of the Examination	: Final Examination
Course Code and Title	: BOU2101/BOE4101/BYU4301/BYE4301 Genetics and Evolution
Academic Year	: 2019/2020
Date	: 30. 12. 2019
Time	: 9.30 to 11.30 am

General Instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of **six (06)** questions in **four (04)** pages.
3. Answer any **four (04)** questions **selecting at least one (01) from each part.** All questions carry equal marks.
4. Answer for each question should commence from a new page.
5. Draw fully labelled diagrams where necessary.
5. Relevant log tables are provided where necessary.
6. Having any unauthorized documents/ mobile phones in your possession is a punishable offense.
7. Use blue or black ink to answer the questions.
8. Circle the number of the questions you answered in the front cover of your answer script.
9. Clearly state your index number in your answer script.

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

PART A

1.

A)

i) Distinguish between coupling phase and repulsion phase in gene linkage.

ii) Explain why backcrosses involving parents, with genes linked in the coupling and repulsion phases, do not yield the same proportions of progeny phenotypes.

B) In an experiment with *Drosophila melanogaster*, females with cut wings (*ct*), vermilion eyes (*v*) and forked bristles (*f*) were mated to wild type males. The F_1 females were then backcrossed to *ct v f* males and 1000 progeny were scored :

Phenotype	No. of Progeny	Phenotype	No. of Progeny
+ + +	341	*ct v* +	96
ct v f	329	+ + *f*	104
ct + +	47	*ct* + *f*	16
+ *v f*	53	+ *v* +	14

i) Determine whether the loci are linked.

ii) If the genes are linked, determine the gene order.

i) Diagram the cross and determine the distances between the genes.

2.

A) What is Epistasis?

B) Plants from a strain breeding true for white flowers was crossed to plants from a strain breeding true for red flowers. The F_1 progeny consisted of plants with red flowers only. The F_1 progeny were crossed to produce an F_2 generation that consisted of 175 red flowered, 62 cream flowered and 81 white flowered plants.

(i) Using genetic symbols, suggest the genetic basis of the inheritance of flower colour.

(ii) Provide genotypes for the parents, F_1 s and F_2 s of this cross.

(iii) Illustrate a biochemical pathway that best explains the steps in pigment production, and indicate the steps affected by each gene.

3.

A)

i) What are sex-linked genes?

ii) Male house cats may be black or yellow. Females may be black, Tortoise-shell pattern, or yellow.

a) If these colours are governed by a sex-linked locus, how can these results be explained?

b) Using appropriate symbols, determine the phenotypes expected in the offspring from the cross, yellow female X black male.

c) A certain kind of mating produces females, half of which are tortoise-shell and half are black; half the males are yellow and half are black.
What colours are the parental males and females in such a cross?

B)

i) What is Co-dominance?

ii) A pair of co-dominant alleles is known to govern cotyledon leaf colour in beans. The homozygous genotype $L^G L^G$ produces dark green, the heterozygous genotype $L^G L^Y$ produces light green, and the other homozygous genotype produces yellow leaves so deficient in chloroplasts that seedlings do not grow to maturity.

i) If light green plants are self-pollinated, determine the phenotypic and genotypic ratios in the seedling progenies.

ii) Will any kind of mating produce only light green plants in the progeny? (Interpret the genetics of the dark green, light green and yellow phenotypes in explaining your answer).

PART B

4. (a) Briefly describe the difference between the microevolution and the macroevolution.

   (b) Give scientific evidence for macroevolution.

5. With reference to suitable examples, explain how reproductive isolating mechanisms restrict gene flow among closely related species.

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

   a. Evolutionary links

   b. Directional selection

   c. Agents that change the allele frequencies of a population.

   d. Cro Magnon man

   e. Origin of early earth