

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



Department	: Botany
Level	: Level 5
Name of the Examination	: Final Examination
Course Title and - Code	: Plant Breeding (BOU3106/BYU5306/BYE5306)
Academic Year	: 2019/2020
Date	: 05. 11. 2020
Time	: 1.30 – 3.30 pm
Duration	: 02 hours

General Instructions

1. Read all instructions carefully before answering the questions.
 2. This question paper consists of **06** questions in **04** pages.
 3. Answer any **04** questions only. All questions carry equal marks.
 4. Answer for each question should commence from a new page.
 5. Draw fully labelled diagrams where necessary
 6. Involvement in any activity that is considered as an exam offense will lead to punishment
 7. Use blue or black ink to answer the questions.
 8. Clearly state your index number in your answer script
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1.

A) There are four main factors that contribute to the change of gene frequencies in a population.

i) What are these factors?

ii) In a plant species, two alleles, P and p , at a particular locus control the pod length. The mutation rate of P to p is 3.2×10^{-5} per generation, whereas the mutation rate of p to P is 6.4×10^{-7} per generation. If the initial frequency of P allele is 0.6, and no other factor is operating in the population to disturb the equilibrium, what will be the equilibrium frequency of allele p ?

B)

i) Give a brief account of the Average effect (α), Breeding value (A) and Dominance deviation (D)

ii) Find the Breeding values (A) and Dominance deviations (D) of the following genotypes.

(Assume that the frequency of allele X_1 (q) is 0.4)

GENOTYPE	X_1X_1	X_1X_2	X_2X_2
GENOTYPIC VALUE	120	160	100

2.

Asexually propagated plants have a varied nature of propagation.

a) What are asexually propagated plants?

b) How are they classified?

c) What are the different breeding methods identified for these plants?

d) Explain the procedure of clonal selection in asexually propagated plants using a flow chart.

e) Compare the advantages and drawbacks of clonal selection procedure.

3.

- a) Identify the different types of selection methods applied for breeding cross pollinated plants.
- b) What is recurrent selection?
- c) Name the different types of recurrent selection methods available and describe them.
- b) Use a flow chart to explain the main steps involved in the Simple Recurrent Selection method.

4.

- a) Heritability of a trait is a measure of its genetic variation. Explain the advantage of estimating the heritability value of a trait of interest when breeding a new crop variety.
- b) Two homozygous brinjal varieties (B1 and B2) were crossed to produce F₁ hybrids. The average phenotypic variance in yield of the three populations P₁, P₂ and F₁, was 12.20. The variance of F₂ was 22.20.
 - i) Calculate the heritability of yield in the F₂ population and comment on the validity of using these two Brinjal varieties (B1 and B2) in a breeding programme based on the heritability value obtained for yield.
- c) In rice, the inbred lines, L1, L2, L3, L4 and L5 were crossed in all possible combinations in a diallel cross. The progeny produced following data for the yield.

	L1	L2	L3	L4	L5
L1	30	32	41	31	30
L2	40	39	41	34	32
L3	41	38	41	35	35
L4	31	40	38	34	29
L5	31	33	30	26	19

- i) Calculate the General Combining Ability (GCA) of each line.
- ii) Identify the line with the highest GCA.

5.

- a) What are the uses of tissue culture techniques in plant breeding?
- b) Embryo rescuing is one of the applications of tissue culture in plant breeding. Explain what embryo rescue is, and describe its use/s.
- c) Somoclonal variations are often found among plants which have been propagated through tissue culture.
 - i) What is somoclonal variation?
 - ii) Explain how somaclonal variation can be utilized for crop improvement.

6.

- a) Several factors determine the breeding behavior of plants.
 - i) What are the factors that determine whether a plant is predominantly self-pollinated or predominantly cross-pollinated?
 - ii) Give a brief account of each factor.
- b) Differentiate between inbreeding and outbreeding, explaining the consequences of each.
- c) What is self-incompatibility?
- d) Briefly explain the terms 'Gametophytic self-incompatibility' and 'Sporophytic self-incompatibility'.