

THE OPEN UNIVERSITY OF SRI LANKA
 B.Sc. DEGREE PROGRAMME – LEVEL 05
 FINAL EXAMINATION – 2017/2018
 BOTANY
 BOU3106/BYU5306/BYE5306– PLANT BREEDING



DURATION: TWO (02) HOURS

DATE: 07. 04. 2019

TIME: 1.30 – 3.30 p.m.

ANSWER ANY FOUR (04) QUESTIONS

1.

A)

i) Partitioning of total phenotypic variance (V_P) into genotypic variance (V_G) and environmental variance (V_E) does not allow us to fully understand the genetic properties of a population. Therefore, it is necessary to divide V_G further.

- a) The genetic variance (V_G) is composed of three major components. What are these components?
- b) Briefly explain the genetic variance (V_G) components.

ii) Using values given in the table, calculate the following,

- a. Additive Genetic Variance (V_A)
- b. Dominance Genetic Variance (V_D)
- c. Complete Genetic Variance (V_G)

(If the epistatic deviation is 0.26)

Genotype	α	d	q
AA	22.5	-1	0.2
AB	19.5	-1	0.5
BB	22.0	-1	0.8

B)

- i) Explain the term "Average Effect" of a gene in a population.
- ii) Consider that pod length in *Vigna unguiculata* is determined by a locus with two alleles. The long pod length (*l*) is the recessive trait. The pod length of the three genotypes of *V. unguiculata*, **Harsha**, **Wijaya** and **Waruna** at 4 weeks are approximately as follows. Find out the Average Effects of the pod length alleles.

	Genotypes		
	Harsha	Wijaya	Waruna
Pod length (cm)	06	05	07

$$a = 5 \text{ cm} \quad d = 3 \text{ cm}$$

$$\text{Frequency of } l \text{ gene } (q) = 0.5$$

2.

- a) What are Somatic Hybrids?
- b) Describe in brief the steps involved in producing Somatic Hybrids.
- c) Explain the methods that are applied to induce fusion between protoplasts.

3.

- a) What are Hybrid Varieties?
- b) What is Hybrid Vigour?
- c) Explain briefly how Hybrid Vigour is utilized in a breeding programme.
- d) Several types of selection methods are practiced for cross pollinated crops.
- i) Identify these methods.
- ii) Briefly explain one of the methods mentioned in Section d) (i).

4.

A)

- i) Name the four (04) main factors which contribute to the change in Gene Frequencies of a population.
- ii) Explain briefly how each factor causes change in gene frequency.
- iii) There are two alleles, *A* and *a* at a particular locus. The mutation rate of *A* to *a* is 3.0×10^4 whereas the mutation rate of *a* to *A* is 6.0×10^8 . What is the equilibrium frequency of *a* allele, assuming no other factor is operating in this population to disturb the equilibrium?

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

(Assume that the frequency of allele Y_1 (*q*) is 0.4)

GENOTYPE	Y_1Y_1	Y_1Y_2	Y_2Y_2
GENOTYPIC VALUE	120	160	100

5.

- a) What are the practices adopted in seed production of a new variety?
- b) Describe the various classes of seeds that are recognized by Seed Certification Agencies.
- c) Out-line the procedure by which a new variety reaches the farmer.
- d) Describe how a variety is certified.

6.

- a) A mutation is a sudden change in hereditary material of a cell. Write a brief account on the types of mutations observed in plants.
- b) Describe the procedures used for mutation breeding in self-pollinated and cross-pollinated plants.
- c) What are the applications and achievements of mutation breeding in plants?
- d) What are the limitations of mutation breeding in plants?
- e) Give a brief account on how mutations and mutation breeding relate to plant biotechnology.

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