

THE OPEN UNIVERSITY OF SRI LANKA  
B.Sc. DEGREE PROGRAMME – LEVEL 05  
FINAL EXAMINATION – 2015/2016  
BOTANY  
BOU 3106/BTU3111/BTE5111/BOE5106 – PLANT BREEDING



DURATION: TWO (02) HOURS

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DATE: 17. 01. 2017

TIME: 1.30 – 3.30 p.m.

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ANSWER ANY FOUR (04) QUESTIONS

1.

- a) Heritability of a trait is a measure of its genetic variation. Explain the advantage of estimating the heritability value of an interested trait when breeding a new crop variety.
- b) Two homozygous tomato varieties (T1 and T2) were crossed to produce  $F_1$  hybrids. The average phenotypic variance in yield of the three populations  $P_1$ ,  $P_2$  and  $F_1$ , was 12.20. The variance of  $F_2$  was 22.20.
  - i) Calculate the heritability of yield in the  $F_2$  population and comment on the validity of using these two tomato varieties (T1 and T2) 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 the 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) Select the best line for GCA.

2.

- a) What is Hybrid Vigour?
- b) Explain briefly how hybrid vigour is utilized in a breeding programme.
- c) 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 c) (i).
- d) Give a comparison of Mass selection and Pure Line selection methods used in self pollinated crops.

3.

- a) Embryo rescuing is an important technique in Plant Tissue culture. Explain what embryo rescue is and describe its uses.
- b) Haploid plants are those possessing the gametic or half the somatic chromosome number.  
Explain briefly how haploid plants are obtained through tissue culture.
- c) Describe in brief the techniques/steps involved in microspore culture.

4.

- a) A mutation is a sudden change in hereditary material of a cell. Plant mutations can be classified into several types. Write a brief account of the types of plant mutations.
- b) Describe the procedures adopted for mutation breeding in self-pollinated and cross-pollinated plants.
- c) What are the applications and uses of mutation breeding in plants?
- d) What are the limitations of mutation breeding in plants?

5.

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

i) What are these factors?

ii) At a particular locus which controls the Pod length, there are two alleles,  $L$  and  $l$ . The mutation rate of  $L$  to  $l$  is  $3.2 \times 10^{-5}$ , whereas the mutation rate of  $l$  to  $L$  is  $6.4 \times 10^{-7}$ . Allele frequency ( $p$ ) of  $L$  is 0.6.

**Assumption:** No other factor is operating in the population to disturb the equilibrium.

What is the equilibrium frequency of  $l$  allele?

B) Average effect ( $\alpha$ ), Breeding value ( $A$ ) and Dominance deviation ( $D$ ) are important components of population genetics.

Find out the breeding values and dominance deviations of the following genotypes.

(Assume allele frequency ( $q$ ) of  $X_1$  is 0.4)

GENOTYPE	$X_1X_1$	$X_1X_2$	$X_2X_2$
GENOTYPIC VALUE	110	150	90

6.

- A) There are strategic perspectives to be taken into account when planning a breeding programme. What are they?
- B) What are the major factors affecting the selection of a breeding method for a particular crop species?
- C) Plant breeders recognize four (04) fundamental populations depending on the mode of reproduction and floral morphology of plants. Briefly describe these four types of plant populations based on above characteristics.

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