THE OPEN UNIVERSITY OF SRI LANKA

B.Sc. DEGREE PROGRAMME – LEVEL 05

FINAL EXAMINATION – 2013/2014

BOTANY

BOU 3106/BTU3111/BTE5111/BOE5106 – PLANT BREEDING

DURATION: TWO (02) HOURS

DATE: 25. 11. 2014 TIME : 1.30 – 3.30 p.m.

ANSWER ANY FOUR (04) QUESTIONS

1.

A) (i) Explain briefly what is understood by Genetic Engineering of plants.

(ii) Describe how herbicide resistant plants are developed using biotechnology.

B) (i) What is Male Sterility?

(ii) Give an account of how male sterility has been developed in crop plants with the aid of biotechnology.

(iii) Explain how male sterility is important in a breeding programme.

2.

a) Different selection methods are practiced in breeding cross pollinated crops. What are they?

b) What is recurrent selection?

c) Name the four (04) types of recurrent selection and explain them in brief.

d) Use a flow chart to explain the main steps involve in the Reciprocal Recurrent selection.

3.

A) Average effect (α), Breeding value (A) and Dominance deviation (D) are important components of population genetics.
The wing length (*l*) in *Drosophila* is a quantitative trait. The wing length of three genotypes in *Drosophila* at 4 weeks of age are as follows;

	Genotypes		
	++	+*l*	*ll*
Wing length in mm	12	10	7

Find out the average effects of the genes. (Assume allele frequency (*q*) of *l* is 0.4).

B) Gene frequencies of three genotypes in three sample populations are as follows. What are the Breeding Values (A) of these genotypes in the population (**Hint**: take the average)? (Gene frequency of allele A (*p*) is 0.4).

Genotype	**Frequencies**		
	Population 1	**Population 2**	**Population 3**
AA	0.03	0.27	0.60
AB	0.33	0.55	0.34
BB	0.54	0.20	0.08

C) 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 3.2×10^{-5}, whereas the mutation rate of *l* to *L* is 6.4×10^{-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?

4.

a) Heritability of a trait provides a measure of its genetic variation. What is the use of estimating the heritability value of an interested trait in a breeding programme.

b) What is the difference between broad-sense and narrow-sense heritability?

c) Two homozygous varieties of rice 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 10.50. The variance of F_2 was 20.50. Calculate the heritability of yield in the F_2 population.

d) In rice, the inbred lines, Bg300, Bg352, Bw364, At362, Bg366, and Bg406 were crossed in all possible combinations in a diallel cross. The progeny produced the following data for yield.

	Bg300	**Bg352**	**Bw364**	**Bw364**	**Bg366**	**Bg406**
Bg300	30	32	41	32	30	33
Bg352	40	39	41	34	32	36
Bw364	41	38	42	35	36	35
Bw364	32	41	38	34	29	34
Bg366	31	35	30	29	21	24
Bg406	30	37	40	35	27	28

Calculate the General Combining Ability (GCA) of each line and select the best line for GCA.

5.

a) Embryo rescuing is an important technique in Plant Tissue culture. Explain what embryo rescue is, and describe its uses.

b) Haploid plants are sometimes used in breeding programs. What are haploid plants?

c) Describe in brief the techniques of microspore culture.

6.

To facilitate the systematic increase and rapid distribution of new improved varieties, extensive and well defined seed production practices are employed.

a) In the development of seed production practices two assumptions are generally being
made. What are they?

b) Briefly describe the various classes of seeds that are recognized by seed certification agencies.

c) Outline the procedure by which a new variety of a field crop is developed.

d) Give an account in brief on the practical problems encountered during the seed production and possible solutions for such problems in small grains and forage crops.