# MACHAKOS UNIVERSITY

**University Examinations for 2021/2022 Academic Year**

**SCHOOL OF AGRICULTURE, ENVIRONMENT AND HEALTH SCIENCES**

**DEPARTMENT OF AGRICULTURAL SCIENCES**

**THIRD YEAR FIRST SEMISTER EXAMINATION FOR**

**BACHELOR OF SCIENCE IN AGRICULTURAL EDUCATION AND EXTENSION**

**AGR 305: PLANT BREEDING**

**DATE: 30/8/2022** **TIME: 8.30-10.30 AM**

---

**INSTRUCTIONS:**

**Answer *ALL* questions from Section A and any other *TWO* from Section B.**

**SECTION A: COMPULSORY**

**QUESTION ONE (30 MARKS)**

a) Distinguish between the following terms used in plant breeding (6 marks)

   i. Hybrids and vivihybrids

   ii. Complementary and heteromorphic systems of self-incompatibility (SI)

   iii. A line and B line in breeding

b) Explain two negative consequences that may result while improving adaptability of rice variety for saline environments (2 marks)

c) Explain the implication of the following in relation to Mendel's experiment. Support your answer with an illustration in each case.

   i. Principle of segregation (3 marks)

   ii. Principle of independent assortment (3 marks)

d) Using an illustration, describe the conditions necessary for successful development of a fungal infection in wheat (3 marks)

e) Explain three factors that determine genetic advance in breeding for abiotic stresses (3 marks)

f) Explain three methods used in breeding high yielding maize varieties for dryland areas (3 marks)

g) i. Using an illustration in each case, distinguish between broad sense and narrow sense heritability (3 marks)

ii. Explain two applications of heritability in sorghum breeding (2 marks)

h) Explain two roles of plant breeder's protection rights in developing new varieties (2 marks)

**SECTION B: Answer any TWO questions (40 Marks)**

**QUESTION TWO (20 MARKS)**

a) Describe the steps employed by a breeder in developing new oat varieties for farmers in Nandi County (8 marks)

b) Explain four techniques that can be utilized by researchers in breeding sweet potatoes for high yield. (12 marks)

**QUESTION THREE (20 MARKS)**

a) With the aid of diagrams, describe two ways a plant breeder can utilize self-incompatibility in developing superior breeding lines in maize (5 marks)

b) Using a diagram, describe an appropriate method used to develop resistance to a disease that is controlled by recessive genes. (15 marks)

**QUESTION FOUR (20 MARKS)**

a) Explain five reasons why utilization of apomixis in breeding superior lines is not attainable (5 marks)

b) With the aid of a diagram in each case, describe five applications of modern breeding methods that can be employed in breeding superior lines for drought tolerance. (15 marks)

**QUESTION FIVE (20 MARKS)**

a) Assume you have been employed by IITA, Kenya, as a plant breeder and you are tasked with improvement of cowpea production for resistance to bruchids. Using illustrations where applicable, describe four methods you will employ in developing a resistant variety (16 marks)

b) During the development of the variety in (a) above, explain four ways of creating variation (4 marks)