**GWANDA STATE UNIVERSITY**

**FACULTY OF NATURAL RESOURCES MANAGEMENT AND AGRICULRURE**

**DEPARTMENT OF HORTICULTURE AND CROP PRODUCTION**

**BACHELOR OF SCIENCE HONOURS DEGREE IN HORTICULTURE AND CROP PRODUCTION**

**GENETICS AND PLANT BREEDING NHC 2104**

**Final Main Examination Paper**

**June 2024**

This examination paper consists of Three pages.

**Time Allowed:** **Three (3) Hours**

**Total Marks:** **100**

**Special Requirements:** **Statistical tables, calculator**

**Examiner's Name:** **Mr. D Dube**

**INSTRUCTIONS**

1. Answer **all** questions in Section A
2. Answer **three** questions in Section B

**MARK ALLOCATION**

| **QUESTION** | **MARKS** |
|---|---|
| SECTION A | **40** |
| SECTION B | **60** |
| **TOTAL ATTAINABLE MARKS** | **100** |

**SECTION A: ANSWER ALL QUESTIONS IN THIS SECTION**

## Question 1

a). Distinguish Between

i). inter-generic and inter-specific hybridization (2)

ii). Trisomic and triploid (2)

iii). Self-incompatibility and male sterility in plants (2)

iv).Complete and incomplete gene linkage (2)

b). Determine the different gametes produced by the following $F_1$ dihybrid: BbDd (4)

c). Explain the theory of chromosomal inheritance following Mendel's Laws (8)

## Question 2

a). Describe different types of gene interactions (8)

b). Explain different mechanisms promoting Autogamy in plants (8)

c). Briefly Explain double fertilization in plants (4)

**SECTION B: ANSWER ANY THREE QUESTIONS IN THIS SECTION**

## Question 3

a). Compare sexual and asexual modes of reproduction in plants. (4)

b). Distinguish between coupling phase and repulsion phase of gene linkage (4)

c). Describe the factors that may alter the gene and genotype frequency in a Mendelian population (12)

## Question 4

a). Briefly explain male sterility highlighting different types of male sterility (10)

b). Discuss different changes in chromosome number and structure. (10)

## Question 5

a). Explain the concept of marker-assisted selection (MAS). (10)

b). Explain how Genetic variation can be created in a breeding program (6)

c). How can pollination be controlled in crop plants? (4)

## Question 6

a) An isolated field of maize is found to be segregating for yellow and white seed coat colour. Allele for Yellow colour is dominant over recessive allele for white colour. A random sample of 1000 kennels revealed that 960 were yellow. Following Hardy-Weinberg law find:

i) The allelic frequency estimates for this Mendelian population. (6)

ii) The genotypic frequency for this population (6)

iii) The number of kennels for dominant homozygous (4)

iv) The number of kennels for recessive homozygous (4)

v) The number of kennels for heterozygous (4)

## Question 7

In the garden pea, yellow seed coat colour is dominant to green, and Round seed shape is dominant to the wrinkled form. In crossing F1 dihybrids (heterozygous for Round and Yellow) with a test cross (homozygous recessive for green and wrinkled), the Test cross progeny appeared in the following numbers:

195 green, round

180 yellow, wrinkled

205 yellow, Round

120 green, wrinkled

Is the gene for seed shape linked with the gene for seed colour? Support your answer using Chi-square test analysis. (20)

**END OF EXAMINATION PAPER**