**FACULTY OF NATURAL RESOURCES MANAGEMENT AND AGRICULTURE**

**DEPARTMENT OF ANIMAL SCIENCE**

**BACHELOR OF SCIENCE HONOURS DEGREE IN ANIMAL SCIENCE**

**Introduction to Genetics (LAS 1201)**

**SEMESTER 2 EXAMINATION**

**June 2023**

| | |
|---|---|
| **Time Allowed:** | **3 hours** |
| **Special Requirements:** | **Chi-Square Table** |
| **Examiner's Name:** | **K. Mafunga** |

*Instructions to Candidates:*

1. The paper consists of six questions, answer **ALL** questions in **Section A** and **ANY TWO** in **Section B**.
2. Marks for each question are shown in brackets. Where a question has subdivisions, the marks for each subdivision are given.
3. Illustrate your answer, where applicable, with large clearly labelled diagrams.

**MARK ALLOCATION**

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

*This paper consists of <u>three</u> printed pages including this one.*

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**SECTION A: ANSWER <u>ALL</u> QUESTIONS IN THIS SECTION**

**Question 1**

a. Differentiate the following terms:

    i.    Metacentric and telocentric chromosomes **[2 marks]**

    ii.    Deletion and duplication in chromosome mutation **[2 marks]**

    iii.    Euploidy and aneuploidy **[2 marks]**

    iv.    Autopolyploidy and allopolyploidy **[2 marks]**

    v.    X-Y and Z-W sex determination system. **[2 marks]**

b. State Mendel's laws of segregation and independent assortment. **[2 marks]**

c. Outline the four traditional subdivisions of genetics. **[8 Marks]**

**Question 2**

a. When a plant of a genotype TtRr is self-fertilised and produces 1200 seeds, how many of these seeds will produce plants of a similar genotype to that of the parent (TtRr)? Show all working. **[10 marks]**

b. A sire's four locus genotype is **NnQqRRTt** and a dam's genotype is **NNQqRRTt**.
Considering these four loci, how many unique gametes can:

    i)    The sire produce? **[3 marks]**

    ii)    The dam produce? **[3 marks]**

    iii)    How many unique zygotes can be produced from the mating of the sire and dam?

    **[4 marks]**

**Question 3**

Write short notes on the following, giving examples in each case:

    i.    Co-dominance **[5 marks]**

    ii.    Sex-influenced inheritance **[5 marks]**

    iii.    Sex-limited inheritance **[5 marks]**

    iv.    Incomplete dominance. **[5 marks]**

**SECTION B: ANSWER ANY <u>TWO</u> QUESTIONS IN THIS SECTION**

**Question 4**

a. State the five conditions that must be met for a population to remain in Hardy-Weinberg equilibrium. **[5 marks]**

b. Discuss in detail the forces that may lead to a change in gene and genotype frequencies in a population. **[15 marks]**

**Question 5**

a. Define the term genetic engineering. **[2 marks]**

b. Discuss genetic engineering under the following headings:

   i. Potential benefits of genetic engineering in crop and livestock farming. **[8 marks]**

   ii. Potential drawbacks of genetic engineering in agriculture. **[10 marks]**

**Question 6**

In Pea plants, round seeds (R) are dominant to wrinkled (r), and yellow seeds (Y) are dominant to green (y). The cross RrYy x RrYy, produced:

● 315 Round, Yellow seed;

● 108 Round, Green seed;

● 101 Wrinkled, Yellow seed; and

● 32 Wrinkled, Green seed.

Test the data to determine if it fits the 9:3:3:1 ratio. Use **α = 0.05** **[20 marks]**

**END OF QUESTION PAPER**