JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF AGRICULTURAL AND FOOD SCIENCES

SECOND YEAR SECOND SEMESTER UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN AGRICULTURAL EXTENSION EDUCATION/ ANIMAL SCIENCE

2021/2022 ACADEMIC YEAR

REGULAR

COURSE CODE: AAS 3217/ APB 1207

COURSE TITLE: Principles of Genetics/ Principles of Genetics

EXAM VENUE: **STREAM: BSc. Agricultural Extension Education/ Animal Science**

DATE: **EXAM SESSION:**

TIME: 2 HOURS

Instructions:

1. **Answer ALL questions in section A and ANY other 2 Questions in section B.**
2. **Candidates are advised not to write on question paper.**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room.**

SECTION A [30 MARKS]

Answer ALL questions from this Section

1. Distinguish the following **[20 MARKS]**

   (a) Coefficient of coincidence vs coefficient of relationship **[2 MARKS]**

   (b) Dihybrid cross vs trihybrid cross **[2 MARKS]**

   (c) Epistasis vs pleiotropy **[2 MARKS]**

   (d) Null mutation vs gain-of-function mutation **[2 MARKS]**

   (e) Forward genetics vs reverse genetics **[2 MARKS]**

   (f) Incomplete penetrance vs variable expressivity **[2 MARKS]**

   (g) Chromosomal inversion vs chromosomal translocation **[2 MARKS]**

   (h) Complete dominance vs incomplete dominance **[2 MARKS]**

   (i) Heterosis vs inbreeding depression **[2 MARKS]**

(j) Exon vs intron **[2 MARKS]**

2. Briefly explain the following **[10 MARKS]**

(a) Chromosome theory of inheritance **[2 MARKS]**

(b) Gene therapy **[2 MARKS]**

(c) Central dogma of molecular biology **[2 MARKS]**

(d) Cross-over **[2 MARKS]**

(e) Independent assortment **[2 MARKS]**

SECTION B (40 MARKS)

Answer ANY TWO questions in this section

3a. Draw and explain a series of diagrams that illustrate the stages of Meiosis I **[10 MARKS]**

3b. Explain the functional properties of the following cellular organelles:

(a) Cell membrane:

(b) Golgi complex:

(c) Vacuole membrane:

(d) Mitochondrion:

(e) Cytoplasm:

(f) Smooth endoplasmic reticulum (smooth ER):

(g) Lysosome:

(h) Centrioles:

(i) Starch grain:

(j) Cell wall:

4a. A plant heterozygous for five independently assorting genes, *Aa Bb Cc Dd Ee*, is self-fertilized. Among the offspring, predict the frequency of **[10 MARKS]**

(a) *AA BB CC DD EE* individuals

(b) *aa bb cc dd ee* individuals

(c) Individuals that are either *AA BB CC DD EE* or *aa bb cc dd ee*

(d) *Aa Bb Cc Dd Ee* individuals

(e) Individuals that are not heterozygous for all five genes.

4b. Describe functions of the following enzymes involved in eukaryotic DNA replication **[10 MARKS]**

(a) DNA helicase:

(b) DNA primase:

(c) DNA polymerases:

(d) Topoisomerase:

(e) DNA ligase:

5a. Female mouse heterozygous for three recessive mutations *e* (ebony), *st* (scarlet eyes), and *ss* (spineless bristle) were testcrossed, and the following progeny were obtained **[10 MARKS]**

Phenotype	Number
Wild-type (+ + +)	67
ebony (e + +)	8
ebony, scarlet (st + e)	68
ebony, spineless (+ ss e)	347
ebony, scarlet, spinelss (st ss e)	78
scarlet (st + +)	368
scarlet, spinelss (st ss +)	10
spineless (+ ss +)	54

(a) What indicates that the genes are linked?

(b) What was the genotype of the original heterozygous females?

(c) What is the proportion of the single recombinants?

(d) What is the proportion of the double recombinants?

(e) What is the order of the genes?

(f) What is the map distance between *e* and *st*?

(g) What is the map distance between *e* and *ss*?

(h) What is the map distance between *ss* and *st*?

(i) What is the coefficient of coincidence?

(j) Diagram the crosses in this experiment

5b. Describe FIVE values of recombinant DNA and gene-cloning technologies to geneticists?

[10 MARKS]