JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

UNIVERSITY EXAMINATION 2012/2013

THIRD YEAR SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF EDUCATION (SCIENCE)

(SCHOOL BASED PROGRAMME)

COURSE CODE: SZL 303

TITLE: GENERAL GENETICS

DATE: **TIME:** **DURATION**: 2 HOURS

INSTRUCTIONS

1. **Answer ALL questions in section A and ANY other TWO Questions from section B**
2. **Write all answers in the booklet provided**

SECTION A: 30 MARKS

1. Explain the role of mutations as the source of genetic variation. (3 marks)
2. List three ways through which polymorphisms are maintained in populations. (3 marks)
3. Outline the key step in transcriptional control in negatively repressible operons (3 marks)
4. Cite the three genes of the *lac* operon citing the function of their products. (3 marks)
5. Distinguish between cytoplasmic inheritance and genetic maternal effect. (3 marks)
6. Explain the phenotypic effect of the following chromosomal rearrangements
    a. Deletions (1 marks)
    b. Translocation (1 mark)
    c. Inversions (1 mark)
7. Explain how linked genes end up being inherited together. (3 marks)
8. Distinguish between threshold and meristic characters (3 marks)
9. Assume that a polygenic character is controlled by three genetic loci. Determine the number of individuals in the F2 generation that will resemble each of the original parental generations. (3 marks)
10. Explain the characteristics of a trait exhibiting anticipation? (3 marks)

SECTION B: 40 MARKS

11. Discuss gene regulation in eukaryotes (2 marks)
12.
    a. Use the ABO blood group system to explain the inheritance of characteristics encoded by multiple alleles. (10 marks)
    b. Explain how recessive epistasis controls coat colour in Labrador retrievers. (10 marks)
13.
    a. Using hypothetical genes, illustrate the arrangement of alleles in a coupling and a repulsion condition. (4 marks)
    b. Waxy endosperm (*wx*), shrunken endosperm (*sh*), and yellow seed (*v*) are encoded by three recessive genes in corn that are linked on chromosome 5. A corn plant homozygous for all three recessive alleles is crossed with a plant homozygous for all the dominant alleles. The resulting F1 are then crossed with a plant homozygous for the recessive alleles in a three-point testcross. The progeny of the testcross are:

wx	*sh*	*V*	97
Wx	*Sh*	*v*	104
Wx	*Sh*	*V*	3,489
wx	*sh*	*v*	3,488
Wx	*sh*	*V*	1,525
Wx	*Sh*	*v*	1,541
wx	*Sh*	*V*	302
Wx	*sh*	*v*	290
TOTAL			**10,836**

i. Which locus would lie in the middle of the genetic map of the three loci? (1 mark)

ii. Explain how you obtained your answer in part (i.) (2 marks)

iii. Calculate the map distance between the three genes (9 marks)

iv. Determine the coefficient of coincidence and the interference among these genes (4 marks)

14. Turkeys have black, bronze, or black-bronze plumage. Examine the results of the following crosses:

Parents	**Offspring**
Cross 1: black and bronze	all black
Cross 2: black and black	¾ black, ¼ bronze
Cross 3: black-bronze and black-bronze	All black-bronze
Cross 4: black and bronze	½ black, ¼ bronze, ¼ black-bronze
Cross 5: bronze and black bronze	½ bronze and ½ black-bronze
Cross 6: bronze and bronze	¾ bronze, ¼ black-bronze

a. Are the differences in plumage arising from incomplete dominance between two alleles at a single locus? (2 marks)

b. Support your conclusion by assigning symbols to each allele and providing genotypes for all turkeys in the crosses. (18 marks)