

CHUKA



UNIVERSITY

## UNIVERSITY EXAMINATIONS

**FIRST YEAR EXAMINATION FOR THE AWARD OF DEGREE  
OF BACHELOR OF SCIENCE (BIOCHEMISTRY), BACHELOR OF EDUCATION  
(SCIENCE) BACHELOR OF SCIENCE IN NATURAL RESOURCES AND BACHELOR  
OF SCIENCE IN WILDLIFE**

**BOTA 111: GENERAL GENETICS**

**STREAMS: BScBiol (Y1S1), BScBioc (Y1S1), BED Sc. (Y1S1), BSc NARE (Y2S1) &  
BSc Wildlife (Y2S1)**

**TIME: 2 HOURS****DAY/DATE: FRIDAY 8/12/2017****8.30 A.M - 10.30 A.M.****INSTRUCTIONS:**

- Answer all the Questions in Section I and any ONE in Section II
- Use of calculators and statistical tables is allowed
- Do not write anything on the question paper

**SECTION I: [50 MARKS]**

1. Explain the following terms; [8 Marks]
- (i) Submetacentric chromosome
  - (ii) Sex-limited traits
  - (iii) Epigenesis
  - (iv) Homologous chromosome
2. The following three pairs of alleles exist in an organism,  $+/x$ ,  $+/y$  and  $+/z$ . Each mutant allele is recessive to its wild-type allele (+). A testcross between heterozygous females and homozygous males yields the following results:

$+++ = 30$	$x++ = 0$
$++z = 32$	$x+z = 430$
$+y+ = 441$	$xy+ = 27$
$+yz = 1$	$xyz = 39$

- (i) List the classes that are parental types. [1 Mark]
- (ii) List the classes that are as a result single and double crosses. [2 Marks]

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- (iii) How are the members of the allelic pairs distributed in the heterozygous females? [1 Mark]
  - (iv) Give the sequence of the three genes. [1 Mark]
  - (v) Calculate the map distance between (a) the first and second genes, and (b) the second and third genes? [3 Marks]
3. Explain criss-cross inheritance in *Drosophila melanogaster*. [5 Marks]
4. According to some cytophotometric measures, the amount of DNA in a diploid nucleus of each human cell is made up of 5.6 picograms ( $5 \times 10^{-12} g$ ) of DNA. How much DNA would be found in the following stages? [5 Marks]
- (i) Prophase of mitosis
  - (ii) Anaphase II of meiosis
  - (iii) Prophase II of meiosis
  - (iv) Metaphase I of meiosis
  - (v) S stage of mitosis
5. In cattle population, the frequency of hornless bull population is 16%. Hornless in bull is due to recessive gene.
- (a) Calculate the frequency of recessive and normal alleles. [4 Marks]
  - (b) Calculate the genotypic frequencies at equilibrium [6 Marks]
6. Outline point mutations that occur in DNA sequences encoding proteins. [6 Marks]
7. Describe briefly genes with multiple alleles. [8 Marks]

**SECTION II [20 MARKS]**

8. In a crossing experiment using garden peas (*Pisum sativum*), a testcross between a homozygous recessive parent and heterozygote F<sub>1</sub> produced the following F<sub>2</sub> phenotypic classes:
- 150 plants bearing round/yellow seeds
  - 430 plants bearing round/green seeds
  - 420 plants bearing wrinkled/yellow seeds
  - 145 plants bearing wrinkled/green seeds
- Suggesting possible hypothesis, determine if the observed data supports your suggested hypothesis at 5% significant level. [20 Marks]
9. Discuss the structure of the nucleic acids. [20 Marks]
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