CHUKA UNIVERSITY

UNIVERSITY EXAMINATIONS

SECOND YEAR EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE IN HORTICULTURE

AGRI 221: PRINCIPLES OF GENETICS AND CYTOGENETICS

STREAMS: B.Sc (HORT) Y2S1 **TIME: 2 HOURS**

DAY/DATE: THURSDAY 7/12/2017 **11.30 A.M - 1.30 P.M.**

INSTRUCTIONS:

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

SECTION I: [30 MARKS]

QUESTION ONE

Differentiate the following terms [8 Marks]

(i) Transcription and Translation
(ii) Coupling and repulsive phase
(iii) Metacentric and acrocentric chromosomes
(iv) Physical map and genetic map

QUESTION TWO

According to some cytophotometric measures, the amount of DNA in a diploid nucleus of each maize *(Zea Mays L.)* cell is made up of 5.0 picograms (5×10^{-12} g) of DNA. How much DNA would be found in the following stages? [5 Marks]

(i) Prophase of mitosios
(ii) Anaphase II of meiosis
(iii) Prophase II of meiosis
(iv) Metaphase I of meiosis
(v) S stage of mitosis

QUESTION THREE

(a) Describe how you can introduce a gene from bacteria to cereal plant. [5 Marks]

(b) Explain four examples of successful chromosome manipulation in distant hybridization. [4 Marks]

QUESTION FOUR

In a cross +r+/w+s x wrs/wrs, the following offspring were obtained:

+r+/wrs 360	w++/wrs 90
wr+/wrs 50	w+s/wrs 350
wrs/wrs 4	+++/wrs 6
+rs/wrs 100	++s/wrs 40
	1000

(i) Show the groups in the progeny that are true breeding. [1 Marks]

(ii) Show the groups in the progeny that represent double crossovers. [1 Mark]

(iii) Give the sequence of the three genes and calculate the map distance between (a) the first and second genes, and (b) the second and third genes. [6 Marks]

SECTION II [40 MARKS]

QUESTION FIVE

A variety A is resistant to viral disease caused by stain I, but it is susceptible to race 2. Variety B is susceptible to race I of the pathogen but resistant to race 2. The F_1 hybrid of the two varieties in resistant to both races. In the F_2 the following segregation was observed.

1. Resistant to 1 and 2: 128 plants
2. Susceptible to 1 and 2: 14 plants
3. Resistant to 1 and susceptible to 2:39 plants
4. Susceptible to 1 and resistant to 2:44 plants

(i) How many genes govern resistance to each race? [2 Marks]

(ii) Suggest the expected segregation model. [2 Marks]

(iii) Using Chi-Square test, test whether the observed F_2 segregation rations are consistent with the suggested model at 5% probability level. [16 Marks]

QUESTION SIX

Discuss the types of DNA mutations. [20 Marks]

QUESTION SEVEN

(a) Differentiate between Eukaryotic and prokaryotic promoter. [8 Marks]

(b) Using chromosomal manipulation, describe how you would synthesis the following:

(i) An amphidiploid hexaploid wheat [8 Marks]

(ii) An amphidiploids triticale [5 Marks]

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