



MACHAKOS UNIVERSITY

University Examinations for 2024/2025 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF BIOLOGICAL SCIENCES

THIRD YEAR FIRST SEMESTER EXAMINATION FOR DEGREE IN
BACHELOR OF SCIENCE IN BIOLOGY
BACHELOR OF SCIENCE (AGRICULTURAL EDUCATION & EXTENSION)
BACHELOR OF EDUCATION (SCIENCE)

SBT300: CELL BIOLOGY AND GENETICS

DATE: 23RD JANUARY, 2025

TIME: 2.00 PM – 4.00 PM

INSTRUCTIONS:

*Answer question **ONE (Compulsory)** and **any other TWO** questions*

QUESTION ONE (30 MARKS)

- a) Coat color in mice depends on three alleles.

Coat Color	Allele	Inheritance Pattern
Agouti	C	dominant to other alleles
Black	c ^b	dominant to albino
Albino	c	recessive

A scientist crosses a black mouse with an agouti mouse. Using letter C for Agouti and Letter c^b edict the possible phenotypes of their offspring. (3 marks)

- b) Describe cyclin dependent regulation of the cell cycle. (3 marks)
- c) Compare cytokinesis in animal cell and plant cells. (3 marks)
- d) Explain how the process of meiosis contributes to genetic diversity in an organism. (3 marks)
- e) Outline three characteristics of the genetic code. (3 marks)

- f) Describe bottleneck and its effect on the genetic diversity of a population. (3 marks)
- g) Explain Mendel's law of independent assortment using a dihybrid cross. (3 marks)
- h) Describe the structure and function of tRNA. (3 marks)
- i) Describe Hershey and Chase experiment on DNA. (3 marks)
- j) In a maternity ward, three kids accidentally get mixed up. The ABO blood types of the three babies are known to be A, B and AB. The ABO types of the three sets of parents are determined. Giving an explanation, indicate which baby belongs to each set of parents:
 - a. AB x O
 - b. A x O
 - c. A x AB(3 marks)

QUESTION TWO (20 MARKS)

Discuss DNA replication in prokaryotes. (20 marks)

QUESTION THREE (20 MARKS)

- a) Discuss RNA processing in eukaryotes. (10 marks)
- b) Discuss how Darwin's theory of natural selection leads to evolution. (10 marks)

QUESTION FOUR (20 MARKS)

Using the lac operon Model as an example, discuss gene regulation in prokaryote. (20 marks)

QUESTION FIVE (20 MARKS)

- a) Discuss the Hardy-Weinberg theory and the conditions necessary for a population to remain in Hardy-Weinberg equilibrium. (10 marks)
- b) Describe how a secreted polypeptide reached the endomembrane system. (10 marks)