



MACHAKOS UNIVERSITY

University Examinations for 2019/2020 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF BIOLOGICAL SCIENCES

FOURTH YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF EDUCATION (SPECIAL NEEDS)

BACHELOR OF EDUCATION (SCIENCE)

BACHELOR OF SCIENCE (BIOLOGY)

SZL 304: EVOLUTIONARY BIOLOGY

DATE: 13/11/2020

TIME: 8:30 – 10:30 AM

INSTRUCTIONS

1. Answer Question 1 (compulsory) and **any two** questions in Section B.
2. Use clean well labelled diagrams wherever appropriate.

SECTION A: COMPULSORY

QUESTION ONE (30 MARKS)

- a) Define the following terminologies (3 marks)
 - i) Anagenesis
 - ii) Cladogenesis
 - iii) Determinism
- b) Describe the principle of population according to Thomas Malthus theory. (3 marks)
- c) Explain the challenges of Darwin's views on evolution (3 marks)
- d) Briefly describe the importance of traits in a population (3 marks)
- e) Outline the stochasiaty nature of evolution (3 marks)
- f) Briefly describe the general principle of gene variation in a population (3 marks)
- g) Describe two commonly used measures of variation in natural selection (3 marks)
- h) Briefly describe the effects of microevolutionary processes on genetic equilibrium (3 marks)
- i) Describe the concept of sexual selection in evolutionary biology (3 marks)
- j) Briefly describe the key characteristics of adaptive radiation (3 marks)

SECTION B: ANSWER ANY TWO QUESTIONS (40 MARKS)

QUESTION TWO (20 MARKS)

- a) The following sequences represent an optimum alignment of the nucleotides of human and sheep *preproinsulin* genes, which last shared a common ancestor 80 million years ago:

Human: ATGGCCTGTT GGATGCGCCT CCTGCCCCTG CTGGCGCTGC TGGCCCTCTG

Sheep: ATGGCCTGTT GGACACGCCT GGTGCCCCTG CTGGCCCTGC TGGCACTCTG

Determine the estimated number of nucleotide substitution and Rate of nucleotide substitutions

(10 marks)

- b) Discuss the limitations of Hardy – Weinburg theory to locus with many alleles (10 marks)

QUESTION THREE (20 MARKS)

Discuss the Jukes and Cantor model of molecular evolution

QUESTION FOUR (20 MARKS)

- a) The genotype of a defendant in a crime scene was found to be $A_{14}A_{27}$ and that of the tissues sample collected from the same crime scene was $A_{14}A_{27}$. Discuss the probability of this match being a false positive? (10 marks)
- b) Using equations discuss the effects of migrations on the allele frequency (10 marks)

QUESTION FIVE (20 MARKS)

Discuss adaptive radiations as an ecological opportunity