



MACHAKOS UNIVERSITY

University Examinations for 2021/2022 Academic year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTING AND INFORMATION TECHNOLOGY

FIRST YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (MATHEMATICS)

SMA 130: INTRODUCTION TO ANALOGUE ELECTRONICS

DATE: 2/2/2022

TIME: 8.30-10.30 AM

INSTRUCTIONS: Answer Question ONE and any other TWO Questions

QUESTION ONE (30 MARKS) (COMPULSORY)

- a) With the aid of well labeled diagrams, explain the Bohr atomic structures of the following elements.
 - i. Insulators
 - ii. Semiconductors (4 marks)
- b) Explain the effect of temperature on a semiconductor under the following conditions
 - i. Below zero degrees
 - ii. At absolute zero
 - iii. Above absolute zero (4 marks)
- c) With the aid of well labeled diagrams, explain the formation of a P-N junction (4 marks)
- d) If an external voltage is added to the P-N junction in (c) above, explain what could be the effect. (4 marks)
- e) With the aid of a circuit diagram, explain the operation of a single stage amplifier. (8 marks)
- f) Explain the Salient Features of Photodiodes (6 marks)

QUESTION TWO (20 MARKS)

- a) Explain three properties of semiconductors (6 marks)
- b) Differentiate between Intrinsic semiconductors and Extrinsic semiconductors (4 marks)
 - i. Calculate the operating point of a transistor whose collector load is $8k\Omega$ and the transistors' quiescent current is 2mA. Take V_{CC} as 20V. (6 marks)
 - ii. If R_C was to be put to $10k\Omega$, what could be the operating point of the transistor in (i) above (4 marks)

QUESTION THREE (20 MARKS)

- a) In a common base connection, the emitter current is 10mA. If the emitter circuit is open, the collector current is 100mA. Find the total collector current given that $\alpha = 0.98$ (6 marks)
- b) With respect to a common emitter connection, derive the relationship between β and α . (6 marks)
- c) Find the values of collector and emitter currents in a transistor having $I_{CBO} = 3\mu A$, and $DC = 0.98$ when its base current is $60\mu A$. (8 marks)

QUESTION FOUR (20 MARKS)

- a) By the aid of well labeled diagram, explain the V-I characteristics on the following considerations: -
 - i. Forward biasing (6 marks)
 - ii. Reverse biasing (6 marks)
- b) Using a well belled graph diagram, describe the Zener effect (8 marks)

QUESTION FIVE (20 MARKS)

- a) Highlight the Characteristics of tunnel diodes. (6 marks)
- b) With the aid of a well labeled diagram, explain a single stage emitter amplifier circuit. (8 marks)
- c) Explain any six types of diodes and their application in the world of electronics. (6 marks)