



MACHAKOS UNIVERSITY

University Examinations for 2020/2021 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL AND MANUFACTURING ENGINEERING

SECOND YEAR SUPPLEMENTARY EXAMINATION FOR

BACHELOR OF SCIENCE (ELECTRICAL AND ELECTRONICS ENGINEERING)

EEE 200 INTRODUCTION TO MATERIAL SCIENCE

DATE: 8/3/2023

TIME: 1030-1.00 PM

INSTRUCTIONS

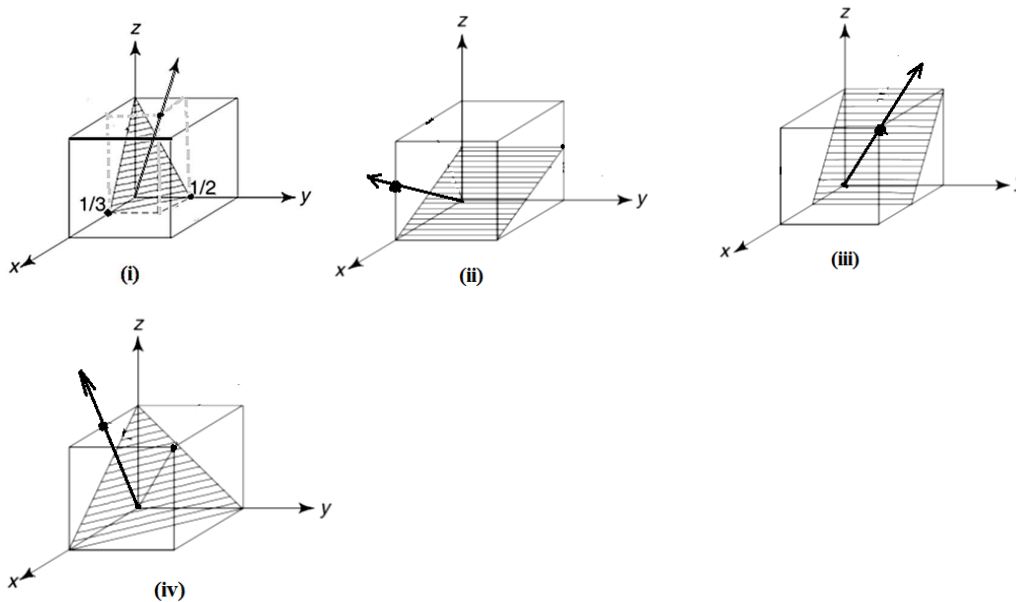
Answer question ONE and any other two questions

QUESTION ONE (COMPULSORY) (30 MARKS)

- a) Explain the following types of materials
 - i. Composites
 - ii. Semiconductors
 - iii. Biomaterials (6 marks)
- b) Draw the crystallographic planes (110), (10 $\bar{1}$), (111) and (0 $\bar{1}$ 0) of simple cubic structures. (8 marks)
- c) Compare and contrast elastic and plastic deformation of materials. Use a clearly labelled graph of load versus strain to explain. (8 marks)
- d) What are the **five** main methods of corrosion prevention? (5 marks)
- e) Calculate the resistance of an aluminium wire 200 m long and having cross-sectional area of 5 sq. mm at 28°C. Given, the resistivity of Al at 28°C = $1.4 \times 10^{-8} \Omega\text{-m}$. (3 marks)

QUESTION TWO (20 MARKS)

- a) Name and mention the properties of **three** basic classes of materials. Give any **two** examples of each (12 marks)
- b) Specify the plane miller indices indicated in each of the following structures (8 marks)



QUESTION THREE (20 MARKS)

- State **five** factors which affect the mechanical properties of materials and state the effect of **each** by using examples where necessary. (15 marks)
- Name any **five** important mechanical tests which give valuable information about metals and alloys. (5 marks)

QUESTION FOUR (20 MARKS)

- Describe the Iron–Carbon Phase diagram with an aid of a clear and well labelled sketch (12 marks)
- State any **two** properties and any **two** applications of each of the following cast irons
 - Gray cast iron
 - White cast iron
 (8 marks)

QUESTION FIVE (20 MARKS)

- Briefly explain the difference between oxidation and reduction electro-chemical reactions. Which reaction occurs at the anode and which at the cathode? (4 marks)
- A bimetallic strip is constructed from strips of two different metals that are bonded along their lengths. Explain how such a device may be used in thermostat regulate temperature. (4 marks)
- Explain the following applications of optical phenomena in materials (i) photoconductivity (ii) Lasers (6 marks)
- Explain what insulators, conductors and semiconductors are? Give examples of each. (6 marks)