



(University of Choice)

**MASINDE MULIRO UNIVERSITY OF  
SCIENCE AND TECHNOLOGY  
(MMUST)**

**MAIN CAMPUS**

**UNIVERSITY EXAMINATIONS**

**2021/2022 ACADEMIC YEAR**

**SECOND YEAR SECOND SEMESTER EXAMINATIONS**

**FOR THE DEGREE**

**OF**

**BACHELOR OF SCIENCE IN MECHANICAL AND  
INDUSTRIAL ENGINEERING**

**COURSE CODE: MIE 212**

**COURSE TITLE: MATERIAL SCIENCE I**

**DATE: 28-04-2022**

**TIME: 12:00-14:00**

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**INSTRUCTIONS TO CANDIDATES**

Answer Question ONE and any other TWO questions

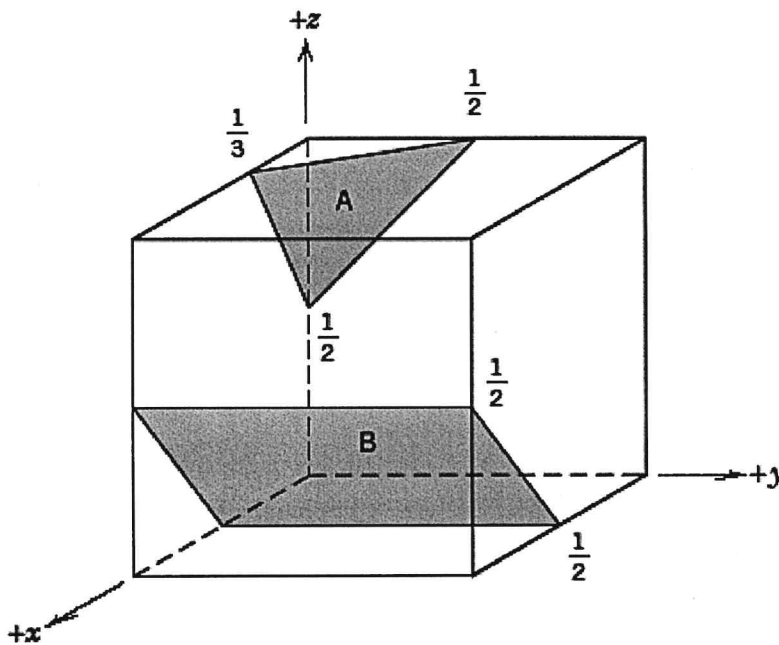
TIME: 2 Hours

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 3 Printed Pages. Please Turn Over

**Question 1** /30 marks/

- a) Explain with the help of a well labelled diagram the arrangement of the atoms in the Hexagonal close packed structure hence atomic packing factor of a HCP structure [6 marks]
- b) Determine the Miller indices for the planes shown in the following unit cell [6 marks]



- c) Describe the following type of bronzes in terms of composition properties and application
- i. Phosphor bronze [3 marks]
  - ii. Gun metal [3 marks]
  - iii. Silicon Bronze [3 marks]
- d) Distinguish in terms of the structure and working principle the following types of composites
- i. Large – Particle composites [3 marks]
  - ii. Dispersion strengthened composites [3 marks]
- e) Discuss nylons as general purpose plastics with regard to their properties and applications [3 marks]

**Question 2** /20 marks/

- a) In the formation of glass additional ingredients are contained in a solid solution with SiO<sub>2</sub>. Outline six (6) functions of these additives [6 marks]
- b) Discuss the following alloys of aluminium with respect to their properties and typical applications
- i. Duralumin [8 marks]
- ii. Magnalium [6 marks]

**Question 3** /20 marks/

Discuss the following common plastic processing processes with respect to the following: Process definition, procedure, features and typical products.

- a) Injection Moulding [10 marks]
- b) Extrusion [10 marks]

**Question 4** /20 marks/

- a) Explain the distinctive features, limitations and applications of the following alloy groups
- (i) Titanium alloys [6 marks]
- (ii) Magnesium alloys [6 marks]
- b) Explain four major reasons why carbon is a high – performance fiber material that is commonly used as a reinforcement in advanced polymer – matrix composites [8 marks]

