20

(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY

MAIN CAMPUS

UNIVERSITY EXAMINATIONS
2023`/2024 ACADEMIC YEAR

FIRST YEAR FIRST SEMESTER EXAMINATIONS FOR THE DEGREE OFBACHELOR OF SCIENCE IN FOOD SCIENCE AND TECHNOLOGY

COURSE CODE: **AET 101**

COURSE TITLE: **MATERIALS SCIENCE AND BASIC SOLID MECHANICS**

DATE: **19th Dec, 2023** **TIME: 8-10 AM**

INSTRUCTIONS TO CANDIDATES

- This paper contains five questions
- Answer QUESTION ONE, and any other three
- Candidate must not write anywhere on the question paper
- Duration of examination is 2 hrs

MMUST observes ZERO tolerance to Examination Cheating

Question 1 (25 marks)

(a) State the different types of bonds found in elements **(4 marks)**

(b) With the aid of diagrams describe the following unit cells as found in materials science, and for each, name any two elements that described by the unit cells.

i. BCC
ii. FCC
iii. HCP **(6 marks)**

(c) State the factors that determine the mechanical properties of a metal **(5 marks)**

(c) State the principles of the following
Rutherford atomic model
Bohr atomic model

Question 2 (15 marks)

(a) Briefly describe the following with the aid of simple sketches

i. Molecular structures
ii. Crystalline structures
iii. Amorphous structures **(5 marks)**

(b) Distinguish between the following;

i. Elastic material and a plastic material
ii. Metallic and non-metallic material
iii. Stress and strain
iv. Physical and mechanical properties
v. Ductility and brittleness

(10 marks)

Question 3 (15 marks)

Describe three ways in which metals can form alloys (3 marks)

Define and explain the importance of an equilibrium diagram (4 marks)

Distinguish between the following stainless steels;

i. True stainless steels
ii. Austenitic stainless steels
iii. Martensitic stainless steels (3 marks)

Question 4 (15 marks)

Discuss the applications of the following materials in design of food processing and engineering systems

i. Steel
ii. Copper
iii. Plastic
iv. Aluminium
v. Ceramics **(15 marks)**

Question 5 (15 marks)

With the aid of a well labelled diagram describe the behavior of an elastic material under tensile stress, until it fractures **(9 marks)**

State the for four quantum numbers used in atomic theory and their principles **(6 marks)**