



(University of Choice)

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

**MAIN CAMPUS**

**UNIVERSITY EXAMINATIONS 2023/2024 ACADEMIC YEAR**

**SECOND YEAR FIRST SEMESTER EXAMINATIONS**

**FOR THE DEGREE  
OF  
BACHELOR OF SCIENCE  
IN  
CIVIL AND STRUCTURAL ENGINEERING**

**COURSE CODE: CSE 223**

**COURSE TITLE: ENGINEERING MATERIALS I**

**DATE: 7<sup>TH</sup> DECEMBER 2023**

**TIME: 12 P.M – 2 P.M**

**INSTRUCTIONS:**

1. This paper consists of **FIVE** questions.
2. **Attempt any FOUR questions in this booklet.**
3. Marks for each question are as indicated in the parenthesis.
4. No unauthorized materials are allowed in the examination room.

Examination duration is **2 Hours**

MMUST observes **ZERO** tolerance to examination cheating

This Paper Consists of 2 Printed Pages. Please Turn Over.

**Question 1****(17.5 marks)**

- a) Define the space Lattice as applied in engineering materials (2 marks)
- b) Sketch the following Bravais Space Lattice patterns:
- 1) Triclinic,
  - 2) Base Centred Monoclinic,
  - 3) Body-centred Orthorhombic,
  - 4) Face-centred Orthorhombic,
  - 5) Hexagonal. (5 marks)
- c) Describe the three crystal Structures in Metals. (7 marks)
- d) Describe the Stress-Strain Curve for typical Metal. (3.5 marks)

**Question 2****(17.5 marks)**

- a) Describe the S-N curves as a means of presentation of steel fatigue data. (4.5 marks)
- b) Discuss the following improvement techniques of steel fatigue:
- 1) Grinding,
  - 2) Weld toe remelting,
  - 3) Hammer peening. (6 marks)
- c) Describe the ductile and brittle behaviours of metal. (7 marks)

**Question 3****(17.5 marks)**

- a) Describe the production of Aluminium. (7 marks)
- b) Discuss briefly the following types of polymers.
- 1) Thermosetting plastics
  - 2) Thermoplastics
  - 3) Elastomers (3 marks)
- c) Describe the 5 methods of foamed or 'Expanded' plastic polymer. (7.5 marks)

**Question 4****(17.5 marks)**

- a) Describe the heat-treatment of ceramics. (4.5 marks)
- b) Discuss the following properties of ceramics:
- 1) Strength,
  - 2) Creep,
  - 3) Hardness. (6 marks)
- c) Explain the following heat treatment of glasses:
- 1) Annealing.
  - 2) Tempering. (7 marks)

**Question 5****(17.5 marks)**

- a) Define Heat treatment of metals. (4 marks)
- b) State and explain reasons for metal heat treatment (6 marks)
- c) Sketch and describe Tensile test that is used to measure the mechanic properties of metals. (4.5 marks)
- d) List three stage processes of steel fatigue. (3 marks)