



TECHNICAL UNIVERSITY OF MOMBASA

SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF BUILDING & CIVIL ENGINEERING
UNIVERSITY EXAMINATION FOR:

BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECV 4311: ENGINEERING MATERIALS I

END OF SEMESTER EXAMINATION

SERIES: JANUARY 2025

TIME: 2 HOURS

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **five** questions.

Attempt question ONE (Compulsory) and any other TWO questions.

Do not write on the question paper.

QUESTION ONE (COMPULSORY) 30 Marks

- a) A construction company is deciding whether to use aluminium or steel for a new high-rise building. Discuss the considerations for selecting each material, focusing on strength, weight, corrosion resistance, and cost. (10 marks)
- b) A civil engineer needs to select materials for the construction of a waterproof tunnel lining. Discuss the considerations for selecting polymer-based materials, focusing on durability, flexibility, and water resistance. (10 marks)
- c) A civil engineer is designing a high-temperature furnace. Discuss the considerations for selecting ceramic materials for the furnace lining, focusing on thermal stability, resistance to thermal shock, and durability. (10 marks)

ANSWER ANY TWO QUESTIONS FROM THIS SECTION

QUESTION TWO (20 marks)



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- a) Differentiate between atomic structure and microstructure, and explain how each impacts material properties. (6 marks)
- b) What are composite materials and how are they classified? Provide two examples. (4 marks)
- c) Explain the manufacture of steel using the Basic Oxygen Furnace (BOF) process, and highlight its importance in the construction industry. (10 marks)

QUESTION THREE (20 Marks)

- a) Differentiate between linear and branched polymers, providing examples of each. (4 marks)
- b) What are the key differences between ceramics and metals in terms of their properties and applications? (6 marks)
- c) Discuss the heat treatment processes used to control the properties of steel, focusing on annealing, quenching, and tempering. (10 marks)

QUESTION FOUR (20 Marks)

- a) Define polymers and explain the significance of polymer structure in determining their properties. (5 marks)
- b) Explain the importance of crystallinity in polymers and how it affects their mechanical properties. (5 marks)
- c) Explain the process of manufacturing ceramics, including key steps like shaping, drying, and firing. (10 marks)

QUESTION FIVE (20 Marks)

- a) Discuss the types of ceramics used in civil engineering, focusing on bricks, tiles, and sanitary ware. (10 marks)
- b) What are thermoplastics and thermosetting polymers? Give one example of each. (4 marks)
- c) Describe the role of additives in improving the performance of polymers used in civil engineering. Give examples of additives. (6 marks)

