



## 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**  
SPECIAL/SUPPLEMENTARY EXAMINATION  
**SERIES: JULY 2025**  
**TIME: 2 HOURS**

### **Instructions to Candidates**

You should have the following for this examination

*-Answer Booklet, calculator, 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 civil engineer needs to select materials for a bridge construction project that will be exposed to a marine environment. Discuss the considerations the engineer should take into account when selecting materials, with specific emphasis on corrosion resistance, durability, and cost-efficiency. (10 marks)
- Explain how alloying affects the mechanical properties of metals, particularly focusing on how it improves strength and durability. Provide examples of alloys used in the construction industry and discuss their applications. (10 marks)
- In an industrial furnace, materials must withstand extremely high temperatures. Describe how refractory ceramics are used in such applications and explain their thermal stability and resistance to chemical attack. (10 marks)

**ANSWER ANY TWO QUESTIONS FROM THIS SECTION**

### **QUESTION TWO (20 marks)**

- Define metals and describe their role in civil engineering. (4 marks)



TUM is ISO 9001:2015 Certified

- b) Explain the concept of metallic bonding and its significance in the properties of metals. (6 marks)
- c) Differentiate between ferrous and non-ferrous metals, providing two examples of each. (4 marks)
- d) Explain the role of processing techniques in enhancing the properties of metals, with an example. (6 marks)

### **QUESTION THREE (20 Marks)**

- a) Compare the use of silicon carbide and alumina ceramics in construction, focusing on their properties and applications. (10 marks)
- b) Describe the crystal structures of metals, focusing on the BCC, FCC, and HCP structures. (6 marks)
- c) Explain the importance of grain boundaries in influencing the mechanical properties of metals. (4 marks)

### **QUESTION FOUR (20 Marks)**

- a) Explain how defects such as point defects and line defects affect the mechanical properties of ceramics, and discuss how controlling these defects can improve performance. (10 marks)
- b) Explain the relationship between structure, properties, processing, and performance in engineering materials, using steel as an example. (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)

