



**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**SCHOOL OF ENGINEERING AND TECHNOLOGY**

**UNIVERSITY EXAMINATION FOR THE DEGREE IN SCIENCE IN RENEWABLE  
ENERGY TECHNOLOGY AND MANAGEMENT**

**2<sup>ND</sup> YEAR 1<sup>ST</sup> SEMESTER 2024/2025 ACADEMIC YEAR**

**CENTRE: MAIN CAMPUS**

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**COURSE CODE: TEB 1201**

**COURSE TITLE: MATERIAL SCIENCE I**

**EXAM VENUE:**

**STREAM: BSc. REN ENGY TEC & MGT**

**DATE: 13 /1/2025**

**EXAM SESSION:14-16.00 HRS**

**DURATION: 2 HOURS**

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**Instructions**

- 1. Answer question 1 (Compulsory) and ANY other two questions**
- 2. Candidates are advised not to write on question paper**
- 3. Candidates must hand in their answer booklets to the invigilator while in the examination room.**

### **Question One (Compulsory)**

- a) State **TWO** types of advanced materials. **(2 Marks)**
- b) Enumerate **FOUR** information that can be obtained from the phase diagrams. **(4 Marks)**
- c) Outline **FOUR** major groups for classifying of engineering materials that falls within the scope of material science and engineering. **(4 Marks)**
- d) State **THREE** types of static stresses to which materials can be subjected to **(3 Marks)**
- e) Explain **WHY** materials bonded in with covalent bonds have limited ductility while those bonded with metallic bonds show good ductility. **(2 Marks)**
- f) Assuming that silica ( $\text{SiO}_2$ ) has 100% covalent bonding, using an illustration show how oxygen and silicon atoms are joined to form in silica ( $\text{SiO}_2$ ). **(3 Marks)**
- g) State **FOUR** defects that can be detected by Non-destructive testing (NDTs). **(2 Marks)**
- h) Explain the difference between the terms materials science and materials engineering. **(3 Marks)**
- i) Define the following terms **(4 Marks)**
1. Mass Number
  2. Atomic mass
  3. Isotope
  4. Valence
- j) A piece of copper originally 305 mm long is pulled in tension with a stress of 276 MPa. If the deformation is entirely elastic, find the resultant elongation. **(3 Marks)**

### **QUESTION TWO**

- a) Non-destructive Testing is not just a method for rejecting substandard material; it is also an assurance that materials are supposedly good for various engineering applications. Describe **FOUR** non-destructive testing methods that are used in material science. **(10 Marks)**
- b) Using a well labelled diagram sketch a stress-strain curve obtained from tensile test. Discuss any **FIVE** properties obtained from the curve. **(10 Marks)**

### **QUESTION THREE**

- a) Apart from the mechanical properties of materials, outline other five properties that are important for an engineer, to enable him in selecting suitable metals for various jobs. (5 Marks)
- b) Using examples of well labelled illustrations discuss the following bonds. (5 Marks)
1. Ionic bond
  2. Metallic bond
- c) Discuss **THREE** methods of measuring hardness (6 Marks)
- d) Discuss **TWO** materials of the future that would have a significant influence on many of our recent technologies in production. (4 Marks)

### **QUESTION FOUR**

- a) Discuss types of corrosion that occur on metal surfaces. (10 Marks)
- b) Use a well labelled diagram discuss the entire range representing the iron-carbon phase diagram. (10 Marks)

### **QUESTION FIVE**

- a) Discuss **FOUR** blocks that are used to describe the modern periodic table. (10 Marks)
- b) As an expert in material science describe **FIVE** mechanical properties affecting the selection of a material for different engineering applications. (10 Marks)