



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**

2ND YEAR 1ST SEMESTER 2023/2024 ACADEMIC YEAR

CENTRE: MAIN CAMPUS

COURSE CODE: TEB 1201

COURSE TITLE: MATERIAL SCIENCE I

EXAM VENUE: STREAM: BSc. REN ENGY TEC & MGT

DATE: /12/2023 EXAM SESSION:

DURATION: 2 HOURS

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) (30 Marks)

- a) Explain **WHY** materials bonded in with covalent bonds have limited ductility while those bonded with metallic bonds show good ductility **(2 Marks)**
- b) Explain the difference between the terms materials science and materials engineering. **(3 Marks)**
- c) Using a well labeled diagram illustrate the principles of atomic bonding showing the presence of attractive and repulsive forces **(4 Marks)**
- d) Define the following terms **(5 Marks)**
 - 1. Binding energy
 - 2. Electronegativity
 - 3. Crystalline materials
 - 4. Composition
- e) Out line **FOUR** considerations that a designer has to consider for satisfactory fatigue life during design procedure **(4 Marks)**
- f) Discuss two materials of the future that would have a significant influence on many of our recent technologies in production **(4 Marks)**.
- e) 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)**
- g) Outline four information that can be obtained from the phase diagrams **(4 Marks)**
- h) Enumerate three methods are widely used for the control and prevention of corrosion in metals **(3 Marks)**.

QUESTION TWO (20 Marks)

- a) Discuss **FOUR** blocks that are used to describe the modern periodic table. **(10 Marks)**
- b) As an expert in material science recommend **FIVE** classifications of material structure an engineer would consider while characterizing materials. **(10 Marks)**

QUESTION THREE (20 Marks)

- 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) Discuss the following bonds (**5 Marks**)

1. Ionic bond
2. Covalent bond

c) Draw and discuss the cooling curves for a binary system forming eutectic solution. (**6 Marks**)

d) What is heat treatment in material science engineering? (**2 Marks**)

e) What is the use of time-temperature transformation (T-T-T) curves? (**2 Marks**)

QUESTION FOUR (20 Marks)

a) Discuss five 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 (20 Marks)

a) Using a well labelled diagram sketch a stress-strain curve obtained from tensile test. Discuss any five properties obtained from the curve (**10 Marks**)

b) Discuss four non-destructive testing methods that are used in material science. (**10 Marks**)