



**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE  
& TECHNOLOGY UNIVERSITY EXAMINATIONS 2012/2013**

**2<sup>ND</sup> YEAR 1<sup>ST</sup> SEMESTER EXAMINATION IN DEGREE OF  
BACHELOR OF SCIENCE RENEWABLE ENERGY  
TECHNOLOGY AND MANAGEMENT**

**(REGULAR)**

**COURSE CODE: TET 3211**

**COURSE TITLE: MATERIAL SCIENCE I**

**DATE: 20/8/13**

**TIME: 2.00 – 4.00 PM**

**DURATION: 2 HOURS**

**INSTRUCTIONS**

- 1. This paper contains five (5) questions.**
- 2. Answer question 1 (compulsory) and ANY other TWO questions.**
- 3. Write all answer in the booklet provided.**

### QUESTION 1 (30 MARKS)

- a. As a student taking BSc in Renewable Energy Technology and Management, briefly explain importance of “Material Science” course to you. **(5 Marks)**
- b. Outline the difference between destructive and non-destructive tests giving specific examples for each. **(5 Marks)**
- c. With reference to specific examples, explain the different classes of engineering materials. **(10 Marks)**
- d. With reference to specific examples, discuss the following properties of metals used as engineering materials.
  - i. Toughness **(2 Marks)**
  - ii. Ductility **(2 Marks)**
  - iii. Malleability **(2 Marks)**
  - iv. Brittleness **(2 Marks)**
  - v. Hardness **(2 Marks)**

### QUESTION 2 (20 MARKS)

- a. Bonding between same or different atom or molecules within a solid structure affects the properties of the material. Explain the different types of bonds commonly experienced and their influence on material properties. **(10 Marks)**
- b. Explain the difference between a crystalline and a non crystalline structure; hence describe any three crystal structures for specific metallic elements. **(10 Marks)**

### QUESTION 3 (20 MARKS)

Explain the following heat treatment processes as applied to steel outlining their purposes.

- i. Annealing **(4 Marks)**
- ii. Normalizing **(4 Marks)**
- iii. Tempering **(4 Marks)**
- iv. Surface hardening **(4 Marks)**
- v. Quenching **(4 Marks)**

### QUESTION 4 (20 MARKS)

- a. Discuss heat treatment, its purposes and theory with respect to steel. **(12 Marks)**
- b. Outline the differences between cold working and hot working processes in metals. **(8 Marks)**

**QUESTION 5 (20 MARKS)**

- a. Ferrous metal (steel) combine iron and carbon in varying amounts. Briefly explain how different proportions of carbon affect the properties of steel. **(8 Marks)**
- b. Discuss the properties and uses of the following non-ferrous materials;
- i. Copper
  - ii. Zinc
  - iii. Aluminium
  - iv. Lead **(12 Marks)**