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

2ND YEAR 1ST 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 atoms 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)