JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF ENGINEERING AND TECHNOLOGY

UNIVERSITY EXAMINATIONS FOR THE DEGREE OF SCIENCE IN:

RENEWABLE ENERGY TECHNOLOGY AND MANAGEMENT

2ND YEAR 1ST SEMESTER 2015/2016 ACADEMIC YEAR

CENTRE: MAIN CAMPUS

COURSE CODE: TET 3211

COURSE TITLE: MATERIAL SCIENCE I

EXAM VENUE: W/S **STREAM: BSc RE. ENERGY TECH AND MGT**

DATE: 28/4/16 **EXAM SESSION: 2.00 – 4.00 PM**

TIME: 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 1 (30 MARKS)

a. Briefly explain what you understand by "Material Science", mentioning its importance to a Renewable Energy Technologist. **(4 Marks)**

b. Outline the different factors you would consider when selecting a material for use in design purposes. **(5 Marks)**

c. Define the following terms as used in describing properties of materials, giving examples where applicable. **(5 Marks)**
   i. Conductivity
   ii. Toughness
   iii. Fusibility
   iv. Hardness
   v. Tenacity

d. With reference to specific examples, briefly state and describe the different classes of engineering materials. **(10 Marks)**

e. With reference to specific examples, describe any three different types of crystal structures for metallic elements. **(6 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, giving specific examples. **(15 Marks)**

b. Briefly explain how degradation/corrosion of engineering materials can be prevented or controlled. **(5 Marks)**

QUESTION 3 (20 MARKS)

a. Heat treatment of metallic material helps in improving material properties. Briefly describe any five heat treatment processes mentioning how the material properties are affected or improved. **(15 Marks)**

b. Outline the difference between elastic and plastic deformation. **(5 Marks)**

QUESTION 4 (20 MARKS)

a. Discuss the properties and uses of any four non-ferrous materials; **(8 Marks)**
   i. Copper
   ii. Aluminum

b. The quality of steel can be improved by adding to it small quantities of pure metals to produce alloy steels. Explain how the additives; nickel, tungsten, chromium and manganese affects the quality of steel. **(12 Marks)**

QUESTION 5 (20 MARKS)

With reference to a well labelled Iron-Carbon Phase diagram, explain the existence and formation of different constituents of iron and steel listed below;

i. Ferrite
ii. Cementite
iii. Pearlite
iv. Martensite
v. Austenite.