JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF ENGINEERING AND TECHNOLOGY

UNIVERSITY EXAMINATIONS FOR THE DEGREE IN SCIENCE IN RENEWABLE ENERGY TECHNOLOGY AND MANAGMENT

2ND YEAR 1ST SEMESTER 2018/2019 ACADEMIC YEAR

CENTRE: MAIN CAMPUS

COURSE CODE: TET 3211

COURSE TITLE: MATERIAL SCIENCE I

EXAM VENUE: **STREAM: BSc REN ENERGY TECH & MGT**

DATE: ../12/2018 **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**

Ques. ONE (30 marks & compulsory)

1. a) Define the term 'mechanical property' of an engineering material. (2marks)

   b) State any five mechanical properties of engineering materials, give their definitions and for each give an example of the material possessing such a property. (15marks)

   c) Explain the meaning of the term alloy.
   Name three alloys commonly found in the workshop and name their composition and also state one use of each. (9marks)

   d) Describe four factors that can affect the properties of materials (4marks)

2. a) Materials in their pure form are unsuitable for most industrial uses.
   Explain why it is so. (4marks)

   b) Explain what is meant by the term alloy and state why alloys are used so extensively in all branches of metalworking. (4M)

   c) List four different alloys and give the constituent metals and the main uses of each alloy. (8M)
   d) Describe the difference between substitutional solid solution and an interstitial solid solution in the crystalline structure of metals (4marks)

3. Give TWO main reasons for the use of these materials:
   i) Water taps being made of brass or chromium –plated brass;

   ii) Surface plates being made of cast iron;

   iii) The skin of an airplane being made of an aluminium alloy;
   iv) Some mild steel sheets being coated with zinc;
   v) The wire of an electric cable being made of copper;
   vi) A centre punch being made of high-carbon steel
   vii) An electrician's ladder being made of aluminium alloy
   viii) Hooks and chains being made of wrought iron
   ix) Mallets being made of wood, plastic or rubber
   x) Toys being made of polymeric materials (20marks)

4) a) i) Explain what is meant by the terms pig iron and wrought iron clearly contrasting between them. (4marks)
ii) Explain why these metals are rarely used for engineering components. (2marks)
iii) State the name of the 'pot' where each is processed. (2marks)

b) Carbon steels are normally divided into three main groups according to their carbon content range and their associated properties.
Name these three groups, giving the approximate carbon content range, and describe briefly the properties of the steels in each range.
(9marks)

c) State the main difference between thermoplastic and thermosetting polymeric materials. (3M)

5. a) explain the difference between a ferrous metal and a non-ferrous metal (2marks)
b) Describe briefly the process involved in manufacturing steel using the Basic oxygen furnace or converter. Use neat labeled sketches . (10marks)

c) Show by means of a clear diagram, how the iron and slag are removed from a blast furnace (6M)
d) Explain the purpose of adding limestone to the charge in the blast furnace (2marks)