



# TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

**UNIVERSITY EXAMINATION FOR:**

**DIPLOMA**

**EME 2104 : MATERIAL SCIENCE**

**END OF SEMESTER EXAMINATION**

**SERIES: APRIL 2016**

**TIME: 2 HOURS**

**DATE:** Pick Date Apr 2016

## Instructions to Candidates

You should have the following for this examination

*-Answer Booklet, examination pass and student ID*

This paper consists of **FIVE** questions. Attempt any **THREE** questions.

**Do not write on the question paper.**

## Question ONE

- a) Describe the following terms used in materials science.
- i) Co-valent combination
  - ii) Electro-valent combination
  - iii) Metallic bond
  - iv) Van -der -waal's forces **(8marks)**
- b) State and explain the **TWO** classifications of substance existence **(4marks)**
- c) With the aid of a suitable sketch explain the typical cooling curve of a pure metal.
- d) With the aid of neat sketches, describe the **THREE** most common types of patterns/space lattice in which metallic atoms arrange themselves. **(4marks)**

## Question TWO

- a) i) State the difference between Ferrous and non-ferrous metals giving three examples in each. **(5marks)**
- ii) Explain briefly each of the following properties of metal
- i. conductivity

- ii. fusibility
- iii. toughness
- iv. malleability
- v. brittleness

(5marks)

- b) Describe any **THREE** alloy steels materials and in each state the form in which each is supplied. State at least one use of each. (6marks)
- c) Describe the **THREE** classification of properties of metals and give an example of each. (4marks)

### Question THREE

- a) i) State and define the principal raw material for producing ferrous metals. (2marks)  
 ii) Describe the **FOUR** types of iron ores. (4marks)  
 iii) Outline the **THREE** charging materials in furnaces. (1 ½ marks)
- b) With the aid of neat sketch explain the operation of a blast furnace. (8 ½ marks)
- c) Explain the following types of cast iron (4marks)
- I. Grey cast iron
  - II. White cast iron
  - III. Ductile cast iron

### Question FOUR

- a) i) What is the difference between hypo-eutectoid and hyper –eutectoid steels. (2 ½ marks)  
 ii) Explain how the plain carbon steels are classified depending upon the carbon content. (2 ½ marks)
- b) i. Explain briefly how the increase in carbon content influences the mechanical properties of an untreated plain carbon steel. (4marks)
- ii. What do you understand by the following terms
- i) killed steel (1 marks)
  - ii) “piping” in steel and explain how this can be minimised. (4marks)
- c) i. Distinguish between plain carbon steel and alloy steel (1marks)
- ii. State with reasons a suitable materials for the manufacture of each of the following giving the appropriate composition. (1marks)
- i. A brass for deep pressed containers

ii. A brass for small machined bolts (1marks)

iii. A bronze for the impeller of sea-water pump (3marks)

### Question FIVE

a) Explain briefly the meaning of the following terms as used in material testing.

i) Elastic limit

ii) Yield point

iii) Ultimate stress

iv) Breaking stress

v) Percentage elongation

(5marks)

b) i. Explain the procedure of testing a steel round specimen for maximum tensile load.

(5marks)

ii. Outline the purpose of tensile testing of materials

(2marks)

c) Briefly explain the following terms as used in heat treatment.

i. Annealing

ii. Normalising

iii. Tempering

iv. Hardening

(8marks)