THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of Jkuat)

Faculty of Engineering & Technology

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

DIPLOMA IN AUTOMATIVE ENGINEERING
DIPLOMA IN CHEMICAL ENGINEERING
DIPLOMA IN MECHANICAL (PLANT)
DIPLOMA IN MECHANICAL (PRODUCTION)

EME 2107: MATERIAL SCIENCE I

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: OCTOBER 2011

TIME: 2 HOURS

Instructions to Candidates:
You should have the following for this examination

- *Answer booklet*
- *Drawing instruments*

This paper consists of **FIVE** questions
Questions **ONE** is **COMPULSORY**. Answer any other **TWO** questions
Maximum marks for each part of a question are clearly shown
This paper consists of **THREE** printed pages

Question 1 (Compulsory)

a) (i) Describe using illustrations the **THREE** states in which elements can exist

(ii) Describe the following terms used for classification of substances

- Crystalline
- Amorphous

(iii) With the aid of a suitable cooling curve diagram explain the cooling stages of a pure metal and indicate **THREE** important. Critical regions (12 marks)

b) (i) Illustrate with suitable sketches any **THREE** common space lattice patterns of metallic Elements.

(ii) State and explain the **THREE** main engineering materials properties

(iii) State any **FOUR** iron ores available in their natural states (11marks)

c) (i) Explain any **TWO** methods of modifying and improving the properties of cast iron

(ii) State **TWO** desirable properties and TWO applications of Wrought-iron

(iii) State the **ONE** effect caused by adding each of the following elements to plain carbon Steels

I. Manganese
II. Nickel
III. Chromium (7 marks)

Question 2

a) (i) Explain the **TWO** main classifications of metals and for each give FOUR examples

(ii) Give **TWO** examples for each of the **THREE** main engineering materials properties

(iii) Explain using suitable illustrations any **FOUR** forms of materials supply (12 marks)

b) (i) Describe the function of the following elements in a blast furnace
I. Coke
II. Limestone

(ii) State any **FOUR** important safety precautions to be observed when using the blast furnace (8 marks)

Question 3

a) (i) Describe the construction of the Blast furnace, stating FOUR important features.

(ii) With the aid of a suitable line diagram, outline the production of the various Ferrous Metals from pig iron (10 marks)

b) (i) Describe briefly the production of cast iron and state their typical composition
(ii) Differentiate clearly between the **TWO** main types of cast irons

(iii) State any **TWO** general applications and **TWO** properties of cast iron give in (b) (ii) Above (10 marks)

Question 4

a) (i) Define the term 'plan carbon steel' and state its main constituent elements

(ii) Explain the effect of adding lead or high Sulphur contents to plain carbon steels and state their acceptable percentages (10 marks)

b) (i) Differentiate between the **FOUR** classifications of plain carbon steels by stating their carbon contents and **TWO** applications for each class

(ii) With the aid of a line diagram, describe the effects of carbon content variation to plain carbon steels in reference to properties (10 marks)

Question 5

a) (i) Describe the term "Alloy steels" and state any **FOUR** effects caused by Alloying Elements

(ii) Describe the defects caused by the presence of the following non-metallic elements in higher percentages to plain carbon steels

I. Phosphorous
II. Sulphur (10 marks)

b) (i) Explain any **FOUR** alloying elements and their effects to plain carbon steels

(ii) State any **FOUR** classifications of Alloy steels

(iii) Describe the term stainless steels and give **FOUR** applications for such steel (10 marks)