THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A CONSTITUENT COLLEGE OF JKUAT)

Faculty of Engineering and Technology

DEPARTMENT OF MECHANICAL AND AUTOMOTIVE ENGINEERING

Diploma in Mechanical Engineering (Plant Option)
Diploma in Mechanical Engineering (Automotive Option)

EME 2109
MATERIALS SCIENCE II

YEAR I SEMESTER II

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: OCTOBER, 2011

TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination:
- Answer Booklet(s)
- Drawing Instruments

This paper consists of **FIVE** questions.
Answer **ONE (Compulsory)** Question and Answer any other **TWO** Questions.
Maximum marks for each question is indicated against each question.
This paper consists of ***3 printed* pages.**

Question ONE (COMPULSORY)

(a) (i) Give any **FOUR** features that make cast iron an important material in

Engineering trades.

(ii) Explain the **TWO** structures of cast iron.

(iii) Describe the **TWO** ways in which carbon is present in cast iron types.

(iv) State any **TWO** suitable properties and **TWO** applications of cast iron.

(b) (i) With the aid of a sketch describe the structure of wrought iron and state

any **FOUR** suitable application for such iron.

(ii) Explain the purpose of the following elements present in plain carbon steel:

(I) Manganese
(II) Silicon
(III) Sulphur
(IV) Phosphorus

(10 Marks)

(c) (i) Define the term plain carbon steels.

(ii) Stat e and explain any **FOUR** common alloying elements and their effects to plain carbon steels.

(8 Marks)

Question TWO

(a) (i) Describe **FOUR** main classifications of plain carbon steels with reference

to their carbon contents.

(ii) Explain any **TWO** applications and **TWO** properties for each of the classifications given in (2ai) above.

(12 Marks)

(b) Using illustrations explain the relationship between mechanical properties and carbon content in steels. **(8 Marks)**

Question THREE

(a) (i) Describe the term Alloy steels and state any **FOUR** general effects induced by adding alloying elements in appropriate percentages. **(10 Marks)**

(ii) State and explain any **FOUR** common alloying elements and give **ONE** specific purpose for using each element in steels. **(10 Marks)**

(b) (i) State any **FOUR** reasons why plain carbon steels are limited to engineering applications.

(ii) State any **TWO** requirements and **TWO** applications of Heat resisting steels.

(iii) Describe the structures suitable for steels working at high elevated temperatures. **(10 Marks)**

Question FOUR

(a) (i) Differentiate clearly between ferrous and non-ferrous metals commonly used for engineering purposes.

(ii) State **TWO** common ferrous and **TWO** non-ferrous metals.

(iii) State **TWO, THREE** common properties and **THREE** applications for non-ferrous metals. **(10 Marks)**

(b) (i) Describe the extraction process of copper by the following processes:

(I) Wet process
(II) Dry process

(ii) Explain the Electrolysis process of Alumiunium from its main ore. **(10 Marks)**

Question FIVE

(a) (i) Explain any **FOUR** parameters that can be analyzed by a Tensile testing method and their significance.

(ii) Using BS18 standard, describe the procedure for preparing and testing a sample specimen using a suitable tensile testing machine. **(10 Marks)**

(b) With the aid of illustrations describe the Brinell testing method to Bs240 standards. **(5 Marks)**

(c) With simple sketches differentiate between the **TWO** methods of impact testing. **(5 Marks)**