THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

Faculty of Engineering and Technology

DEPARTMENT OF MECHANICAL AND AUTOMOTIVE ENGINEERING

DIPLOMA IN MECHANICAL ENGINEERING
(PLANT OPTION)
(PRODUCTION OPTION)
(CHEMICAL OPTION)
(AUTOMOTIVE OPTION)

EME 2106 : MATERIALS SCIENCE I

SUPPLEMENTARY/SPECIAL EXAMINATIONS

SERIES: APRIL 2011

TIME: 2 HOURS

Instructions to Candidates:

1. You should have the following for this examination:
   - Drawing instruments
   - Answer booklets

2. This paper consists of **FIVE** Questions. Answer Question **ONE** (Compulsory) and any other **TWO** Questions.
3. Maximum marks for each part of a question are shown.

Question ONE

(a) (i) Describe with the aid of sketches the **THREE** states in which elements can exist.

(ii) Explain the **TWO** different classifications of substances.

(iii) Describe using suitable illustrations, the cooling curve of a pure metal and indicate **THREE** critical points.

(12 Marks)

(b) (i) Describe by use of sketches any **THREE** common crystalline space lattice patterns of metallic materials.

(ii) For each lattice above give any **TWO** metals.

(iii) Describe the **THREE** main engineering materials properties giving **TWO** examples for each main property.

(12 Marks)

(c) (i) State any **FOUR** common iron ores in their natural states.

(ii) State the **TWO** main types of cast iron and give any two was of modifying their properties.

(iii) State **TWO** properties and **TWO** applications of plain carbon steels.

(6 Marks)

Question TWO

(a) (i) Differentiate clearly between the **TWO** types of metals and give **TWO** examples for each type of metal.

(ii) State **TWO** applications and **TWO** properties for each type of metal.

(b) (i) Describe using suitable sketches any **FOUR** forms of material supply.

(ii) Explain the function of any **TWO** additional charging materials in the blast furnace.

(iii) State and **FOUR** important safety precautions necessary for furnaces.

(10 Marks)

Question THREE

(a) (i) Describe using suitable line diagram the production of the various ferrous metals from their iron ores.

(ii) For each metal in (ai) above state the type of furnace and the by-products given out.

(iii) With aid of a sketch describe the Blast Furnace construction and state its importance in the production of pig iron. (10 Marks)

(b) (i) Explain the production of cast iron.

(ii) Describe the properties of each type of cast iron in (bi) above.

(iii) State **TWO** applications for each of the **TWO** types of cast iron.

(10 Marks)

Question FOUR

(a) (i) Define the term plain carbon steel and state the main constituent elements in such steels.

(ii) Describe the purpose of adding higher percentages of Sulphur to steels.

(iii) Outline the **FOUR** main classifications of plain carbon steels and their carbon contents.

(10 Marks)

(b) (i) State **THREE** properties and **THREE** applications of High Carbon Steels.

(ii) Explain the effects of "carbon" to plain carbon steels in regards to properties.

(iii) Explain the effect of "Manganese" to plain carbon steels.

(10 Marks)

Question FIVE

(a) (i) Describe the term Alloy Steels and state **FOUR** effects induced into Alloy steels.

(ii) Describe the effects of the following elements to steel when present in greater amounts than recommended.

(I) Sulphur

(II) Phosphorus

(8 Marks)

(b) (i) State any **FOUR** common alloying elements and their main effects on plain carbon steels.

(ii) State any **FOUR** classifications of Alloy steels and **ONE** application for each.

(iii) Clearly describe the difference between the various classes of stainless steels, giving **ONE** application for each class.

(12 Marks)