



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) i. Describe the **TWO** types of metals commonly used for engineering operations. **(2marks)**
- ii. Give **THREE** important mechanical and **THREE** physical properties of each type of metal state above. **(6marks)**
- b) i. State the **THREE** allotropic forms of iron and provide a brief explanation of each. **(6marks)**
- ii. Outline any **FOUR** important properties of cast iron. **(4marks)**
- iii. State any **FOUR** classifications of iron and steel. **(2marks)**

Question TWO

- a) i) Clearly define the terms below as used in material science.
- i. Compound
 - ii. Nucleus
 - iii. Molecule
 - iv. Van-der-waal forces **(4marks)**
- b) I. Substances are known to exist in **THREE** different classes. State the classifications. **(3marks)**
- ii. With the aid of a sketch, describe the electronic configuration of a sodium atom and chlorine atom before and after a reaction. **(4marks)**
- c) i. Define the term “allotropic” in reference to an element. **(1marks)**
- ii. Explain the term “crystalline structure” of metals. **(1marks)**
- iii. With the aid of a sketch, describe the eutectic type of equilibrium diagram. **(7marks)**

Question THREE

- a) i) State any **FOUR** physical properties of iron. **(4marks)**
- ii) Distinguish between the following.
- I. Grey cast iron
 - II. White cast iron
 - III. Ductile cast iron **(6marks)**
- b) i. State the difference between sheet and strip. **(2marks)**
- ii. Define the following terms
- i) temper rolling
 - ii) aging in steel **(4marks)**
- c) i. Explain the following on metals
- i) brass
 - ii) bronze **(4marks)**

Question FOUR

- a) With an aid of a sketch explain the operation of the following furnaces.
- i) Puddling furnace
 - ii) Cupola furnace **(8marks)**

- b) i. Outline the need of addition of impurities in steel manufacture. **(2marks)**
- ii. State the impurities which exist in steel **(2marks)**
- c) i. State the composition and two uses of bronze commonly used in engineering. **(2marks)**
- ii. What do you understand by season cracking in brasses and how can it be prevented. **(6marks)**

Question FIVE

- a) i. Explain the principle of
- i) chemical corrosion **(3marks)**
 - ii) electrolytic corrosion **(3marks)**
- ii. Clearly differentiate between heat resistant and corrosion resistant steels. **(3marks)**
- b) i. Define the term non-ferrous metals and state any **FOUR** good properties for non-ferrous metals. **(4marks)**
- ii. Give **TWO** non-ferrous metals, their ores and production processes. **(6marks)**
- c) Define the following terms as used in material testing.
- i) Yield stress
 - ii) Ultimate tensile strength
 - iii) Percentage elongation
 - iv) Percentage reduction in area **(4marks)**