

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY



FACULTY OF INDUSTRIAL TECHNOLOGY

DEPARTMENT OF INDUSTRIAL AND MANUFACTURING ENGINEERING

Bachelor of Engineering Honours Degree Industrial and Manufacturing Engineering

2nd Semester Main Examination

COURSE : MATERIALS TECHNOLOGY II

CODE : TIE 2204

DATE : APRIL/MAY 2014

DURATION : 3 HOURS

INSTRUCTIONS AND INFORMATION FOR THE CANDIDATE

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1. Answer any five (5) questions.
 2. Each question carries 20 marks.
 3. This paper contains seven (7) questions.
 4. There are three (3) printed pages in this paper.
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QUESTION 1

- (a) Explain why titanium alloys are finding increased application as biomedical implants. [5]
- (b) What are the key differences between mild steel and stainless steels? [4]
- (c) Discuss the advantages of ferrous metal alloys over their non-ferrous alloys. [6]
- (d) Aluminium alloys are classified into cast and wrought alloys. Describe these classifications and state examples for each class. [5]

QUESTION 2

- (a) Explain the relative solubility of carbon in ferrite iron and austenite iron. [5]
- (b) Describe the usefulness of the iron-iron carbide diagram to:
 - (i) Casting [5]
 - (ii) Alloying [4]
- (c) Based on heat treatment applications, distinguish between hypo-eutectoid and hyper-eutectoid steels. [6]

QUESTION 3

- (a) A small spur gear made from steel is expected to have a hard casing and tough core. Describe, with aid of diagrams where applicable, any heat treatment method that can be applied in order to meet this objective. [8]
- (b) Compare and contrast full annealing and normalising. [9]
- (c) What are the characteristics of martensitic steel? [3]

QUESTION 4

- (a) What is a composite material? [3]
- (b) Fibreglass is widely used in automobile body building. To what extent can this wide use be attributed? [5]
- (c) What is the influence of fibre orientation and concentration on the strength of fibre-reinforced composites? [12]

QUESTION 5

- (a) Write down an oxidation reaction equation for a hypothetical metal M [2]
- (b) Describe three (3) methods that can be used to minimise erosion corrosion. [12]
- (c) Name and describe any situation in which corrosion is beneficial in engineering [6]

QUESTION 6

- (a) Use the Lever Rule of mixtures to derive the mass fractions for a two-component alloy system [8]
- (b) How can the limitations of binary phase diagrams (for example the iron-iron carbide diagram) be overcome? Site appropriate examples. [5]
- (c) Explain the layered structure of pearlite. [3]
- (d) Describe the formation and characteristics of spheroidite. [4]

QUESTION 7

State and describe the applications of

- (a) Abrasive ceramics [5]
- (b) Refractories [5]
- (c) Cements [5]
- (d) Glass ceramics [5]

End of Examination