



THE UNIVERSITY OF ZAMBIA
SCHOOL OF ENGINEERING
DEPARTMENT OF MECHANICAL ENGINEERING

UNIVERSITY EXAMINATIONS

2005 ACADEMIC YEAR - SECOND SEMESTER

DECEMBER 2005

ME 232 – PROPERTIES OF ENGINEERING MATERIALS I
FINAL EXAMINATION

Read the following instructions carefully before you start writing:

1. Answer Five Questions, two from Section A and three from Section B.
 2. Hand in Sections A and B separately
 3. All Questions carry equal marks
 4. Time allowed is Three (3) Hours
 5. This examination is Closed Book
 6. This question paper has two printed pages including this cover
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SECTION A: Answer any two questions from this Section

- Q1. (a) Sketch and fully label the blast furnace used in the production of iron. [10 marks]
(b) Discuss the various processes that take place during the production of iron in the blast furnace. [10 marks]
- Q3. Discuss in detail each of the following:
(a) Annealing of steel [10 marks]
(b) Ionic crystals [10 marks]
- Q3. (a) Discuss strain aging and sketch a typical stress-strain curve of a material that exhibits strain aging. [08 marks]
(b) Describe each of the following:
(i) Ferrite. [04 marks]
(ii) Austenite. [04 marks]
(iii) Cementite. [04 marks]

SECTION B: Answer any three questions from this Section

- Q4. (a) Define electrochemical corrosion. [03 marks]
(b) Differentiate between oxidation and reduction in metal corrosion [05 marks]
(c) Describe one method and the principle involved by which each of the following may be protected against corrosion:
(i) an exposed steel power transmission pylon at ambient temperature. [03 marks]
(ii) a steel boiler. [03 marks]
(iii) a ship's hull. [03 marks]
(iv) a buried steel pipeline. [03 marks]
- Q5. (a) What is a polymer? Mention the three major classes of polymers, stating their basic differences? [05 marks]
(b) Describe in detail the two main ways polymerisation may take place. [06 marks]
(c) Compare and contrast the mechanical properties of thermoplastics, thermosetting plastics and elastomers, stating at least three industrial applications of each. [09 marks]
- Q6. (a) State applications where ceramics have distinct advantages over metals and why. [05 marks]
(b) What are basic differences between polymer and ceramic composites? [05 marks]
(c) Give five classes of generic ceramics and glasses, stating their compositions. Give at least three specific applications of each class, justifying why they are suitable for such applications. [10 marks]
- Q7. (a) What is 'doping' in semiconductor theory and what is its significance? [05 marks]
(b) Distinguish in detail between *n*-type and *p*-type semiconductors. [12 marks]
(c) Explain in detail what would happen, and why, as the temperature of a doped semiconductor in an electric circuit is increased from absolute zero to just below its melting point. [03 marks]

END OF ME 232 EXAMINATION
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