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**Question Paper Code : 77216**

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2015.

Fourth Semester

Mechanical Engineering

ME 6403 — ENGINEERING MATERIALS AND METALLURGY

(Common to Automobile Engineering, Mechanical and Automation Engineering and also common to Third Semester Manufacturing Engineering)

(Regulation 2013)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Name and explain the standard rule for the formation of substitutional type of solid solutions.
2. Name the system and sketch the labeled ideal binary phase diagrams for the system where the components are completely soluble in liquid and partially soluble in solid states.
3. Differentiate annealing and normalizing treatments.
4. "Austempering is different from other hardening treatments". Explain the statement.
5. What is HSLA? Explain with respect to composition, properties and application.
6. Explain briefly the effect of ferrite stabilizer on the eutectoid temperature and composition.
7. Differentiate thermosetting and thermoplastic polymers.
8. What is meant by metal matrix composites? Give one example each to matrix material and reinforcements used.

9. Draw a typical creep curve for ductile metal and explain the regions.
10. Draw a typical load versus percentage elongation curve for ductile material and explain the tensile properties.

PART B — (5 × 16 = 80 marks)

11. (a) Neatly sketch labeled Iron-Carbon equilibrium diagram. Name, write and explain the reactions involved.

Or

- (b) Explain the procedural steps for constructing the binary phase diagram where the components show complete liquid and solid solubility. Draw the labeled diagram and name the system. Give one example for the alloy system showing above mentioned behavior.

12. (a) Draw a neat sketch of the Isothermal Transformation diagram for Eutectoid steel and explain the constructional procedure. Label all the salient features on it. Superimpose on it a cooling curve to obtain bainitic phase.

Or

- (b) Differentiate hardness and hardenability. Explain with a neat sketch, the procedure to plot the hardenability curves for eutectoid steel in Jominy End Quench Test.

13. (a) Classify Stainless steel and tool steels and explain the following :
- (i) Maraging steel (5)
  - (ii) Spheroidal graphite iron (5)
  - (iii) High speed steel in terms of composition, property and use. (6)

Or

- (b) With part of phase diagram and relevant graphs explain precipitation hardening treatment of Al-Cu alloy.

14. (a) Name, explain the properties and application of any eight varieties of polymers used as engineering materials.

Or

- (b) Name, explain the properties and application of any four types of ceramics.

15. (a) Name and explain the different types of hardness tests with respect to the procedure, relative advantages and disadvantages.

Or

- (b) With geometry and arrangement of impact test specimens explain Charpy and Izod test with relative advantages and disadvantages.
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