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B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2024

Third/Fourth Semester

Mechanical Engineering

ME 3392 – ENGINEERING MATERIALS AND METALLURGY

(Common to Manufacturing Engineering/Mechanical Engineering (Sandwich)/Mechanical and Automation Engineering)

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Distinguish between substitution and interstitial solid solutions.
2. Distinguish between hypoeutectic and hypereutectic cast irons.
3. Define the term heat treatment.
4. In what ways cyaniding differs from carburizing.
5. Name some of the Tool steel.
6. State three characteristics of ferrous alloys that limit their utilization.
7. Define the term polymer.
8. Draw the structure of Polypropylene [PP] and write the applications
9. Write the difference between Slip and Twinning
10. Define ductile fracture.

PART B — (5 × 13 = 65 marks)

11. (a) Name the phase reactions occurring in Fe-Fe_3C system. What are the temperatures and compositions at which they occur?

Or

(b) How does the time-temperature cooling curve of an alloy of eutectic composition differ from that of a pure metal that of a non-eutectic composition alloy?

12. (a) Give a detailed account on annealing, normalizing, austempering and case hardening.

Or

(b) Brief about tempering process and explain CCT diagram.

13. (a) State the effects of following alloying elements on steel

(i) Chromium (5)

(ii) Molybdenum. (5)

(iii) Also state any three objectives of adding alloying elements on steel. (3)

Or

(b) Discuss the different types of stainless steel making reference to approximate composition, structure heat treatment.

14. (a) Discuss the properties and applications of the following four ceramics.

(i) Silica (3)

(ii) Zirconia (3)

(iii) SiC and Cubic boron nitride (7)

Or

(b) Explain the properties and applications of the following polymers and discuss anyone fabrication methods of polymers.

(i) PMMA (3)

(ii) PP (3)

(iii) ABS and Glass (7)

15. (a) Explain the types of impact tests and how ductile to brittle transition is occur with diagram.

Or

(b) Explain the testing procedure for Vickers hardness testing.

PART C — (1 × 15 = 15 marks)

16. (a) Draw S-N curve for ferrous and non-ferrous metals and explain how endurance strength can be determined. Also discuss the factors that affect the fatigue life.

Or

(b) What are the special properties of plastics that make them suitable for engineering applications? Describe the concept of 'Co-polymerization'.

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