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Question Paper Code : 91378

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2025.

Third Semester

Mechanical Engineering

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ME 3392 – ENGINEERING MATERIALS AND METALLURGY

(Common to : Manufacturing Engineering/Mechanical Engineering (Sandwich))

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is an equilibrium phase diagram?
2. How steels are classified?
3. Differentiate between normalizing and full annealing.
4. What is a CCT diagram?
5. List four important alloying elements added in alloy steels.
6. What are cupronickels? What is the use of monel metal?
7. Define the term degree of polymerisation.
8. Name any four thermoplastics and thermosetting plastics.
9. Distinguish between slip and twinning.
10. What is meant by ductile fracture?

PART B — (5 × 13 = 65 marks)

11. (a) Draw a neat sketch of Iron-carbon Equilibrium diagram and label the various phase fields. Also explain the various invariant reactions.

Or

- (b) Classify cast iron and brief on the properties and applications of any four types.

12. (a) Distinguish between hardness and hardenability. With suitable sketches, explain the Jominy hardness test for hardenability.

Or

- (b) Write short notes on the following surface heat treatment operations with suitable sketches.

(i) Carburising (7)

(ii) Nitriding. (6)

13. (a) Discuss the composition, properties, and typical applications of any four copper alloys.

Or

- (b) Write a short note on the following: (5+4+4)

(i) Tool steels

(ii) HSLA steels

(iii) Maraging steels.

14. (a) Discuss the properties and applications of the following thermoplastics: (5+4+4)

(i) PTFE

(ii) PMMA

(iii) PET.

Or

- (b) (i) Explain the strengthening mechanism of fiber-reinforced composites. (6)

(ii) List the advantages, limitations and applications of composite materials. (7)

15. (a) (i) What is fatigue failure? How fatigue test is carried out? Explain. (8)
(ii) Differentiate between Ductile and Brittle fracture. (5)

Or

- (b) (i) Draw creep curve and explain the different stages of creep damage. (7)
(ii) Describe the principles and applications of the Izod and Charpy impact tests (6)

PART C — (1 × 15 = 15 marks)

16. (a) Draw a neat sketch of the TTT diagram for a eutectoid steel and label the regions. Mark the different products formed on this diagram.

Or

- (b) What is brittle fracture? Explain the Griffiths theory on brittle fracture and deduce an expression for the critical stress required to propagate a crack simultaneously in a brittle material.

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