Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 30918

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

Third/Fourth Semester

Mechanical Engineering

ME 8491 — ENGINEERING METALLURGY

(Common to Automobile Engineering/Manufacturing Engineering/Mechanical and Automation Engineering/Production Engineering)

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Differentiate between substitution and interstitial solid solutions.

2. What is the main difference between steel and cast iron in terms of carbon content?

3. What are the special advantages of nitriding over carburizing and cyaniding?

4. Why does hardness decrease during recrystallization much more than during grain growth?

5. Distinguish between grey and white cast iron.

6. What is precipitation strengthening?

7. Distinguish between commodity and engineering polymers.

8. Why thermosetting plastics cannot be remelted?

9. With the Vickers hardness test, a 30 kg load was given for a sample of steel and an indentation with diagonals having a mean length of 0,53 mm. What is the hardness?

10. Why does high-temperature creep have the same activation energy as self-diffusion?

PART B — (5 × 13 = 65 marks)

11. (a) Describe the iron-carbon equilibrium diagram with annotations and explain the significance of each phase and boundary.

Or

(b) Compare and contrast eutectic eutectoid peristaltic and peritectoid reactions with the help of phase diagrams.

12. (a) Compare and contrast normalizing, hardening and tempering including the micro structural transformations that occur in steel during these processes.

Or

(b) Compare flame hardening and induction hardening, including their advantages, limitations, and typical applications.

13. (a) Compare and contrast stainless steel and tool steels in terms of their composition properties and applications.

Or

(b) Discuss the effects of alloying additions on the mechanical properties of steel.

14. (a) Describe the classifications of composites focusing on metal matrix and fiber-reinforced plastics (FRP).

Or

(b) Describe the composition proposes and uses of engineering ceramics

(i) Al_2O_3 (3)

(ii) SiC and Si_3N_4 (5)

(iii) PSZ and SIALON. (5)

15. (a) Explain the types of fracture that can occur in materials under stress and the microscopic features that can lead to each type of fracture.

Or

(b) Discuss the principles behind the Izod and Charpy impact tests, including how they are preformed and what aspects of material behavior they reveal.

PART C — (1 × 15 = 15 marks)

16. (a) Discuss the advantages and limitations of Polyether Ether Ketone (PEEK) in high-performance applications.

Or

(b) Compare and contrast the characteristics of Polyethylene terephthalate and polycarbonate and describe their engineering applications.

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