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Question Paper Code : 40917

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2025.

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.

1. The first part of the paper is devoted to the study of the asymptotic behavior of the solutions of the system (1) as $\epsilon \rightarrow 0$. It is shown that the solutions of the system (1) converge to the solutions of the system (2) as $\epsilon \rightarrow 0$. The convergence is uniform on compact subsets of the domain Ω .

1. Compare substitutional and interstitial solid solutions.
2. What is an isomorphous phase diagram?
3. What is the purpose of full annealing?
4. What is spheroidising?
5. What is the main alloying element in stainless steel?
6. Mention two differences between brass and bronze.
7. Mention two applications of fibre-reinforced plastics.
8. List different types of polymers.
9. What is a brittle fracture?
10. State the difference between fatigue and creep.

PART B — (5 × 13 = 65 marks)

11. (a) Explain the constitution of alloys and types of solid solutions with examples. (13)

Or

- (b) Discuss the significance of phase diagrams and explain the binary isomorphous phase diagram with a neat sketch. (13)

12. (a) With neat sketches, explain the TTT and CCT diagrams, highlighting their significance in steel heat treatment. (13)

Or

- (b) Discuss in detail the various methods of surface hardening.

13. (a) Explain the composition, properties, and applications of HSLA and Maraging Steels.

Or

- (b) Explain the properties and applications of Ni-based superalloys.

14. (a) Explain engineering ceramics and discuss properties and applications of Al_2O_3 and SiC.

Or

- (b) Discuss metal matrix composites with examples and applications.

15. (a) Explain the mechanisms of plastic deformation in metals.

Or

- (b) Discuss in detail about tests carried out for the hardness, tensile and compression strength of materials, highlighting their importance in engineering applications.

PART C — (1 × 15 = 15 marks)

16. (a) With neat sketches, explain the iron-carbon equilibrium diagram, describing important transformation and phases.

Or

- (b) Discuss in detail the classification, microstructure, properties and applications of steels and cast irons.