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

Question Paper Code : 70825

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Third/Fourth Semester

Mechanical Engineering

ME 6403 – ENGINEERING MATERIALS AND METALLURGY

(Common to Automobile Engineering, Manufacturing Engineering, Mechanical and Automation Engineering)

(Regulations 2013)

(Also common to : PTME 6403 – Engineering Materials and Metallurgy for B.E. (Part-Time) – Mechanical Engineering – Third Semester – (Regulations 2014))

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. State Gibbs phase rule.

2. Give the typical eutectic and eutectoid reactions.

3. What are the principal advantages of austempering over conventional quenching and temper method?

4. Mention few applications of induction hardening system.

5. Which type of stainless steel is used for surgical instruments?

6. What is the typical constituent microstructure of bearing alloy?

7. Define the term degree of polymerization.

8. State any four applications of Bakelite.

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 × 13 = 65 marks)

11. (a) Explain with a neat sketch of iron-iron carbide equilibrium diagram and indicate all the phases. Also write the three important invariant reactions. (13)

Or

(b) Explain the various classification of steels and Cast Iron with microstructure, properties and applications. (13)

12. (a) (i) Distinguish between annealing and tempering. (4)

(ii) Explain in detail the flame and induction hardening with neat sketches. (9)

Or

(b) Explain the principle and procedure of Jominy end quench test with a diagram. Also sketch the graph hardness Vs distance from quenched end. (13)

13. (a) Classify Stainless steel and tool steels and explain the following :

(i) Maraging steel

(ii) Spheroidal graphite iron

(iii) High speed steel in terms of composition, property and use.

Or

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

14. (a) (i) Classify composite materials and list TWO properties and application of them. (10)

(ii) State the properties and applications of PSZ or SiC. (3)

Or

(b) (i) Classify engineering ceramics and list properties and applications of any TWO of them. (7)

(ii) Brief on properties and application of any TWO polymers from the list : PTFE, PC, PET, ABS and PS. (6)

15. (a) Discuss the mechanisms of slip and twinning in detail. (13)

Or

(b) Sketch and describe the following hardness tests.

(i) Brinell

(ii) Vickers. (13)

PART C — (1 × 15 = 15 marks)

16. (a) Suggest a suitable material for the gear used in the gearbox of an automobile. Since the surface of the gear is subjected to constant wear, suggest and discuss any three methods to improve its wear resistance property. (15)

Or

(b) It is required to do turning operation of mild steel shaft on a lathe machine. Suggest and discuss suitable material for the single point cutting tool for this purpose. (15)

———————