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

Question Paper Code : 90361

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2019
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. Why are metal phase diagrams known as equilibrium phase diagrams ?
2. Classify steel based on its microstructure.
3. Stress relief annealing is an important Heat treatment process for engineering components-Comment.
4. How is Austempering differ from Martempering heat treatment process ?
5. What is the effect of addition of Manganese in steel ?
6. List the characteristics of Duralumin alloy.
7. Composite materials are replacing metallic materials in many engineering applications-comment.
8. List the characteristics of PMMA polymers and its advantageous over other transparent polymers.
9. Mention the various factors that affect the fatigue strength of material.
10. What do you mean by Ductile to Brittle Transition Temperature ?

PART – B (5×13=65 Marks)

11. a) Explain the factors that affect the formation of substitutional solid solution.

(OR)

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

12. a) Explain the various phase transformations that occur during tempering to achieve an optimum combination of strength and toughness.

(OR)

b) i) Why post carburizing heat treatment is necessary for case hardened parts ? (3)

ii) Discuss the three main types of carburising processes with the chemical reactions. (10)

13. a) How are Cast irons classified based on the fractured surface and phase constituents ? Explain its characteristics and microstructure.

(OR)

b) Write down the composition, properties and applications of the following:

i) Cupronickel (5)

ii) Nickel silver (4)

iii) Alpha Titanium alloy. (4)

14. a) i) Enumerate the parameters and conditions of the polymer molecular structure that affect the tribological characteristics of polymers. (4)

ii) Discuss the classifications of engineering polymer and explain its properties and application. (3×3=9)

(OR)

b) i) How are composites classified based on the forms of reinforcement ? (3)

ii) Discuss in detail the different forms of reinforcement. (10)

15. a) Explain the mechanisms of plastic deformation.

(OR)

b) i) Define fatigue. Why is this property important for materials with fluctuating load ? (3)

ii) Draw a typical SN curve and explain. (10)

PART – C (1×15=15 Marks)

16. a) Construct the hypothetical phase diagram for metals A and B between temperatures 600°C and 1000°C and explain the various phase fields. Given are the following information.

- The melting temperature of metal A is 940° C.
- The solubility of B in A is negligible at all temperatures.
- The melting temperature of metal B is 830° C.
- The maximum solubility of A in B is 12 wt% A, which occurs at 700° C.
- At 600°C, the solubility of A in B is 8 wt% A.
- One eutectic occurs at 700°C and 75wt% B-25 wt% A.
- A second eutectic occurs at 730°C and 60 wt% B-40 wt% A.
- A third eutectic occurs at 755°C and 40 wt% B-60 wt% A.
- One congruent melting point occurs at 780°C and 51 wt% B-49 wt% A.
- A second congruent melting point occurs at 755°C and 67 wt% B-33 wt%
- The intermetallic compound AB exists at 51 wt% B-49 wt% A.
- The intermetallic compound AB_2 exists at 67 wt% B-33 wt% A.

(OR)

b) i) Enumerate the methods that are used to obtain good surface hardness and impact resistance of the core ? (3)

ii) Suggest a suitable heat treatment for an alloy steel containing nitride forming element to get good surface hardness and explain the process. (12)

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