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18ME34

Third Semester B.E. Degree Examination, Feb./Mar. 2022
Material Science

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. State and explain Fick's laws of diffusion. (08 Marks)
b. Sketch and explain Edge dislocations. (04 Marks)
c. Distinguish between SC, BCC, FCC and HCP with respect to structure, number of atoms, Lattice constant, coordination number and APF. (08 Marks)

OR

- 2 a. Draw stress-strain diagram of Ductile material and explain plastic properties. (08 Marks)
b. Derive expressions showing relationship between True Stress versus Engineering Stress and True Strain versus Engineering Strain. (08 Marks)
c. Sketch and explain plastic deformation by Twinning. (04 Marks)

Module-2

- 3 a. What is fatigue? Sketch and explain R.R. MOORE fatigue testing showing S-N curves. (08 Marks)
b. What is Creep? Explain the stages of creep using creep curve. (08 Marks)
c. Explain the application of Gibb's phase rule using binary phase diagram. (04 Marks)

OR

- 4 a. Draw Iron-Cementite diagram. Indicate phases, critical temperatures and explain invariant reactions. (12 Marks)
b. Briefly explain the effect of alloying elements on Iron-Carbon diagram. (04 Marks)
c. What is Solidification? Explain the mechanism of Solidification. (04 Marks)

Module-3

- 5 a. What is heat treatment? Mention the classification. (06 Marks)
b. Sketch and explain TTT diagram. (06 Marks)
c. Differentiate between hardness and hardenability. Sketch and explain 'JOMINY END QUENCH' test to determine hardenability. (08 Marks)

OR

- 6 a. Sketch and explain Annealing heat treatment process. (06 Marks)
b. What is Age hardening? Explain the Age hardening of Al-Cu alloys using phase diagram. (06 Marks)
c. Explain the composition, properties and applications of Gray Cast Iron, White Cast Iron, Malleable iron and S.G. Iron. (08 Marks)

Module-4

- 7 a. What are composites? How do you classify them? (06 Marks)
b. Sketch and explain the fabrication of MMC's using stir casting process. (08 Marks)
c. Explain the functions of matrix and reinforcement. (06 Marks)

OR

- 8 a. Derive an expression for Elastic modulus of the composite under iso-strain condition. (06 Marks)
- b. List advantages, disadvantages and applications of composite materials. (08 Marks)
- c. Sketch and explain the fabrication of CMC's using "slurry infiltration process". (06 Marks)

Module-5

- 9 a. Briefly explain Thermoplastics, Thermosets and Elastomers. (06 Marks)
- b. Sketch and explain the processing of plastics by "injection molding". (08 Marks)
- c. What are ceramics? Mention the classification. (06 Marks)

OR

- 10 a. Briefly explain optical and thermal materials. (06 Marks)
- b. What are smart materials? Explain briefly the types of smart materials. (08 Marks)
- c. Write a brief note on Non-Destructive methods used for residual life assessment. (06 Marks)
