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Third Semester B.E. Degree Examination, Jan./Feb. 2021 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. Classify the crystal defects. Explain point defect with neat sketches. (07 Marks)
- b. Define Atomic Packing Factor and Calculate APF for FCC crystal structure. (07 Marks)
- c. State and explain Ficks first law of Diffusion. (06 Marks)

OR

- 2 a. Draw stress-strain diagram for mild steel and cast iron. Explain its behavior under uniaxial tension until fracture. (08 Marks)
- b. Explain with neat sketches the different stages of creep deformation. (08 Marks)
- c. Explain the factors affecting Fatigue life. (04 Marks)

Module-2

- 3 a. Define solid solution. Explain the different types of solid solutions. (08 Marks)
- b. Explain Lever rule and Gibbs phase rule with an example. (08 Marks)
- c. Explain with neat sketch different cast metal structures. (04 Marks)

OR

- 4 a. Draw the Iron-Carbon diagram and label all the points and fields in it. Explain the different phases in it. (08 Marks)
- b. Define homogeneous and heterogeneous nucleation. Obtain an expression for critical radius of nucleus. (06 Marks)
- c. Explain the effect of alloying elements to the steel. (06 Marks)

Module-3

- 5 a. Draw TTT diagram for eutectoid steel (0.83%C) and explain different micro structures. (10 Marks)
- b. Give the detailed classification of heat treatment types. Explain Mastempering and Austempering with neat sketches. (10 Marks)

OR

- 6 a. Explain with a neat sketch, Jominy end quench test. (06 Marks)
- b. With neat sketch explain age hardening of Al-Cu alloys. (08 Marks)
- c. Explain the properties, compositions and uses of gray cast iron and SG iron. (06 Marks)

Module-4

- 7 a. Explain mechanical and electrical properties of Ceramic materials. (08 Marks)
- b. How are plastics classified based on structure and behavior? Give the advantages and disadvantages of plastic materials. (08 Marks)
- c. Define ceramics and what its types. (04 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

OR

- 8 a. Differentiate between Thermosetting and Thermo-plastic materials. (06 Marks)
 b. What are smart materials? Write short note on piezoelectric material and shape memory alloys. (08 Marks)
 c. Explain the properties and applications of smart materials. (06 Marks)

Module-5

- 9 a. Define composite. How do you classify composites? (06 Marks)
 b. Explain the role of matrix and reinforcement in composite material. (06 Marks)
 c. Sketch and explain Filament winding process to produce composites. (08 Marks)

OR

- 10 a. List the assumptions made in rule of mixtures for evaluating the elastic moduli. Derive an expression for Young's modulus in a composite for longitudinal loading of fiber reinforced composite. (08 Marks)
 b. Explain the merits and demerits of MMC's. (08 Marks)
 c. Calculate the tensile modulus of elasticity of unidirectional carbon fiber reinforced composite material contains 62% by volume of carbon fibers in iso-strain and iso-stress condition. Take $E_{\text{carbon fiber}} = 37.86 \times 10^4 \text{ N/mm}^2$ and $E_{\text{Epoxy}} = 42 \times 10^2 \text{ N/mm}^2$. (04 Marks)

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