

# CBCS SCHEME



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17ME32

## Third Semester B.E. Degree Examination, June/July 2019 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. Define Atomic Packing Factor and calculate Atomic Packing Factor for FCC Crystal Structure. (08 Marks)
- b. State and explain Ficks first law of Diffusion. (06 Marks)
- c. Explain the different types of Point Imperfections, with neat sketches. (06 Marks)

OR

- 2 a. Draw Stress – Strain diagram for mild steel and cast iron. Explain its behaviour under uniaxial Tension until fracture. (08 Marks)
- b. What is Fracture? How are they classified? (04 Marks)
- c. With a neat sketch, explain the different stages of creep deformation. (08 Marks)

### Module-2

- 3 a. With a neat sketch, explain the construction of phase diagram. (08 Marks)
- b. Explain Gibbs phase rule and Lever rule. (06 Marks)
- c. With a neat sketch, explain different cast metal structures. (06 Marks)

OR

- 4 a. Explain Homogeneous nucleation and discuss the significance of critical radius of nuclei. (10 Marks)
- b. Two metals A & B of melting points  $900^{\circ}\text{C}$  and  $700^{\circ}\text{C}$  respectively have unlimited mutual liquid solubilities. The solid solubility of B in A is 30% at eutectic temperature of  $400^{\circ}\text{C}$ , which reduces to 20% at  $0^{\circ}\text{C}$ . The solid solubility of A in B is 20% at eutectic temperature which reduces to 15% at  $0^{\circ}\text{C}$ . The eutectic composition is 70%B and 30% A. Draw the phase diagram. Calculate the solid and liquid phases of 40% B alloy at  $500^{\circ}\text{C}$ . (10 Marks)

### Module-3

- 5 a. Draw TTT diagram for eutectoid steel (0.83% C) and explain different micro structures. (08 Marks)
- b. Sketch and explain Austempering and Martempering. (08 Marks)
- c. Sketch and explain Flame hardening. (04 Marks)

OR

- 6 a. Define and list the types of Heat Treatment processes. (05 Marks)
- b. With a neat sketch, explain Jominy End Queuch test. (08 Marks)
- c. Sketch and explain Nitriding process. (07 Marks)

### Module-4

- 7 a. Define Ceramics and briefly explain the types of ceramics. (08 Marks)
- b. Explain Powder Metallurgy technique for Ceramic processing. (08 Marks)
- c. Differentiate between Thermoplastics and Thermoset plastics. (04 Marks)



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OR

- 8 a. Briefly explain the characteristics of plastics. (05 Marks)  
b. Define Smart Materials. Write a note on Piezoelectric materials. (05 Marks)  
c. Write a note on Shape Memory alloys. List the Applications of Smart Materials. (10 Marks)

Module-5

- 9 a. Define Composites and classify them. (05 Marks)  
b. Sketch and explain Filament winding process to produce composites. (08 Marks)  
c. Write a note on Fibre reinforced plastic composites. (07 Marks)

OR

- 10 a. Derive an expression for Young's Modulus in a composite for longitudinal loading of fibre reinforced composite. (08 Marks)  
b. Calculate the volume ratio of Aluminum and Boron in Aluminum – Boron composite having Young's Modulus equal to Iron. The Young's Moduli of Aluminum, Boron and Iron are respectively 71 GPa, 440 GPa and 210 GPa. (08 Marks)  
c. State some Applications of composites. (04 Marks)

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