

# CBCS SCHEME

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18MR32

## Third Semester B.E. Degree Examination, Dec.2023/Jan.2024 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 Coordination number and APF. Write the coordination number and APF for SC, BCC and FCC structures and explain their significance. (07 Marks)  
b. Briefly explain Point imperfections. (07 Marks)  
c. Explain the factors affecting diffusion. (06 Marks)

OR

- 2 a. Differentiate between Ductile and Brittle materials with stress – strain diagram. (06 Marks)  
b. Explain the Plastic range properties. (06 Marks)  
c. For the tensile test results of a steel specimen having 30mm diameter and 200mm length. Extension at load of 50kN = 0.1mm, Load at elastic limit = 230kN, Maximum load = 30kN. Total extension = 50mm, Diameter of rod at failure = 20mm. Calculate  
i) Young's Modulus ii) Ductility in terms of Area and length. (08 Marks)

### Module-2

- 3 a. Explain Plastic deformation of single crystal. (07 Marks)  
b. Explain with diagram the types of fractures. (07 Marks)  
c. What are the types of Fatigue loading? Explain them briefly. (06 Marks)

OR

- 4 a. Draw and explain S – N curve. (07 Marks)  
b. Derive expression for stress relaxation. (07 Marks)  
c. Explain three stages of Creep. (06 Marks)

### Module-3

- 5 a. Explain Homogeneous Nucleation and discuss the significance of critical radius of Nuclei. (08 Marks)  
b. State and explain Hume – Rothery Rules. (06 Marks)  
c. Briefly explain Gibb's Phase Rule. (06 Marks)

OR

- 6 a. With neat sketch, explain construction of phase diagram. (10 Marks)  
b. Lead (Pb) melts at 323°C and Tin (Sn) melts at 232°C. Additions of Sn to Pb lowers the melting point of Pb and addition of Pb to Sn also lowers the melting point of Sn. At 180°C Liquid of composition 61.9% Sn, alpha ( $\alpha$ ) Phase of composition 19.2% Sn and beta ( $\beta$ ) phase of composition 96.2% Sn are in thermal equilibrium. The solubilities of Pb in Sn and Sn in Pb at room temperature are negligible.  
i) Draw the Pb – Sn phase diagram.  
ii) Identity the reactions occurring at 180°C.  
iii) Calculate the amount of phases in an alloy of composition 40% Sn at 179°C. (10 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.

**Module-4**

- 7 a. Draw the Iron – Carbon diagram indicating the phase temperatures. Explain the different phases in Iron Carbon diagram. (12 Marks)
- b. Explain the Solidification process of Eutectoid and Eutectic composition in Iron – Carbon system. (08 Marks)

**OR**

- 8 a. Differentiate between Annealing and Normalizing process. (06 Marks)
- b. With neat sketch, explain Joining Quench End test. (07 Marks)
- c. Sketch and explain Park – Carburizing process. (07 Marks)

**Module-5**

- 9 a. Write the classification of Metals. Explain the properties and composition of cast iron. (12 Marks)
- b. Discuss the Composition, Properties and Applications of Copper Alloys. (08 Marks)

**OR**

- 10 a. Define Composites and classify them. (05 Marks)
- b. Sketch and explain pultrusion process. Also mention advantages and disadvantages of this process. (10 Marks)
- c. Write a short note on Laminated composites. (05 Marks)

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