



# CBCS SCHEME

21ME33

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## Third Semester B.E. Degree Examination, Jan./Feb. 2023 Material Science and Engineering

Time: 3 hrs.

Max. Marks: 100

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

### Module-1

- 1 a. Classify engineering materials and compare crystalline solids and non-crystalline solids. (07 Marks)
- b. What are voids? Explain Tetrahedral voids and octahedral voids with suitable diagrams. (08 Marks)
- c. Briefly explain the steps to prepare a specimen for microstructural examinations. (05 Marks)

OR

- 2 a. What is meant by imperfections in solids? Explain edge dislocation and screw dislocation. (10 Marks)
- b. In crystallography, what is the theme of symmetry operation? Explain two fold and three fold rotation. (06 Marks)
- c. Define Planar Atomic Density and Atomic Packing Factor. (04 Marks)

### Module-2

- 3 a. Define solid solution. Describe the classification of solid solution. (07 Marks)
- b. Draw iron-carbon equilibrium diagram. Explain various phases and locate invariant points. (08 Marks)
- c. Explain the method of measuring hardness in Rockwell Hardness test machine. (05 Marks)

OR

- 4 a. With a neat sketch, explain Fick's 1<sup>st</sup> and 2<sup>nd</sup> law of diffusion. (08 Marks)
- b. The solidus and liquidus temperatures for an alloy system containing two metals A and B which are completely soluble in liquid and solid states are presented in the table below. Metal 'A' melts at 1080°C and metal 'B' melts at 1450°C.
  - (i) Construct the phase diagram for the system and label all regions.
  - (ii) Predict the number, type, relative amounts and composition of phases present in an alloy containing 60% A and 40% B at 1250°C.

Sl. No.	Alloy composition (Wt %)	Solidus temp °C	Liquidus temp °C
1	90% A	1100°C	1175 °C
2	60% A	1160°C	1290 °C
3	20% A	1310°C	1400 °C

(12 Marks)

### Module-3

- 5 a. Deduce the expression for critical radius of nucleation. (07 Marks)
- b. Draw and explain the process of flame hardening. (06 Marks)
- c. Explain the test procedure of creep test. (07 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

- 6 a. Explain normalizing heat treatment process. Also compare normalizing heat treatment with annealing. (08 Marks)
- b. Explain the concept of mechanisms behind strengthening in metals. Also explain strengthening by grain size reduction. (07 Marks)
- c. Explain Hardening heat treatment in brief. (05 Marks)

**Module-4**

- 7 a. Explain common types of coatings techniques in brief. (10 Marks)
- b. Briefly explain different types of mechanical methods of powder production techniques. (10 Marks)

OR

- 8 a. What is meant by sintering process? Explain liquid phase and activated sintering. (07 Marks)
- b. How the particle size and particle shape influences the characterization of metal powders? (06 Marks)
- c. Explain the wear test and state the important of conducting wear test. (07 Marks)

**Module-5**

- 9 a. Explain the need for material selection process in design. (05 Marks)
- b. What are the different types of design? Explain each type. (07 Marks)
- c. Explain the procedure for measuring hardness by Brinell's Hardness testing equipment. (08 Marks)

OR

- 10 a. What are the different functional properties of material? Explain thermal properties. (06 Marks)
- b. Describe in brief about the factors affecting the selection of materials. (06 Marks)
- c. The following data is noted in a tensile test. Diameter of specimen = 200 mm, extension under a load of 10 kN = 0.035 mm, load at yield point = 110 kN, maximum load = 190 kN. Length of specimen after failure = 255 mm, Neck dia = 12.25 mm. Determine :
- |                            |                                  |                       |
|----------------------------|----------------------------------|-----------------------|
| (i) Young's modulus        | (ii) Yield stress                | (iii) Ultimate stress |
| (iv) Percentage elongation | (v) Percentage reduction in area | (08 Marks)            |

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