



# CBCS SCHEME

21ME33

## Third Semester B.E. Degree Examination, June/July 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. Explain them with examples. (08 Marks)
- b. Differentiate between crystalline and non-crystalline solids. (07 Marks)
- c. Explain the various geometrical crystal rotation geometry operations. (05 Marks)

OR

- 2 a. Define unit cell and crystal lattice. Explain the cubic, tetragonal, orthorhombic and rhombohedral unit cells with examples. (10 Marks)
- b. Define atomic packing factor. Calculate APF of FCC unit cell. (05 Marks)
- c. Define crystal imperfections in solids. Explain point imperfections. (05 Marks)

### Module-2

- 3 a. Classify and explain solid solutions. What are intermediate phases? (10 Marks)
- b. Explain Hume – Rothery rules. (04 Marks)
- c. Explain (i) Gibb's phase rule (ii) Level rule. (06 Marks)

OR

- 4 a. Explain the eutectic system binary phase diagram for two metals completely soluble in liquid state but completely insoluble in solid state. (10 Marks)
- b. Explain the two Fick's laws of diffusion. (04 Marks)
- c. Explain the role of imperfections in diffusions. (06 Marks)

### Module-3

- 5 a. Explain the homogeneous and heterogeneous nucleation process with a suitable sketch or graph or equations. (10 Marks)
- b. Explain the plastic deformation by : (06 Marks)  
(i) Slip (ii) Twinning.
- c. Define and classify strengthening mechanisms. Explain anyone method. (04 Marks)

OR

- 6 a. Differentiate between Annealing and Normalising. (05 Marks)
- b. With sketch, explain the flame hardening process. (05 Marks)
- c. Explain the TTT diagram for 0.8% C eutectoid steel. (10 Marks)

### Module-4

- 7 a. Classify surface coating methods. Explain the electrochemical coating method. (08 Marks)
- b. Explain the various surface coating materials. (06 Marks)
- c. What are the advantages and disadvantages of powder metallurgy? (06 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. Explain the characteristics of metal powders with regard to particle size and shape distribution. (06 Marks)
- b. Explain : (i) Powder compacting process (ii) Powder sintering process. (08 Marks)
- c. What are the applications of powder metallurgy? (06 Marks)

Module-5

- 9 a. Explain the evolution of engineering materials. (06 Marks)
- b. Explain the design process with a suitable flow chart. (08 Marks)
- c. With sketch, explain the design tools and materials data. (06 Marks)

OR

- 10 a. Classify engineering materials. Explain them with examples. (10 Marks)
- b. Classify material property charts. Sketch and explain the Young's modulus – density chart. (10 Marks)

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