

# CBCS SCHEME

USN

--	--	--	--	--	--	--	--	--	--

18IM45

## Fourth Semester B.E. Degree Examination, July/August 2022 Materials Science and Metallurgy

Time: 3 hrs.

Max. Marks: 100

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

### Module-1

- 1 a. Define the following terms :
- Unit cell
  - Co-ordination number
  - Space lattice
  - Atomic packing factor. (08 Marks)
- b. Identify the four types of Imperfections in the crystal structures and explain them with neat sketches. (12 Marks)

OR

- 2 a. Determine the Atomic packing factor for an FCC unit cell. (06 Marks)
- b. Define Diffusion. Illustrate the mechanisms of Diffusion. (07 Marks)
- c. State and explain Fick's I law of diffusion. (07 Marks)

### Module-2

- 3 a. Compare the plastic deformation by slipping and twinning. (04 Marks)
- b. Define fracture. Explain the stages of fracture with a neat sketch. (08 Marks)
- c. With a neat sketch, explain the stages of creep mechanism/process. (08 Marks)

OR

- 4 a. Explain types of fatigue loading with a neat diagram. List the factors affecting fatigue. (10 Marks)
- b. Explain S-N curve using a neat diagram. (05 Marks)
- c. Distinguish between ductile and brittle fracture. (any 5 differences) (05 Marks)

### Module-3

- 5 a. Define solid solution. (02 Marks)
- b. Explain the Hume Rothery Rules for formation of solid solutions. (08 Marks)
- c. Two metals A and B are used to form an alloy containing 70% A and 30% B. Metal A melts at 610°C and B at 410°C. When alloyed together, these metals form no compound or solid solution but form a Eutectic mixture of 40% A and 60% B. The Eutectic solidifies at 260°C. Determine the following :
- Draw the phase diagram and represent all regions and phases
  - Temperature at which alloys begin to crystallize from melt and at which the alloy melt will be completely solid.
  - The percentage of eutectic in the alloy at room temperature and at 300°C amount of solid present. (10 Marks)

OR

- 6 a. Explain Gibb's phase in brief. (04 Marks)  
b. Construct Iron-Carbon equilibrium diagram and label all regions, phases and temperatures. Mention the three invariant reactions. (08 Marks)  
c. Construct TTT curves (Time Temperature Transformation) for eutectoid steel and explain the same in brief. (08 Marks)

**Module-4**

- 7 a. Define heat treatment process. (02 Marks)  
b. Explain the objectives of heat treatment process (any 6). (06 Marks)  
c. With a neat sketch, explain full annealing process. (08 Marks)  
d. List out the differences between Austempering and Martempering (any 4). (04 Marks)

OR

- 8 a. Bring out the classification of Heat Treatment Process. (04 Marks)  
b. With a neat sketch, explain the Jominy End Quench test. (08 Marks)  
c. Explain with a neat sketch the pack carburizing process. (08 Marks)

**Module-5**

- 9 a. Explain/outline the composition, properties and applications of High Carbon Steels. (06 Marks)  
b. Explain the Role of matrix and reinforcement in composite materials. (08 Marks)  
c. List mechanical properties of composite materials and also the applications. (06 Marks)

OR

- 10 a. Explain in brief the composition, properties and applications of Grey cast iron. (06 Marks)  
b. Define ceramics. Explain in brief different types of ceramics with examples. (08 Marks)  
c. Distinguish between thermosetting and thermoplastic (any 3) with examples. (06 Marks)

\* \* \* \* \*