

CBCS SCHEME

USN

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

18IP45

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. Draw HCP lattice and calculate its atomic packing factor. (06 Marks)
- b. Explain different types of point imperfections with neat sketches. (10 Marks)
- c. Aluminium has a FCC structure and atomic radius of 0.143 nm. Calculate the volume of its unit cell in cubic meters. (04 Marks)

OR

- 2 a. Explain with neat sketch edge dislocation and screw dislocations. (10 Marks)
- b. State and explain Fick's 1st and 2nd law of diffusion. Explain the factors affecting atomic diffusion. (10 Marks)

Module-2

- 3 a. Derive an expression for the critical resolved shear stress for slip in single crystal. (10 Marks)
- b. Illustrate the stages in the cup and cone fracture with suitable sketches. (10 Marks)

OR

- 4 a. Draw the creep curve and explain the different mechanisms of creep. (10 Marks)
- b. Explain plastic deformation by slip and twinning. (10 Marks)

Module-3

- 5 a. Explain the following with example:
 - (i) Gibb's phase rule
 - (ii) Lever rule(08 Marks)
- b. Draw and explain iron carbon equilibrium diagram and label all the points and fields. (12 Marks)

OR

- 6 a. Two metals A and B have their melting points at 900°C and 800°C respectively. The alloy pair forms a eutectic at 600°C of composition 60% B and 40% A. A and B have unlimited mutual liquid solubilities. Their solid solubilities are as follows:
 10% B in A at 600°C and 5% B in A at 0°C.
 8% A in B at 600°C and 4% A in B at 0°C.
 Assume the liquidus, solidus and solvus lines to be straight. No solid state reactions or any intermediate phase changes occur in the series.
 - (i) Draw the phase diagram for the series and label all salient temperatures, compositions and regions.
 - (ii) Find the room temperature structure of an alloy of composition 60% A and 40% B with respect to the number, type, extent and composition of phases. (10 Marks)
- b. Explain TTT diagram (for 0.8% C steel) by super imposing the cooling curves on it. (10 Marks)

Module-4

- 7 a. Write notes on the following with sketches:
(i) Annealing
(ii) Carburizing (10 Marks)
b. What is hardening? Explain with a sketch induction hardening. (10 Marks)

OR

- 8 a. Explain the process of flame hardening and cyaniding. (12 Marks)
b. Differentiate between Austempering and Martempering with neat sketches. (08 Marks)

Module-5

- 9 a. Define composite. Give brief classification of composites. (08 Marks)
b. Give composition, microstructure, properties and applications of different types of cast irons. (12 Marks)

OR

- 10 a. Explain the following:
(i) Role of matrix
(ii) Role of interface
(iii) Role of reinforcement in a composite material (12 Marks)
b. What are the applications of composites? (04 Marks)
c. Explain the properties of ceramics. (04 Marks)

* * * * *