

INTRODUCTION TO MATERIALS (MT – 301)

Time: 3 hrs

Full Marks: 70

Answer Any Seven Questions

1. (a) Draw the following 1.5 x 4+4=10
- (i) (111) in cubic crystal
 - (ii) [110] in cubic crystal
 - (iii) (001) in tetragonal crystal
 - (iv) (0001) in hexagonal closed packed plane
- (b) Discuss Bravais lattice and its varieties
2. Differentiate between (any five) 5 x 2 = 10
- a. Schottky and Frankel Imperfections
 - b. Slip and Twinning
 - c. Edge and Screw Dislocation
 - d. Malleability and Ductility
 - e. Stiffness and Toughness
 - f. Allotrope and Polymorph
3. Write Short note on the following (any four) 4 x 2.5 = 10
- a. Hume-Rothery Rules for Mixing
 - b. Slip systems in Aluminium Alloys
 - c. Determination of Yield Point in a stress strain curve
 - d. Classification of Engineering Materials
 - e. Relation Between Lattice and Basis
4. Answer the following numerical problems (any four) 2.5 x 4 = 10
- a. Find the equilibrium vacancies in 1 m³ of Copper at 1000°C;
Given: density of Copper is 8.4 g/cc,
atomic weight of Copper is 63.5 g/mol,
activation energy is 0.9 eV/atom
 - b. Determine the density of BCC iron, which has a lattice parameter of 0.2866 nm.
 - c. Calculate the c/a ratio for hcp crystal

- d. Calculate the planar atomic density on the (110) plane of the α iron BCC lattice in atoms per square millimeter. The lattice constant of α iron is 0.2787.
- e. Calculate the linear atomic density on the [110] direction in the Copper crystal lattice in atoms per millimeter. Copper has a lattice constant of 0.361 nm.
5. Justify the Following (any four) 2.5 x 4 = 10
- Stacking fault in fcc may locally create hcp stacking
 - Atomic Packing Factor (APF) for fcc crystal structure is 0.74
 - Metallic bonded solids more ductile than covalent bonded ones
 - Phase diagram can give indications about equilibrium situations.
 - Degree of freedom (DOF) is zero for invariant reactions.
6. (a) Write different reactions seen in Fe-Fe₃C phase diagram. 4+3+3 =10
- (b) Define Intermetallic Compound. How they are different from other compounds?
- (c) Discuss the nature of Pearlitic transformation.
7. Describe with diagram the various types of flames that can be produced in Oxy-acetylene flame welding. State the advantages, disadvantages and applications of Oxy-acetylene flame welding. 6 + 4 = 10
8. State the advantages of Rightward technique over Leftward. 3 + 7 = 10
Explain the role of Fluxes in Oxy-acetylene flame welding.
9. State the Factors for Selection of right kind of Electrode for a particular welded joint. State and explain the Functions of Flux Coating Ingredients. 3 + 7 = 10
10. Describe the process of manufacturing flux coated electrodes for MMAW. 10