M.Phil. (Science) Examination

PHYSICS—II

(Material Science)

Time : Three Hours] [Maximum Marks : 80

Note :—(1) Solve any **FIVE** questions.

(2) All questions carry equal marks.

1. (a) Describe phase, components and variables with examples. 8

   (b) Show the correlation between free energy and equilibrium diagram of eutectic containing binary diagrammatically. 8

2. (a) Describe the phase diagram of uniary H_2O system. How a lever rule is used to determine the composition of eutectic C ? 8

   (b) Explain a general binary phase diagram of components A and B with partial solid solubility in each other. Describe the micro-structural changes during cooling of eutectic binary system. 8

3. (a) Discuss four invariant reactions using phase boundaries. What is pro-eutectic composition ? 8

(b) Describe the significance of time scale of cooling in suppressing phase transformation. Discuss dendritic structure. 8

4. (a) Describe the mass-flow process under steady state condition. What is the solution of Ficks second law ? 8

(b) Explain the vacancy and interstitial diffusion process in terms of enthalpies of defect formation and migration. 8

5. (a) Describe the Czochalski method for single crystal growth. Discuss solid state reaction to prepare polycrystalline ceramics. 8

(b) Describe any four techniques to prepare thin films. 8

6. (a) Describe the Braggs law for x-ray diffraction. How x-ray diffraction data are used to determine crystal structure ? 8

(b) What is the principle of thermogravimetric analysis (TGA) ? What are the general applications of differential thermal analysis (DTA) ? 8

7. (a) Draw a Burger's circuit around edge dislocation and screw dislocation. What are print defects ? 8

(b) Distinguish between the direction of the dislocation line, the Burger vector and the direction of motion of both edge and screw dislocations. 8

8. (a) Explain the frequency dependent polarization and loss phenomenon. 8

(b) State and explain occurrence of different polarization on application of external field to a dielectric material. Explain piezoelectricity in solids. 8

9. (a) Describe the ferromagnetism in solids. Why all materials exhibit diamagnetism ? 8

(b) Discuss soft and hard magnetic materials. Why ferrites are used in transformers ? 8

10. (a) Discuss the luminescence spectra of Ag activated ZnS. Distinguish between fluorescenee and phosphorescence. 8

(b) On what factors the extents of opacity of transparent materials depnds ? Why polycrystalline materials are opaque ? 8