Exam.Code:0906
Sub. Code: 6666

1058

B.E. (Mechanical Engineering)
Second Semester
APH-207: Physics of Materials
(Common with ECE, IT and EEE)

Time allowed: 3 Hours | Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each Part.

x-x-x

Q. 1 (a) What do you understand by inversion symmetry in a cube.

(b) Sketch $(1\bar{2}1)$ plane in a cubic unit cell.

(c) Write a short note on fullerenes.

(d) Discuss two factors affecting the rate of diffusion.

(e) What is viscoelasticity?

(f) How grain size affects the strength of a material?

(g) Differentiate between resilience and toughness of a material.

(h) What information you get from a fractograph?

(i) Explain Eutectic transformation with an example.

(j) What is temper embrittlement? (10×1)

Part A

Q. 2 (a) Magnesium (At. mass 24.3 amu) has an HCP structure, a c/a ratio of 1.624, and a density of 1.74 g/cm^3. Compute the atomic radius for Mg. (3)

(b) Show that the void in a simple cube can be filled by sphere having radius not larger than $0.732R$, where R is the radius of the larger sphere involved in the packing of these spheres. (3)

(c) Discuss symmetry elements in a cube. (4)

Q. 3 (a) What are dislocations? Differentiate between edge and screw dislocations. (3)

(b) Monochramatic X-rays of $\lambda = 1.51A^o$ are incident on a crystal face having an interplaner spacing of 1.61A^o. Find various orders of Bragg's reflections. (3)

(c) The steady state diffusion flux through a metal plate is 7.8 $\times 10^{-8}$ Kg/m^2-s at a temperature of 1200°C and when the concentration gradient is -500 Kg/m^4. Calculate the diffusion flux at 1000°C for the same concentration gradient and assuming an activation energy of 145,000 j/mol. (4)

Q. 4 (a) Discuss three factors responsible for promoting non crystallinity in long chain polymers. (3)

(b) Cite primary differences between the elastic, anelastic and plastic deformation behavior. (3)

(c) A steel bar and an aluminium bar are each under a load of 5000N. If the cross-sectional area of the steel bar is 100 mm^2, what must be the area of aluminium for the same elastic deformation. Given the young's moduli $E_{Al} = 71\,GN/m^2$, $E_{steel} = 210\,GN/m^2$. (4)

P.T.O.

Part B

Q. 5 **(a)** What do you understand by slip system? Describe the mechanism of slip in a single crystal. (5)

(b) What is cold work and how it affects the strength of a material? (3)

(c) Give at least three differences between a stable and an unstable crack (2)

Q. 6 **(a)** Discuss three measures that can be taken to increase the resistance to fatigue of a metal alloy. (3)

(b) Discuss the creep behaviour of a metal w.r.t. time. (3)

(c) Discuss the development of microstructure in Cu-Ag alloy of eutectic composition as it is cooled from a temperature above the eutectic temperature to a temperature below the eutectic temperature. (4)

Q. 7 (a) Explain the phenomenon of coring. Also cite undesirable consequences of coring. (5)

(b) Cite the differences between pearlite, bainite and spheroidite relative to microstructure and mechanical properties. (5)

x-x-x