SEAT No._____

[127/A-22]

SARDAR PATEL UNIVERSITY
M.Sc. (Physics)(IVth Semester) Examination
Date : 30/10/2018, Day : Tuesday, Time : 2:00 p.m. to 5:00 p.m.
Subject : Cyrstal growth and Imperfections in solids, Paper No. PS04EPHY02
CBCS(choice based credit system)

Important Note : Q.1 : Multiple choice questions (MCQ) carries one mark each.
Q.2 : Short questions carries two marks each (attempt any seven out of nine)
Q.3 to Q.6 : Long questions carries 12 marks .

Total Marks : 70

Q.1 *Choose the appropriate options from the following in Q.1* (8)

1 The number of independent variable for the layer type phase equilibrium diagram above the melting point of Pb and Al is _____ .
(a) 0   (b) 1   (c) 2   (d) 3

2 Which of the following defect is considered to be similar to reflecting plane.
(a)twin   (b) tilt   (c) stacking fault   (d) twist

3 An atom located at a position that is not a normal lattice site is known as

(a) Frenkel defect   (b) Schottky defect   (c) dislocation   (d) tilt defect

4 The Burger's vector of mixed dislocation is --------- to the dislocation line.
(a) perpendicular   (b) parallel   (c) diagonal   (d) none of these

5 Dynamic and fluctuating stresses are related to which type of failure.
(a) Creep   (b) Fatigue   (c) Fracture   (d) dislocation

6 Which technique can be used for the making silicon crystal ?
(a)float zone   (b) flame fusion   (c) Bridgman   (d) Czochralski

7 Decoration method is limited to crystals which are _____ to light.
(a) opaque   (b) transparent   (c) reflecting   (d) refracting

8 Two adjacent F centers forms :
(a) M-Center   (b) R- center   (c) V-center   (d) F_A- center

①

Q.2 **Answer any seven questions out of nine in Q.2** (14)

1 Differentiate between homogeneous and heterogenous nucleation.
2 What is Gibb's phase rule?
3 Define Burger's vector and Burger's circuit.
4 How many slip planes and slip directions are there in FCC lattice.
5 A single crystal of copper (fcc) contains a low angle tilt boundary on a (010) plane and the tilt axis parallel to the [001] direction. Calculate the tilt angle, if the spacing of the dislocations in the boundary is 1.5×10^{-6} m. (Given : $a = 3.61A^0$).
6 Classify different types of colour centers.
7 Define fatigue and creep ?
8 How Rockwell hardness test is done?
9 State Ficks first , second law of diffusion and Kikendall effect.

Q.3(a) Draw phase equilibrium diagram of two component system which is mutually soluble in liquid state and insoluble in solid state and discuss it in detail. (6)

Q.3(b) Explain vapour transport technique used for the growth of crystals. (6)

OR

Q.3(b) Discuss growth of crystals by gel technique and state its advantages and disadvantages. (6)

Q.4(a) Derive the expression for concentration of Schottky defects. (6)
Q.4(b) Explain different types of line defects known to you with proper diagrams. (6)

OR

Q.4(b) Discuss how stacking faults may be produced in fcc and hcp crystals. (6)

Q.5(a) Describe decoration method used for viewing dislocations in transparent crystals. (6)
Q.5(b) Explain in detail how multiplication of dislocations can take place in crystals. (6)

OR

Q.5(b) Explain stress field in an edge and screw dislocation with proper equations and diagrams. (6)

Q.6(a) Differentiate between ductile and brittle fracture. (6)
Q.6(b) How carburizing and decarburizing process occurs in steel ? (6)

OR

Q.6(b) Discuss different types of cyclic stresses and explain how experimentally S-N curves can be obtained. Also explain two distinct types of S-N behavior observed for ferrous and non-ferrous alloys. (6)