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SARDAR PATEL UNIVERSITY

M.Sc. (Physics)(3rd Semester) Examination

Day : Saturday, Date : 25/04/2015,Time : 2:30 p.m. to 5:30 p.m.

Subject :Crystallography and Materials Science Paper No. PS03EPHY01

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.7 : Long questions carries 12 marks .

Total Marks : 70

Choose the appropriate options from the following s.

Q.1

i) If g is reciprocal lattice vector , the Bragg's law can be written as
(a) K+g =0 (b) $2k.g+g^2=0$ (c) $2k.g+k^2=0$ (d)) k.g=0

ii) The fundamental building block whose repetition generates a crystal is
a. Unit cell b. lattice cell c. primitive cell d. none of these.

iii) Aluminium has f.c.c lattice with interatomic spacing equal to 4.01 A. The value of lattice constant is
(a) 1.27 (b) 4.01 (c) 2.005 (d) 1.05

iv) Basis is defined as
(a) An atom (b). a group of atoms
(c) One or group of atoms about a point (d). none of these

v) The number of basic crystal system is
(a) 2 (b). 4. (c) . 7 (d) 9

vi) Which of the following Bragg reflections are absent for an f.c.c lattice
(a) 100 (b) 200 (c) 220 (d) 111

vii) Camera constant is defined as
(a) λ L= rd (b) λR= DL (c) λL=RD (d) λL= rD

viii) Ba Tio_3 is an example of
(a) ferroelectric (b) paramagnetic (c) antiferromagnetic
(d)ferromagnetic

Q. 2

Answer any seven out of nine: 14

i) Mention the characteristics of ferroelectric materials?

ii) What is an Ewald sphere?

iii) Define single crystal , polycrystalline and amorphous materials .

iv) What are atomic packing factor and coordination number?

v) Differentiate between atomic scattering factor and structure factor.

vi Differentiate between ferroelectricity and antiferrroelectricity

vii) Explain the terms annealing and quenching

viii) What are polariton and polarn? .

ix) Write LST relation. What is Peierls instability?

P.T.O.

Q.3(a) Justify the statement : as and when reciprocal lattice touches the sphere there is a diffraction otherwise not. Discuss spherical projection, stereographic projection and gnomonic projection . 6

Q.3(b) Construct the reciprocal lattice graphically. Prove that the reciprocal lattice vector is normal to crystal plane (hkl) and of length 1/d. A unit cell has lattice parameters a= 10. 50 ,b= 8.50 and c= 5.25 Å with orthogonal axes . Display and calculate the reciprocal lattice parameters and the volume of both the cells . 6

OR

Q.3(b) What is camera constant and give its significance. Discuss a suitable technique to record an electron diffraction pattern from a polycrystalline specimen . How do you index such pattern. 6

Q.4(a) Obtain the structure factor equation for scattering of X rays from all the atoms of a unit cell of orthorhombic lattice. Interpret the result. How does it help in understanding the diffraction pattern. 6

Q.4(b) Derive the required formula for the conduction mobilities for localized and delocalized states for amorphous semiconductors.. 6

OR

Q.4(b) Explain ferro electric domain. What are the main characteristics of ferroelectric materials. Give its classification. Compare ferroelectricity and piezoelectricity. 6

Q.5(a) Discuss the electron –electron interaction in metal based on electrostatic screening . 6

Q.5(b) What are polymers? Give a broad classification of polymer. Discuss the structure of long chain polymers. 6

OR

Q.5(b) Describe the interaction of photons and transverse optical phonons while deriving the expression $\varepsilon(\omega) = \varepsilon(\infty) + [\varepsilon(0) - \varepsilon(\infty)] \cdot \frac{\omega_T^2}{\omega_T^2 - \omega^2}$. 6

Q.6(a) Write short notes on (1) long range order (2) Kondo effect 6

Q.6(b) What are liquid crystals? Give a detailed classification of liquid crystals. Describe in brief the applications of liquid crystals. 6

OR

Q.6(b) Define ordered and disordered alloys. Describe the effect of alloying on the residual resistivity of an alloy. 6

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