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SARDAR PATEL UNIVERSITY

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

Day : Monday, Date : 11 /04/2016, 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) Piezoelectric crystals have
No centre of inversion (b) center of inversion (c) mirror symmetry (d) no symmetry
- ii) Laue equation is
(a) $r.s = n$ (b) $r^2.s = n$ (c) $r.s^2 = d$ (d) $r.s = d$
- iii) Aluminium has f.c.c lattice with interatomic spacing equal to 4.01 Å. the value of lattice constant is
(a) 4.01 (b) 2.05 (c) 5.08 (d) 8.02
- iv) Ba TiO₃ is an example of
(a) ferroelectric (b) paramagnetic (c) antiferromagnetic
(d) ferromagnetic
- v) Atomic scattering factor for any element is maximum at
(a) $2\theta = 0$ (b) $2\theta = 180$ (c) $2\theta = 90$ (d) none of the above
- v) Which of the following Bragg reflections are absent for f.c.c. lattice
(a) 100 (b) 200 (c) 220 (d) 111
- vii) The quartz crystals are
(a) Pyroelectric (b) Piezoelectric (c) Ferroelectric (d) non crystalline
- viii) Reciprocal lattice vector is
(a) Length is $1/d$ and normal to set of planes
(b) length $1/d^2$ and parallel to set of planes
(c) length d and perpendicular to planes
(d) length is infinity

Q.2

Answer any seven out of nine:

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- i What is an Ewald sphere?
- ii What is an optical fibre?
- iii Discuss the characteristic of BaTiO_3 .
- iv Discuss the properties of Vitreous silica
- v Differentiate between atomic scattering factor and structure factor
- vi What are polarons.?
- vii What are fullerenes ?
- viii Mention the differences between spherical projection and stereographic projection.
- ix Discuss the principle on which optical fibre works.

- Q.3(a) Give the graphical construction of reciprocal lattice and interpret the result. Prove that the reciprocal lattice vector is normal to direct lattice plane and is of length $1/d$. 6
- Q.3(b) Establish the Bragg condition suitable for thin specimen. Outline the experimental set up to record an electron diffraction pattern from a polycrystalline specimen and discuss its working.. 6

OR

- Q.3(b) Give the graphical presentation of Bragg's law with the help of Ewald sphere and interpret the result 6
- Q.4(a) i What do you mean by non coherent Compton scattering? 6
ii. Explain polarization factor and its impact .
- Q.4(b) What are the characteristics of ferroelectric materials? . In the case of displacive transition, establish the relationship between dielectric constant and transition temperature for these material . 6

OR

- Q.4(b) Obtain the differential equation for acoustic wave propagating through a thin piezoelectric slab generated by an alternating electric field. Derive the necessary solution and interpret the result. 6

Q.5(a) Give the classification of liquid crystals with the help of proper diagrams. Give one examples of each type illustrating its use in industry. 6

Q.5(b) Obtain the required formula for the conduction nobilities for the localized and delocalized states in amorphous semiconductors. 6

OR

Q.5(b) Differentiate between integral quantum Hall effect and fractional quantum Hall . Explain the integral quantum Hall effect with proper illustration. 6

Q.6(a) Discuss the xerography and switching processes as an application of the amorphous semi conductor . 6

Q.6(b) Write notes on 6

i. Home Rothery rules

ii. Order-disorder transformation.

OR

Q.6(b) Explain the interaction of phonon with transverse optical phonons and derive the relations 6

Best Luck.