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## SARDAR PATEL UNIVERSITY

M.Sc. (Physics)(IIIrd Semester) Examination

Date :16/04/2018, Day : Monday , Time : 10:00am to1:00 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.6 : Long questions carries 12 marks .

Total Marks : 70

Choose the appropriate options from the following in Q.1

Q.1

(8)

- i) The locus of a point where the diffracted beam and reciprocal lattice point intersect a circle of radius ----- is called Ewald sphere.  
(a)  $2/\lambda$  (b)  $4/\lambda$  (c)  $3/\lambda$  (d)  $1/\lambda$
- ii) The wavelength of the electron beam depends inversely on  
(a) accelerating voltage (b) target area (c) density of specimen  
(d) magnetic field.
- iii) ----- is an effect produced in a pyroelectric crystal by the application of an external electric field.  
(a) piezoelectricity (b) ferroelectricity (c) antiferroelectricity  
(d) ferrielectricity
- iv) Which technique is superior for quantitative determination of several elements in a complex sample with high accuracy  
(a) WDAX (b) EDAX (c) X-ray diffraction (d) Electron diffraction.
- v) Materials showing large GMR-CMR effect finds application in the field of ?  
(a) Xerography (b) solar cells (c) batteries (d) magnetic recording
- vi) In an insulator the combination of electron and its strain field is known as  
(a) polariton (b) polaron (c) photon (d) phonon
- vii) The magnetic fluid can be levitated by means of  
(a) electric field (b) magnetic field (c) electromagnetic radiations  
(d) none of these
- viii) From below which term relates to liquid crystals ?  
(a) total internal reflection (b) birefringence (c) superconductivity  
(d) semiconductor

[P.T.O.]

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

- i) Define ferroelectricity and piezoelectricity.
- ii) What is Compton effect ?
- iii) Mention the salient features of reciprocal lattice.
- iv) Differentiate between spherical and stereographic projection.
- v) Give difference between thermosetting and thermoplastic polymers.
- vi) What is meant by SQUID ?
- vii) Define polaron and polariton.
- viii) Give classification of liquid crystals.
- ix) What is meant by charged and sterically stabilized magnetic fluid?

Q.3(a) What are Laue equations ? Prove the equivalence of Bragg and Laue equations. (6)

Q.3(b) Explain Ewald construction and obtain Bragg's law in vectorial form. (6)

OR

Q.3(b) Describe in detail how indexing of electron diffraction pattern is done for polycrystalline specimen. (6)

Q.4(a) Derive an expression for Thomson equation for scattering of an X-ray beam by a single electron. (6)

Q.4(b) What is meant by Polarization Catastrophe? Explain it in detail by deriving appropriate equations. (6)

OR

Q.4(b) Calculate the structure factor for NaCl crystal. (6)

Q.5(a) How room temperature Hall effect differs from integral quantum Hall effect explain with proper diagrams and equations. (6)

Q.5(b) Deriving equations showing the coupling between transverse electromagnetic waves and transverse optical phonons, obtain LST relation. (6)

OR

Q.5(b) What is superconductivity ? Discuss in detail high temperature superconductors. (6)

Q.6(a) Classify different types of liquid crystals and discuss effect of magnetic field on liquid crystals. (6)

Q.6(b) Explain applications of amorphous semiconductors for switching and Xerography. (6)

OR

Q.6(b) What are Fullerenes ? Explain different properties of fullerenes. (6)

x