

[94/A-23]

SARDAR PATEL UNIVERSITY

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

Date : 25/03/2019, Day : Monday, Time : 10:00 a.m. to 1:00 p.m.

Subject : Crystallography and Material 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

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

- 1 The intensity of a wave is proportional to the ----- of its amplitude.
(a) cube (b) square (c) underroot (d) fourth power
- 2 Ewald construction is done by taking inverse of the ----- of the incoming X-ray beam.
(a) Wavelength (b) Energy (c) momentum (d) velocity
- 3 Form factor is also known as a _____.
(a)Polarization factor (b)Structure factor (c)atomic scattering factor
(d)None of above
- 4 The resultant wave scattered by all the atoms of the unit cell is called
(a)Lorentz factor (b)absorption factor (c) structure factor (d)atomic scattering factor
- 5 The magnetic fluid can be levitated by means of
(a)electric field (b) magnetic field (c) electromagnetic radiations (d) charging
- 6 In an insulator the combination of electron and its strain field is known as
(a) polariton (b) polaron (c) photon (d) phonon
- 7 The molecules in liquid crystals are long and rodlike having typical length of the order of
(a) $15-40\text{\AA}$ (b) $150-400\text{\AA}$ (c) $1500-4000\text{\AA}$ (d) $15000-40000\text{\AA}$
- 8 DC SQUID contains how many junctions in superconducting ring ?
(a)one (b) two (c) three (d) four

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

- 1 Why thin specimens are required for obtaining electron diffraction patterns ?
- 2 Which condition is to be satisfied for diffraction to occur from crystals ? Why ?
- 3 Define ferroelectricity and give examples of ferroelectric crystals.
- 4 What are X-rays ? How one can get characteristic and continuous X-rays ?
- 5 For what purpose Kramer's -Kroning relation is used .
- 6 Abbreviate SQUID and state its importance.
- 7 What are single mode and multimode optical fibers?
- 8 Which molecule of fullerene family is considered to be the most stable ? Why?
- 9 Define liquid crystals and differentiate between lyotropic and thermotropic liquid crystals.

Q.3(a) How electron diffraction occurs for single crystalline specimen ? Explain its indexing procedure. (6)

Q.3(b) Prove the equivalence of Bragg's law and Laue equations. (6)

OR

Q.3(b) What is reciprocal lattice ? Obtain Bragg's law in vector form. (6)

Q.4(a) Obtain the equation which shows that the scattered intensity decreases as the inverse square of the distance from the scattering electron. (6)

Q.4(b) Calculate the structure factor of the body centered cell and face centered cell. (6)

OR

Q.4(b) Explain the theory of the ferroelectric displasive transitions in terms of polarization catastrophe. (6)

Q.5(a) Discuss electron-electron interaction mechanism in metals. (6)

Q.5(b) Describe GMR-CMR materials with the help of examples and plots. (6)

OR

Q.5(b) Explain Raman effect in crystals . (6)

Q.6(a) What are Fullerenes ? Discuss various properties of fullerene molecule C_{60} . (6)

Q.6(b) Describe various properties exhibited by magnetic fluid under the presence of magnetic field. (6)

OR

Q.6(b) Explain electronic conduction mechanism in amorphous semiconductors along with its optical properties. (6)

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