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SARDAR PATEL UNIVERSITY
Fifth Semester B. Sc. Examination
Under CBCS

Monday, 18th Nov-2013

Time: From 10:30 am to 1:30 pm

Subject: PHYSICS [US05CPHY03]

Solid state physics

N.B : (i) All the symbols have their usual meanings.

Total Marks 70

Que. -1 To answer the following Multiple Choice Questions choose the correct option. [10]

- (i) In the Powder Method the type of specimen placed in a beam of monochromatic X- ray is _____.
(a) Polycrystalline (b) Single (c) crystalline (d) None of these
- (ii) Bragg derived the condition $n\lambda = 2d\sin\theta$ for _____ interference of the X-rays scatter by a set of parallel lattice planes.
(a) destructive (b) constructive
(c) Either (a) or (b) (d) Both (a) and (b)
- (iii) In the Laue method $\lambda = \dots\dots\dots$ and $\theta = \dots\dots\dots$
(a) Variable - Fixed (b) Fixed - Variable
(c) Fixed- Fixed (d) Variable - Variable
- (iv) Isotope effect is used to study _____ vibrations.
(a) lattice (b) electron-lattice
(c) both (a) and (b) (d) photon
- (v) Meissner effect is found in _____ superconductor.
(a) Type I (b) Type II (c) Type I & II (d) None of these
- (vi) The value of critical magnetic field is always _____ for Type I superconductor.
(a) to high (b) moderate (c) to low (d) None of these
- (vii) Pure semiconductor is insulator at _____ temperature.
(a) ~ 450K (b) -140K (c) Room (d) absolute zero
- (viii) For intrinsic Semiconductor for the case $m_e^* = m_h^*$ then the Fermi level lies exactly at the _____.
(a) Near the valance band (b) Near the conduction band
(c) Middle of the forbidden gap (d) Valance band edge
- (ix) Full name of CMOS is _____.
(a) Complementary metal oxide semiconductor
(b) Complementary metal oxide superconductor
(c) Complementary mode oxide semiconductor
(d) Common mode oxide semiconductor
- (x) Any material engineered at nanoscale to perform a specific task is called _____.
(a) Nanoscale bio-structure (b) Sensor (c) Smart material
(d) Lithography

- Que. -2** Answer *briefly* any ten of the following questions. [20]
- (1) What is X-ray Crystallography? Give the names of three experimental X-ray diffraction methods.
 - (2) What are BCC, FCC, and HCP structures?
 - (3) List out the properties of X-ray.
 - (4) What is Fermi energy?
 - (5) What is contradiction of Meissner effect?
 - (6) Write any four importance of Hall effect.
 - (7) What is intrinsic semiconductor?
 - (8) What is Photovoltaic effect?
 - (9) Which phenomenon is called fluorescence?
 - (10) Explain the working principle of electron microscope.
 - (11) What are nano materials?
 - (12) Explain the working principle of scanning probe instruments.
- Que. -3** (a) Discuss in detail: Powder Method. [06]
 (b) Explain X-ray back reflection Laue method. [04]
 OR
- Que. -3** (a) Explain the geometrical construction of reciprocal space. [06]
 (b) Give the properties of reciprocal lattice. [04]
- Que. -4** (a) Explain Drude model of free electron. [06]
 (b) Explain the effect of isotopes on superconductor. [04]
 OR
- Que. -4** (a) What is superconductivity? Discuss Type I and Type II superconductors. [06]
 (b) Define Drift velocity and derive the equation for electrical conductivity. [04]
- Que. -5** Draw energy level diagram for a metal and N-type semiconductor (with $\Phi_m > \Phi_s$) before and after junction formation and explain rectifying contacts. [10]
 OR
- Que. -5** Draw the diagram of the location of Fermi level at 0^oK in an intrinsic semiconductor and explain Fermi level and carrier concentration in semiconductors. [10]
- Que. -6** (a) Explain at length the production of biostructures at nanoscale. [06]
 (b) Write a note on dip pen nanolithography. [04]
 OR
- Que. -6** (a) Explain at length the process of self assembly used in nanofabrication. [06]
 (b) Write a note on molecular synthesis. [04]