SEAT No._____ No. of Printed Pages : 2

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SARDAR PATEL UNIVERSITY

5th Semester B. Sc. EXAMINATION (Under CBCS)

Wednesday, 11th April - 2018

Time 2:00 pm to 5:00 pm

Subject Code: PHYSICS [USO5CPHY03]

(Solid State Physics)

N.B: (i) All the symbols have their usual meanings.
(ii) Figures at the right side of questions indicate full marks.

Total Marks: 70

Q-1 Choose the correct option for the following questions. [10]

(1) The distance of each of the points from the origin preserves the interplanar spacing of that stack of parallel planes it is the _____
(a) d-spacing (b) k-spacing
(c) h-spacing (d) None of these

(2) In the Laue method λ is _____ and θ is_____.
(a) variable - fixed (b) fixed - variable
(c) fixed - fixed (d) variable - variable

(3) In Rotating crystal method _____ X-Ray is fall on the specimen.
(a) polychromatic (b) diachromatic
(c) monochromatic (d) All are these

(4) The ratio of thermal conductivity to electrical conductivity is .....to the temperature for a large number of metals.
(a) Equal (b) proportional
(c)Inversely proportional (d) less than

(5) With the help of a Hall effect _____can be determined.
(a) The sign of charge carriers (b)electronic structure of the substance
(c) The no. of charge carriers per unit volume (d) All are these

(6) The net force on an electron moving with velocity V under the action of a static electric field E and a uniform magnetic field B is _____.
(a) F= e [E+(V x B)] (b) F= -e [E+(V x B)]
(c) F= e [E+V + B] (d) F= -e [E x V x B]

(7) The electrical conductivity of a pure and perfect semiconductor crystal at any temperature [not very low] is due to _____.
(a) only holes (b) only electrons
(c) Extrinsic charge carriers (d) Intrinsic charge carriers

(8) The increase in the electrical conductivity of Photo conductor is due to the production of electron hole pairs by the _____.
(a) absorbed phonons (b) absorbed photons
(c) absorbed neutrons (d) absorbed electrons

(9) The process of mixing the chemicals and get nanostructures by letting the molecules sort themselves out is called _____ .
(a) Dip pen lithography (b) molecular synthesis
(c) self assembly (d) E-beam lithography

(10) Any material engineered at nanoscale to perform a specific task is called _____.
(a)nanoscale biostructures (b)smart material
(c)polymer (d)self healing structure

(P.T.O.)

Q-2 Answer any ten questions in brief. [20]

(1) Distinguished between electron diffraction and X-ray diffraction.
(2) State Bragg's law.
(3) Write down primitive vectors of the reciprocal lattice.
(4) State the Widemann-Fraz law and define Lorentz number L.
(5) Which phenomenon is called Meissner effect?
(6) Explain the effect of Isotopes on superconductors.
(7) Define n-type semiconductor and p-type semiconductor.
(8) What is Peltier effect?
(9) What is inter band transition?
(10) With necessary diagram predict Moore's first law.
(11) Explain the working principle of electron microscope.
(12) Explain in brief about molecular synthesis.

Q-3 (A) What is X-ray crystallography? Discuss in detail X-Ray diffraction Powder Method. [06]

(B) Write a note on Geometrical construction of reciprocal lattice. [04]

OR

Q-3 (A) Write a note on properties of reciprocal lattice. [06]

(B) Write a note on structure factor for bcc crystal. [04]

Q-4 (A) What are Superconductor and superconductivity? Explain in detail type I and type II superconductor. [06]

(B) State the free particle Schrodinger equation in three dimension and derive the following equation for free electron gas in three dimension [04]

$D(E) = \frac{dN}{D\epsilon} = \frac{3N}{2\epsilon}$

OR

Q-4 (A) Write a detail note on Heat capacity of the electron gas. [06]

(B) Explain electrical conductivity and Ohm's Law [04]

Q-5 Discuss the formation of the Metal – Semiconductor junction with suitable energy level diagrams. [10]

OR

Q-5 Explain in detail : (i) Photoconductivity (ii) Photoelectric effect. [10]

Q-6 (A) Explain in detail about scanning probe instruments for measuring nanostructures. [06]

(B) Write a detail note on dip pen nanolithography. [04]

OR

Q-6 (A) With necessary examples explain in detail about self healing structures. [06]

(B) Write a detail note on nanosphere lift-off nanolithography. [04]

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