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[18] SEAT No._____ No. of Printed Pages : 02

SARDAR PATEL UNIVERSITY Seat No_____

B.Sc.SEM-5 EXAMINATION-2019

Subject : Physics Course Code: US05CPHY03

Date: 09-04-2019 Tuesday Solid State Physics Time: 10am to 1pm

09th April, 2019

Total Marks: 70

Instructions:

1.Attempt all questions. 2.The symbols have their usual meaning.

3.Figures to the right indicate full marks.

Q.1 Multiple Choice Questions (10)

1. In the rotating-crystal method λ =____ and θ =_____
   (a) variable – fixed (b) fixed – variable (c) variable – variable (d) fixed – fixed
2. _____ diffraction method is used to structural studies of magnetic materials
   (a) electron (b) neutron (c) x-ray (d) none of these
3. An electron diffraction method is used to investigate_____
   (a) the structure of thin crystals (b) strength of materials
   (c) colour of materials (d) none of these
4. The density of states for free electron gas in three dimension is D(ε) = _____
   (a) $\frac{3N}{2\varepsilon}$ (b) $\frac{2N}{3\varepsilon}$ (c) $\frac{3\varepsilon}{2N}$ (d) $\frac{2\varepsilon}{3N}$
5. Ohm's law relates to the electric field (E), conductivity (σ) and current density (j) as
   (a) $j = \frac{\sigma}{E}$ (b) $j = \sigma E$ (c) $j = \sigma E^2$ (d) $j = \frac{E}{\sigma}$
6. In photo electric effect the work done by the stopping potential is equal to the maximum _____ energy of the photo electrons
   (a) potential (b) total (c) kinetic (d) mechanical
7. The negative sign of the hall coefficient indicates that the nature of semiconductor is___
   (a) intrinsic (b) insulator (c) P-type (d) N-type
8. Einstein's photo electric equation is _____
   (a) $h\nu = T_{max}$ (b) $h\nu = T_{max} \sim W$ (c) $h\nu = T_{max} + W$ (d) $h\nu = W - T_{max}$
9. Nano science is the study of structures having size between _____ nm
   (a) 10 to 100 (b) 1 to 100 (c) 1 to 1000 (d) 10 to 1000
10. The scientist who could predicted about nano structure and nano science in the year 1960 was
    (a) Richard Feynman (b) Max Plank (c) De-Broglie (d) Enrico Fermi

Q.2 Answer any TEN in short (20)

1. State Bragg's law.
2. Which type of source is used in the powder diffraction method ?
3. Define : Reciprocal lattice vector.
4. State the wiedemann – franz law and define Lorenz number.
5. What is meissner effect ?
6. Explain the penetration depth for super conductor.

(P.T.O.)

7. Draw the graph of mobility as a function of temperature for pure and impure Semiconductors.
8. What is photo electric effect ?
9. Write any four importance of Hall effect.
10. State Moore's first and second law.
11. Give the working principle of electron microscope.
12. What is nano science ?

Q.3 (a) Describe Laue method for determination of crystal structure in detail. (6)
(b) Write a note on geometrical construction of reciprocal lattice. (4)

OR

Q.3 (a) Discuss the Ewald construction of x-ray diffraction. (6)
(b) Write a note on structure factor of a bcc crystal. (4)

Q.4 (a) Explain Drude model of free electron. (6)
(b) Discuss the effect of temperature on Fermi – Dirac distribution function (4)

OR

Q.4 (a) Define drift velocity and derive the equation for electrical conductivity (6)
(b) Write a note on type – 1 and type – 2 super conductors. (4)

Q.5 Discuss in detail intrinsic and extrinsic semiconductors. (10)

OR

Q.5 Discuss the formation of the metal – semiconductor junction with suitable Energy level diagram. (10)

Q.6 (a) Write a detail note on Dip Pen nano lithography. (5)
(b) Write a note on E – beam lithography. (5)

OR

Q.6 (a) Discuss about scanning probe instrument. (5)
(b) What are smart materials ? (5)

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