24019

B.Tech. 2nd Semester Examination, May–2016

PHYSICS–II

Paper–Phy-102-F

Common for all branches

Time allowed : 3 hours]   *[Maximum marks : 100*

Note : *Attempt **five** questions in all selecting at least **one** question from each unit. Question No. **1** is compulsory.*

1. (a) What are quarks and gluons ?   4

    (b) What are Miller indices ? Give their significance.   4

    (c) Discuss concept of effective mass for electron and holes.   4

    (d) Show that group velocity and phase velocity are same in a non-dispersive medium.   4

    (e) In a n-type semiconductor, the Fermi level lies 0.35eV below the conduction band at 300K. If the temperature is increased to 335K, find the position of new Fermi level.   4

Unit–I

2. (a) Explain the concept of Miller indices. Deduce formula for the distance between two adjacent planes of a simple cubic lattice.   10

    (b) Discuss briefly the various crystal defects present in crystals.   10

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3. (a) Derive time dependent and time independent Schrodinger equation for a particle. 16

   (b) Discuss expectation value. 4

Unit–II

4. Discuss important applications of nanomaterials. Also discuss some tools to make nanostructures. 20

5. (a) How do you define Fermi Energy and Fermi level? Derive an expression for Fermi Energy. 12

   (b) Show that average K.E. of an electron is 60% of Fermi-energy at absolute zero. 8

Unit–III

6. (a) What is the effect of periodic potential on the energy of electrons in a metal ? Explain on the basis of Kronning-Penny model and also explain the formation of energy bands. 15

   (b) For intrinsic semiconductor with gap width $E_g = 0.7eV$, determine the density of holes and electrons at 300 K. 5

7. What is photovoltaic cell ? Explain in detail the construction and working of a photovoltaic cell. Also explain solar cell and its uses. 20

Unit–IV

8. (a) Distinguish between diamagnetic and paramagnetic substances. Derive an expression for magnetic susceptibility of a paramagnetic material. 14

   (b) How would you use hysteresis curve to select material for the construction of permanent magnets ? 6

9. (a) Describe the Weiss molecular theory of ferromagnetism and derive the Curie-Weiss law. 15

   (b) A paramagnetic salt contains 10^{28} ions/m³ with magnetic moment of one Bohr magneton. Calculate the paramagnetic susceptibility and the magnetization produced in a magnetic field of 10^6 amp/m when the temperature is 27°C. 5