Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 51512

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2024.

Second Semester

Computer Science and Engineering

PH 3256 – PHYSICS FOR INFORMATION SCIENCE

(Common to: Computer Science and Design/Computer Science and Engineering (Artificial Intelligence and Machine Learning)/Computer Science and Engineering (Cyber Security)/Computer and Communication Engineering/Artificial Intelligence and Data Science/Computer Science and Business Systems/Information Technology)

(Regulations 2021)

(Also Common to PTPH 3256 – Physics for Information Science for B.E. (Part–Time) Second Semester – Computer Science and Engineering–Regulations 2023)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. The density, and atomic weight of Cu are 8900 kgm^{-3}, and 63.5 g/mol. The relaxation time of electrons in Cu at 300 K is 10^{-14} s. Calculate the electrical conductivity of Copper.

2. What is meant by free electron?

3. The phosphorous doping in Si causes the Fermi level to lie 0.3 eV above the intrinsic Fermi level. Calculate the electron and hole concentration at 300 K. Assume intrinsic carrier concentration as 1.6×10^{16} atom m^{-3}.

4. Distinguish between intrinsic and extrinsic semiconductors.

5. A magnetic material has a magnetization of 2800 A m^{-1} and flux density of $28\pi \times 10^{-4}$ Wb m^{-2}. Calculate the magnetizing force and the relative permeability of the material.

6. What causes ferromagnetism in Fe, Co and Ni?

7. Define recombination process.

8. Draw the energy level diagram of an indirect band gap semiconductor.

9. Define Coulomb blockade effect.

10. What is Bloch sphere?

PART B — (5 × 16 = 80 marks)

11. (a) What are the postulates of free electron theory? Derive an expression for electrical conductivity based on free electron theory. (16)

Or

(b) (i) What is meant by effective mass of an electron? Derive an expression for the effective mass of an electron? (10)

(ii) Write a short note on Fermi dirac distribution. (6)

12. (a) (i) Derive an expression for the number of density of holes in an intrinsic semiconductor. (10)

(ii) Explain direct and indirect bandgap semiconductors. (6)

Or

(b) (i) What is a hall effect? Derive an expression for hall coefficient. Describe an experiment for the measurement of the hall coefficient. (12)

(ii) Find the hall voltage in a Si doped with 10^{23} phosphor atoms m^{-3}. The Si sample is 100 μm thick with a current flow of 1 mA for a magnetic field of 10^{-5} Wb cm^{-2}. (4)

13. (a) (i) Distinguish between Ferro, antiferro and ferrimagnetism materials. Give some examples for each type. (8)

(ii) Explain the different contributions for the formation of domains in a ferro magnetic material and show how the hysteresis curve is explained on the basis of the domain theory. (8)

Or

(b) (i) Explain the magnetic principle in computer data storage (10)

(ii) Differentiate between hard and soft magnetic materials. (6)

14. (a) (i) Explain with a neat sketch the construction, working and V-I characteristics of solar cell. (12)

(ii) Mention the applications of solar cells. (4)

Or

(b) (i) Explain with a neat sketch the basic principle, working and the advantage of LED. (12)

(ii) Calculate the wavelength of light emitted by an LED with band gap of energy 1.8 eV. (4)

15. (a) (i) Explain Quantum confinement in quantum wells, wires and dots. (8)

(ii) Explain the principle and working of single electron transistor. (8)

Or

(b) (i) Explain the importance of quantum system for information processing. (8)

(ii) Explain the advantage of quantum computing over classical computing. (8)
