

Reg. No. :

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**Question Paper Code : 82035**

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2025.

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 Science and Engineering (Data Science)/Computer and Communication Engineering/Artificial Intelligence and Data Science/Computer Science and Business Systems/Information Technology)

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — ( $10 \times 2 = 20$  marks)

1. State the concept of hole.
2. Write the expression for Fermi-Dirac distribution function.
3. What are direct and indirect band gap semiconductors?
4. Draw the graph between majority charge concentration and temperature for an extrinsic semiconductor.
5. Define magnetic susceptibility.
6. What is Curie temperature?
7. What is the working principle of LED?
8. What is optical data storage?
9. What are qubits?
10. What is quantum mechanical tunneling?

PART B — ( $5 \times 16 = 80$  marks)

11. (a) (i) Explain classical free electron theory and use it to derive expression for electrical and thermal conductivities of a metal. (12)
- (ii) Within the limits of classical free electron theory, calculate the thermal conductivity of a material at room temperature whose electrical conductivity is  $1.02 \times 10^7 \text{ ohm}^{-1}\text{m}^{-1}$ . (Given : Lorentz number =  $2.44 \times 10^{-8} \text{ W}\Omega\text{K}^{-2}$ ). (4)

Or

- (b) (i) Derive an expression for density of energy states and show that the density of energy state for a bulk material is directly proportional to square root of energy. (14)
- (ii) Calculate the velocity of electron at the Fermi level of a sodium metal whose Fermi wave vector is  $0.92 \text{ cm}^{-1}$ .  
(Given Reduced Planck's constant =  $1.054 \times 10^{-34} \text{ Js}$ ). (2)
12. (a) Deduce the expression for the hole concentration in a p-type semiconductor starting from carrier concentration expression for valence band.

Or

- (b) What is Hall effect? Deduce the expression for Hall coefficient and Hall voltage. Illustrate the experiment to find Hall voltage.
13. (a) (i) Derive an expression for magnetic dipole moment of an electron revolving in its orbit. (6)
- (ii) Classify diamagnetism, para magnetism and ferromagnetism. (10)

Or

- (b) Discuss in detail about domain theory of ferromagnetism and exchange interaction.
14. (a) (i) Discuss in detail with neat sketch about optical processes in a semiconductor. (12)
- (ii) An electromagnetic radiation of intensity  $I_0$  is incident on a InGaAs semiconductor of thickness  $x \text{ cm}$  the intensity of the emerging light falls to  $I_0/2$ . If the thickness of the InGaAs is increased to  $2x \text{ cm}$ , the intensity falls to  $I_0/8$ . Find the value of  $x$ . (Given absorption coefficient  $\alpha = 8000 \text{ cm}^{-1}$ ). (4)

Or

- (b) (i) Discuss in detail with neat sketch about solar cell. (14)
- (ii) Calculate the energy gap required for a semiconductor to emit a light radiation for wavelength  $6000 \text{ \AA}$ . (2)
15. (a) Describe in detail about the quantum confined structures namely, quantum well, quantum wires and quantum dots. Explain the density of states for these structures with the help of a graph.

Or

- (b) Explain with a neat sketch, the working principle of single electron transistor.
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