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Question Paper Code : 12031

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2026.

Second Semester

Electrical and Electronics Engineering

PH3202 — PHYSICS FOR ELECTRICAL ENGINEERING

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Define electric dipole moment and provide its mathematical expression.
2. Give one application of quartz oscillators in electrical engineering.
3. What are degenerate states in quantum mechanics?
4. Define effective mass of an electron.
5. Distinguish between N-type and P-type extrinsic semiconductors.
6. Brief the process of diffusion in a semiconductor.
7. Define radiative recombination.
8. Write the concept of an excitonic state.
9. What happens to the band gap of a nanomaterial as its size decreases?
10. List two properties of Carbon Nanotubes.

PART B — ($5 \times 16 = 80$ marks)

11. (a) Explain the four primary polarization mechanisms and discuss their frequency dependence.

Or

- (b) Derive the Clausius-Mossotti equation and demonstrate how it establishes a relationship between microscopic polarizability and the macroscopic dielectric constant.

12. (a) Compare diamagnetic, paramagnetic, and ferromagnetic materials, analyzing them based on their spin interactions and susceptibility.

Or

- (b) Examine the principle of GMR (Giant Magneto Resistance) devices and analyze their application in modern magnetic sensing instruments.

13. (a) Derive the expression for carrier concentration in an intrinsic semiconductor and show how the Fermi level position changes with temperature.

Or

- (b) Elaborate the principle of the Hall effect and explain how it is used to experimentally determine carrier type and density.

14. (a) Describe the principle construction and working of solar cells with neat diagram.

Or

- (b) Discuss the operational principles of laser diodes, highlighting the requirements for radiative recombination and population inversion.

15. (a) Explain the concept of quantum confinement and describe the density of state functions of quantum wells, wires, and dots with suitable expression and diagram.

Or

- (b) Discuss the characteristics and applications of Single Electron Transistor (SET) and explain the significance of Coulomb blockade.