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Question Paper Code : 91654

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2025.

Second Semester

Electrical and Electronics Engineering

PH 3202 — PHYSICS FOR ELECTRICAL ENGINEERING

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Out of four polarization processes in dielectrics, which one is comparatively fastest polarization process and why?
2. Mention any four factors affecting insulation breakdown.
3. Write any two postulates of classical free electron theory.
4. Classify magnetic materials based on susceptibility values given below:
 - (a) -1×10^{-3}
 - (b) $+1 \times 10^{-3}$ and
 - (c) 100
5. Distinguish between direct and indirect band gap semiconductors.
6. List out the advantages of Schottky diode over ordinary PN junction diode.
7. Calculate the bandgap energy value of semiconductor which can emit a radiation of wavelength 500 nm.
8. Infer briefly about the application of plasmonics in the optoelectronic devices.
9. Give reason for increase in band gap energy on particle size reduction.
10. State the working principle of spintronic devices.

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) Discuss the types of polarization in dielectrics with neat diagrams. (10)
- (ii) With suitable diagram, elaborate the dependence of dielectric polarization with frequency of applied electric field. (6)

Or

- (b) (i) Using suitable theory, explain how the commercial dielectric materials are having finite dielectric power loss compared to ideal dielectric material. (10)
- (ii) Give structure, two properties and applications of piezoelectric crystals. (6)
12. (a) (i) Obtain an expression for electrical conductivity of metals using classical free electron theory. (8)
- (ii) Explain temperature dependence of Fermi function with suitable diagram. (8)

Or

- (b) (i) Describe the mechanism of domain formation in ferromagnetic material. (8)
- (ii) Explain the structure and working of GMR devices. (8)
13. (a) Elucidate an expression for total carrier concentration in an intrinsic semiconductor.

Or

- (b) Attain an expression for drift and diffusion current density in semiconducting materials.
14. (a) (i) Summarize the optical absorption, emission and recombination processes occurring in semiconductor with suitable diagrams. (12)
- (ii) Give reason for why direct band gap semiconductors are used for LED fabrication. (4)

Or

- (b) (i) Explicate basic operation and applications of solar cell with neat sketch. (12)
- (ii) Conclude the influence of light intensity on the performance of solar cell. (4)

15. (a) Discuss the significance of Fermi energy vs volume of material and apply this concept on how quantum confinement can control the energy gap of semiconductor.

Or

- (b) Explain the construction and working of single electron transistor based on single electron phenomena and interpret its applications in modern nanotechnology.
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