Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code : 70177

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

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 × 2 = 20 marks)

1. What is special about electronic polarization?

2. Mention any four properties of pyroelectric materials with an example.

3. Distinguish relaxation time and collision time.

4. Show the magnetic moment alignments of dia, para and ferromagnetic materials.

5. Give an example for direct and indirect bandgap semiconductors and draw its band sketch.

6. What is the working principle of schottky diode?

7. Give the expression for optical absorption coefficient in terms of band gap E_g of a semiconductor.

8. What are (a) Excitons (b) Plasmons?

9. Explain zero, one and two dimentional confinement in nanostructures.

10. What do you understand by 'ballistic transport'?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Discuss the frequency dependence of polarization of dielectric materials. (9)

(ii) Calculate the electronic polarizability of neon. Given radius of neon atom is 0.16 nm and permittivity of free space is 8.85 × 10⁻¹² Fm⁻¹. (7)

Or

(b) (i) Define local field and derive Claussius-Mossoti equation. (9)

(ii) Compare the insulation breakdown in gases, liquids and solids. (7)

12. (a) (i) Based on classical theory, deduce the expression for electrical conductivity. (11)

(ii) Using the Fermi function, evaluate the temperature at which there is 1% probability that an electron in a solid will have an energy 0.5 eV above E_f of 5 eV. (5)

Or

(b) (i) Discuss in detail the origin of band gap when the electron is moving in the periodic potential. (10)

(ii) What are GMR devices? List the applications of these. (6)

13. (a) (i) Differentiate intrinsic and extrinsic semiconductors with examples. (6)

(ii) Deduce an expression for carrier concentration in intrinsic semiconductor. (10)

Or

(b) (i) With neat diagram, explain the experiment to measure the concentration of charge carriers in N type semiconductor using Hall effect. (11)

(ii) The electrical conductivity of Germanium at 20° is 2 mho/m. What is its conductivity at 40°? Bandgap of Germanium = 0.72 eV. (5)

14. (a) (i) Tabulate various optical materials and its applications. (6)

(ii) Discuss the optical absorption in metals, semiconductors and insulators. (10)

Or

(b) (i) Explain the construction, working and advantages of
(1) LED
(2) Laser diode (12)

(ii) Define Kerr and Pockels effect. (4)

15. (a) (i) What are nanomaterials and how are they unique? (6)

   (ii) Draw the schematic sketches and corresponding density of states of various low dimensional nanostructures. (10)

Or

   (b) (i) What is Coulomb blockade effect? Explain its role in the working of Single electron transistors. (9)

   (ii) Give a note on the synthesis techniques and characteristics of metallic nano wires. (7)

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