Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code : 60049

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2022.

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 × 2 = 20 marks)

1.   Define dielectric breakdown phenomenon.

2.   What are piezo and pyroelectric crystals?

3.   Write the Fermi distribution function for electrons in a solid.

4.   What are GMR devices?

5.   Plot the Energy band diagram of direct and indirect band gap semiconductors.

6.   Define Hall effect.

7.   Mention the classification of optical materials

8.   How does an excitonic state form?

9.   Define quantum confinement.

10.   How does a quantum well laser work?

PART B — (5 × 16 = 80 marks)

11. (a) Obtain Langevin-Debye equation far the total polarization in a dielectric material (16)

Or

(b) Obtain Lorentz internal field and derive the Clausius-Mossotti equation. (16)

12. (a) (i) Derive expressions for drift velocity and electrical conductivity for a conducting material kept in an electric field. (12)

(ii) List the drawbacks of Classical Free Electron theory. (4)

Or

(b) Explain the origin of Ferromagnetism and exchange interaction in magnetic materials. Discuss the M versus H behavior using domain theory. (16)

13. (a) Derive expressions for density of holes in an intrinsic semiconductor and from the results, obtain an expression for density of holes in a p-type semiconductor. (16)

Or

(b) Write elaborate notes on Carrier transport (drift and diffusion of electrons and holes) in semiconductors. (16)

14. (a) Explain the construction and working of Light detector and solar cell (16)

Or

(b) Explain the construction and working of LED and Laser Diode (16)

15. (a) Formulate expressions for density of states in quantum well, quantum wire and quantum dot structures. (16)

Or

(b) Write elaborate notes on the properties and applications of Carbon nanotubes. (16)

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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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