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Question Paper Code : 70185

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

Second Semester

Computer Science and Engineering

PH 3256 — PHYSICS FOR INFORMATION SCIENCE

(Common to 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 × 2 = 20 marks)

1. Calculate the electrical resistivity of sodium at 0°C. It has 2.533×10^{28} electrons per unit volume and has a mean free time of 3.1×10^{-14} S.

2. State Wiedemann-Franz law.

3. If the mobilities of electrons and holes in an intrinsic semiconductor at 300 K are 0.36 and 0.14 $m^2 V^{-1}s^{-1}$ respectively. Calculate the number of charge carriers (Given that the conductivity is 2.2 $\Omega^{-1} m^{-1}$).

4. What is the difference between PN junction diode and schottky diode?

5. Define the term magnetic relative permeability.

6. A magnetic field strength of 2×10^5 Am^{-1} is applied to a paramagnetic material with a relative permeability of 1.01. Calculate the value of B and M.

7. What are optical materials? Give its types.

8. Why the shape of LED is made hemispherical?

9. Define quantum well.

10. What is quantum mechanical tunneling?

PART B — (5 × 16 = 80 marks)

11. (a) Using the classical free electron theory, derive the mathematical expressions for the electrical conductivity and thermal conductivity of metals and hence deduce Wiedemann – Franz law.

Or

(b) What is density of states? Derive an expression for the density of states.

12. (a) What is Hall Effect? Derive an expression for the Hall voltage. Explain an experimental method used to measure the Hall coefficient of a specimen. What are the uses of Hall Effect?

Or

(b) Derive a mathematical expression for the carrier concentration of a P-type semiconductor and hence derive the expression for the Fermi level. Explain the variation of the Fermi level of a P-type semiconductor with temperature and concentration.

13. (a) What are domains? Discuss the domain concept and hence explain the hysteresis-curve. What are soft and hard magnetic materials? Mention the properties and applications of hard and soft magnetic materials.

Or

(b) Discuss in detail the classification of magnetic materials into dia, para, ferro, antiferro and ferromagnetism.

14. (a) Explain absorption and emission of light in metals, insulators and semiconductors.

Or

(b) (i) What is meant by OLED? Explain the principle, construction and working of OLED.

(ii) Distinguish between LED and OLED.

15. (a) Explain in detail what is quantum confinement and how quantum structures, in nano materials are classified.

Or

(b) Describe single electron phenomena and single electron transistors with necessary diagrams.

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