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Unique Paper Code : 2223010014
Name of the Paper : Physics of Materials (DSE Paper)
Name of the Course : B.Sc. Hons.– (Physics)_NEP: UGCF-2022
Semester : V - Semester
Duration : 2 hours
Maximum Marks : 60 Marks

Instructions for Candidates

1. Attempt a total of four questions, including Question No. 1, which is compulsory.
2. Write your roll number on the top immediately on receipt of this question paper.

Q1. Attempt any five (3 × 5=15)

- (a) What is the difference between mobility and conductivity in semiconductors? How are they related mathematically?
- (b) What are thermotropic liquid crystals? Explain their significance in display technology.
- (c) Differentiate between single-walled and multi-walled carbon nanotubes (SWCNT and MWCNT) in terms of structure and properties.
- (d) Write the chemical structure and one key property each of Polyethylene (PE) and Epoxy resin.
- (e) Using a schematic diagram, explain the principle for the deposition of thin films using PLD?
- (f) What is piezoelectricity? Explain one application of piezoelectric materials in sensors or actuators.

Q2. (a) Derive expressions for electron and hole concentration in an n-type and p-type semiconductor using Fermi-Dirac statistics. (7 Marks)

(b) Explain the concept of Fermi level, Fermi energy, and Fermi surface in semiconductors. How do these parameters vary with temperature and doping? (8 Marks)

Q3. a) Discuss the properties of ferroelectric, piezoelectric, and pyroelectric materials. (6 Marks)

(b) Differentiate between soft and hard magnetic materials. Discuss their various properties, applications. Explain the concept of spin transport in spintronic systems. How does it differ from conventional charge transport? (9 Marks)

Q4. (a) Compare the chemical structure and properties of thermoplastic and thermosetting polymers with suitable examples. (7 Marks)

((b) Discuss the anisotropic and birefringent properties of liquid crystals. Explain their applications in display technologies. (8 Marks)

Q5. (a) Discuss the structure and properties of Fullerenes, single walled Carbon Nanotubes and Graphene. (6 Marks)

(b) Describe the synthesis of thin films using Thermal evaporation and MBE technique. (9 Marks)