

PG CBCS
M.Sc. Semester-II Examination, 2022
PHYSICS
 PAPER: PHS202

(SOLID STATE-II & SEMICONDUCTOR PHYSICS)

Full Marks: 40

Time: 2 Hours

Write the answer for each unit in separate sheet

The figures in the right-hand margin indicate full marks.
 Candidates are required to give their answers in their own words as far as practicable.

PHS 202.1 Solid State-II

Marks: 20

GROUP-A

1. Answer any two questions:

2×2=4

- a) Define penetration depth for a superconductor. What is its value at the critical temperature?
- b) What is vortex state of a superconductor?
- c) Explain 'Magnetic Levitation'. Write down its one application.
- d) Write down the expression of Local field (Lorentz relation) for a spherically symmetric dielectric and explain each term.

GROUP-B

2. Answer any two questions:

2×4=8

- a) What is isotope effect? Mercury having an average atomic mass of 200.59 amu has a critical temperature of 4.153 K. Calculate the critical temperature of the isotope Hg_{80}^{204} .
- b) Graphically show the variation of (i) Gibbs free energy (G), specific heat (C) and energy gap (ΔE) with temperature (T), at normal and superconducting state.
- c) Describe complex dielectric constant and dielectric loss.
- d) Explain electronic and dipolar polarizability. Review their temperature dependency.

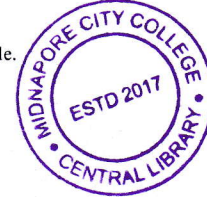
GROUP-C

3. Answer any one questions:

1×8=8

- a) Derive London equation and explain how its solution explains Meissner effect.
- b) Deduce Clausius-Mosotti relation and explain its use in predicting the dielectric constant of solid. Silicon has the dielectric constant 12, and the edge-length of the conventional cubic cell of Silicon lattice is 5.43 Å. Calculate the electronic polarizability of Silicon atom.

(Turn Over)



PHS 202.2 Semiconductor Physics

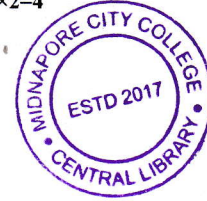
Marks: 20

GROUP-A

1. Answer any two questions:

2×2=4

- What is degenerate and non-degenerate semiconductor?
- What is Einstein's relation of diffusion in a semiconductor?
- Draw the variation of density of hole in valence band for a non-degenerate semiconductor.
- Why CdTe is used in solar cell?



GROUP-B

2. Answer any two questions:

2×4=8

- Derive expression for density of electron in degenerate semiconductor.
- Derive the electric neutrality condition for a semiconductor.
- Show how Fermi level of a semiconductor is related with temperature for a low temperature region.
- Derive the expression for the depression temperature for a semiconductor.

GROUP-C

3. Answer any one questions:

1×8=8

- Derive the diode equation. Discuss the I-V characteristic of a diode from diode equation. (6+2)
- Explain the mechanism of generation of photovoltage in solar cell with a neat band diagram. Find an expression of efficiency of a solar cell. (3+5)
