

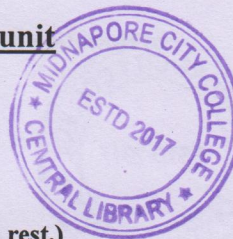
PG (NEW) CBCS
M.Sc. Semester-II Examination, 2019
PHYSICS
PAPER: PHS 202

Full Marks: 40

Time: 2 Hours

Use Separate Answer Scripts for each unit

PHS 202.1:
SOLID STATE II
Marks-20



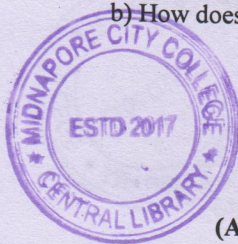
(Answer question number 1, 2 and any ONE from rest.)

1. Answer any two. (Marks: $2 \times 2 = 4$)
 - a) What are type I and type II superconductors?
 - b) What is fluxoid? What are its applications?
 - c) Write down Langevin-Debye equation in dielectric and hence plot $\epsilon_0(\epsilon_r - 1)$ vs. $1/T$.
 - d) How is dielectric constant related to electric susceptibility? What are its sources?
2. Answer any two. (Marks: $4 \times 2 = 8$)
 - a) Explain two fluid model in superconductor.
 - b) What is DC Josephson effect? What is SQUID?
 - c) Find an expression for the local field that is responsible for polarizing molecules or atoms of a solid.
 - d) What is the magnetic susceptibility of a superconductor? Describe the effect of magnetic field on superconductor.
3. a) The crystal of NaCl has static dielectric constant 5.6 and optical index of refraction 1.5. Calculate the percentage contribution of ionic polarizability. (Marks: 3)
b) Give a schematic sketch of the variation of the total polarizability of a dielectric as a function of frequency. Explain the physical origin of the various contributions and relevant frequency ranges. (Marks: 5)

(Turn Over)

4. a) What are high T_c superconductor? Give examples. Show that how the London equations lead to the Meissner effect and flux penetration through thin films of superconductor. (Marks: 2+4=6)

- b) How does the total polarizability depend on frequency? (Marks: 2)



PHS 202.2:
SEMICONDUCTOR PHYSICS
Marks-20

(Answer question number 1, 2 and any ONE from rest.)

1. Answer any two.

(Marks: 2×2=4)

- Show the variation of $\ln \phi$ vs. $1/T$ plot (from low temperature to high temperature range) for a non-degenerate semiconductor.
- Find an expression of barrier potential of a p-n junction under equilibrium condition.
- What is meant by direct and indirect recombination?
- Explain what is meant by ohmic contact?

2. Answer any two.

(Marks: 4×2=8)

- Prove that Fermi level remains invariant in a p-n junction under equilibrium condition.
- Derive Einstein's relation for holes in a p-n junction under equilibrium condition.
- Find an expression of open circuit voltage and short circuit current for a p-n junction solar cell.
- Find the neutrality condition when a semiconductor is doped both with donor as well as acceptor impurity.

3. What is meant by linearly graded junction? Find an expression of junction capacitance of linearly graded junction.

(Marks: 2+6=8)

4. Find the expression of carrier concentration in a non-degenerate semiconductor.

Clearly distinguish non-degenerate and degenerate semiconductor. (Marks: 6+2=8)
