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PG CBCS
M.Sc. Semester-IV Examination, 2022
PHYSICS
 PAPER: PHS 404A
(SOLID STATE PHYSICS - SPL-II)

Full Marks: 40

Time: 2 Hours

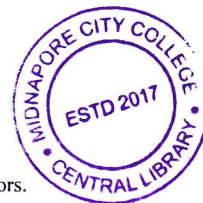
The figures in the right-hand margin indicate full marks.
 Candidates are required to give their answers in their own words as far as practicable.

Marks: 40

GROUP-A**1. Answer any four question:**

4×2=8

- a) What is a fluxoid?
- b) Explain Frohlich interaction.
- c) Explain importance of relaxation time to observe NMR or ESR spectra.
- d) Describe what will happen if an insulator is placed between two superconductors.
- e) State the "Ginzburg-Landau theory" for a superconductor.

**GROUP-B****2. Answer any four questions:**

4×4=16

- a) Find NMR frequency for H⁺ ion operated at 0.5 T magnetic field. What will be ESR frequency for same magnetic field?
- b) Why O₂ is paramagnetic and N₂ is diamagnetic? Explain using quantum MO theory.
- c) Explain Pauli's Spin Paramagnetism.
- d) What is the physical origin of a Domain?
- e) Describe the working principle of a SQUID.
- f) "Superconducting state is more ordered state than a normal state"- Explain.

GROUP-C**3. Answer any two questions:**

2×8=16

- a) Explain briefly the BCS theory. Find out the expression of BCS ground state (W_{BCS}^0). (2+6)
- b) Explain coherence length (ξ). Find out its expression. Estimate the intrinsic coherence length (ξ) of Al if the energy gap is 3.4×10^{-4} eV, $V_F = 2.02 \times 10^6$ m/s, $h = 6.63 \times 10^{-34}$ J/s (5+3)
- c) Explain the origin of spin wave in ferromagnetic solid. Find the dispersion relation for a spin excited on the chain. What is magnon? (2+5+1)
- d) Explain antiferromagnetism in a solid and hence find an expression of Neel temperature. Give an example of an Antiferromagnetic Solid. (2+5+1)
