

N.G.M.COLLEGE (AUTONOMOUS) : POLLACHI**END-OF-SEMESTER EXAMINATIONS : MAY– 2026****M.Sc. – PHYSICS****MAXIMUM MARKS: 75****II SEMESTER****TIME : 3 HOURS****CONDENSED MATTER PHYSICS****SECTION – A****(10 X 1 = 10 MARKS)****ANSWER THE FOLLOWING QUESTIONS.**

- Name the symmetry element that allows only 2-fold, 3-fold, 4-fold and 6-fold rotations in crystals:
 - Mirror plane
 - Rotation axis
 - Inversion center
 - Glide plane
- Recall the model that explains T^3 variation of specific heat at low temperature:
 - Einstein model
 - Classical model
 - Debye model
 - Free electron model
- Relate Wiedemann–Franz law to:
 - Electrical and thermal conductivity
 - Mobility and resistivity
 - Hall coefficient and current
 - Band gap and temperature
- Who proposed the molecular field theory of ferromagnetism?
 - Langevin
 - Weiss
 - Heisenberg
 - Curie
- What is the effect called when magnetic flux is expelled from a superconductor?
 - Hall effect
 - Meissner effect
 - Josephson effect
 - Isotope effect

ANSWER THE FOLLOWING IN ONE (OR) TWO SENTENCES

- Define Bragg's law.
- Define specific heat of solids.
- What is Bloch theorem.
- What is Hund's rule?
- Define superconductivity.

SECTION – B**(5 X 5 = 25 MARKS)****ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.**

- a) Derive and calculate the Madelung constant for NaCl structure.

(OR)

- Explain and interpret Bragg's law and its significance in XRD.

- a) Describe Einstein models of specific heat.

(OR)

- Explain the role of Umklapp process in thermal resistance.

(CONTD 2)

13. a) Derive expression for Fermi energy of free electron gas in 3D.
(OR)
b) Describe Kronig–Penney model and show how it explains energy in solids.
14. a) Describe Weiss theory of ferromagnetism and examine its limitations.
(OR)
b) Explain Bloch wall and spin waves.
15. a) Explain Meissner effect and distinguish Type I and Type II superconductors.
(OR)
b) Describe Josephson effect and show DC & AC effects.

SECTION – C

(5 X 8 = 40 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.

16. a) Analyze and compare SC, BCC, FCC and HCP crystal structures with respect to packing efficiency, coordination number and stability.
(OR)
b) Examine X-ray diffraction and construct Bragg's law. Evaluate the role of structure factor.
17. a) Explain lattice vibrations in monoatomic and diatomic chains and investigate their dispersion relations.
(OR)
b) Explain Debye model of specific heat.
18. a) Explain free electron theory. Discuss its successes and limitations and derive the Fermi energy expression.
(OR)
b) Explain De Hass Van Alphen effect. Derive the equation for oscillations.
19. a) Discuss Weiss theory of ferromagnetism and critically evaluate Heisenberg exchange theory.
(OR)
b) Discuss Langevin's classical theory of magnetism. Compare and justify how the theory explains diamagnetism and paramagnetism and discuss its limitations.
20. a) Explain BCS theory and evaluate thermodynamic properties of superconductors.
(OR)
b) Determine the working principle of SQUID. Analyze its construction, operation based on Josephson effect, and evaluate its applications.
