25PHU204

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION MAY 2026
(Second Semester)

Branch – **PHYSICS**

THEMAL & STATISTICAL PHYSICS

Time: Three Hours Maximum: 75 Marks

SECTION-A (10 Marks)
Answer **ALL** questions
ALL questions carry **EQUAL** marks (10 × 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	The basic principle of a liquid thermometer relies on thermal expansion of liquid. (i) Change in electrical resistance (ii) Thermal expansion of liquid (iii) Seebeck effect (iv) Emission of infrared radiation	K1	CO1
	2	The standard constant volume hydrogen thermometer is preferred because hydrogen behaves ideally at (i) High temperatures (ii) Low pressures and moderate temperatures (iii) Absolute zero (iv) Critical temperature	K2	CO1
2	3	Andrews' experiment was performed on: (i) Oxygen (ii) Nitrogen (iii) CO_2 (iv) Helium	K1	CO2
	4	Adiabatic demagnetization is a method used for achieving (i) High temperatures (ii) Room temperature cooling (iii) Very low temperatures (iv) Liquefaction by compression	K2	CO2
3	5	Stefan's law relates the total energy radiated by a black body to (i) T (ii) T^2 (iii) T^4 (iv) 1/T	K1	CO3
	6	Newton's law of cooling can be deduced from (i) Wien's law (ii) Planck's law (iii) Stefan's law (iv) Rayleigh-Jeans law	K2	CO3
4	7	The Zeroth law of thermodynamics defines (i) Energy conservation (ii) Entropy increase (iii) Thermal equilibrium and temperature (iv) Absolute zero unattainability	K1	CO4
	8	In a T-S diagram, the area under the curve for a reversible process represents (i) Work done by the system (ii) Heat absorbed by the system (iii) Change in internal energy (iv) Change in enthalpy	K2	CO4
5	9	Phase space is defined by: (i) Position only (ii) Momentum only (iii) Position and momentum (iv) Energy only	K1	CO5
	10	Fermi–Dirac distribution obeys: (i) Pauli exclusion principle (ii) Planck's law (iii) Wien's law (iv) Newton's law	K2	CO5

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SECTION - B (35 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** Marks (5 × 7 = 35)

Module No.	Question No.	Question	K Level	CO
1	11.a.	Define a platinum resistance thermometer and state its basic working principle.	K1	CO1
		(OR)		
	11.b.	Enumerate the major corrections applied to mercury-in-glass thermometers and briefly state the reason for each.		
2	12.a.	Explain the concept of inversion temperature in the Joule-Thomson effect and why it differs for different gases.	K2	CO2
		(OR)		
	12.b.	Describe the behavior of helium below the lambda point and explain what is meant by superfluidity in Helium II.		
3	13.a.	Outline Forbes' method for determining the thermal conductivity of a good conductor and write the expression used to calculate k.	K3	CO3
		(OR)		
	13.b.	Explain Lee's disc method for bad conductors and apply the steady-state condition to derive the formula for thermal conductivity.		
4	14.a.	Derive the change in entropy for an ideal gas undergoing reversible isothermal expansion and apply it to calculate ΔS for a given volume ratio.	K3	CO4
		(OR)		
	14.b.	State and derive any one of Maxwell's thermodynamic relations from a suitable potential function.		
5	15.a.	Derive the average energy per particle using Maxwell-Boltzmann statistics and show it leads to the equipartition theorem.	K3	CO5
		(OR)		
	15.b.	Write the Bose-Einstein distribution function and apply it to explain the condition for Bose-Einstein condensation.		

SECTION -C (30 Marks)

Answer **ANY THREE** questions

ALL questions carry **EQUAL** Marks (3 × 10 = 30)

Module No.	Question No.	Question	K Level	CO
1	16	List and describe the construction details and working principles of different types of thermometers and include their typical temperature ranges.	K1	CO1
2	17	Explain the significance of Andrews' experiment results in demonstrating the continuity of the liquid and gaseous states and the existence of a critical point.	K2	CO2
3	18	Explain how Newton's law of cooling is deduced as an approximation from Stefan's law when the temperature difference is small.	K3	CO3
4	19	Derive the Clausius-Clapeyron equation and analyze its application to vapor pressure curves and phase transitions.	K4	CO4
5	20	Evaluate the superiority of Fermi-Dirac statistics over classical statistics in explaining properties of electron gas in metals.	K5	CO5

Z-Z-Z END