

**PSG COLLEGE OF ARTS & SCIENCE  
(AUTONOMOUS)**

**MSc DEGREE EXAMINATION MAY 2025  
(Fourth Semester)**

Branch - **PHYSICS**

**APPLIED THERMODYNAMICS AND STATISTICAL MECHANICS**

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	Out of the following, the physical quantity that relates with first law of thermodynamics is a) temperature                      b) pressure c) energy                              d) number of moles	K1	CO1
	2	The efficiency of Carnot engine working between steam point and ice point is: a) 1                      b) 0                      c) 26.81%                      d) 16.81%	K2	CO2
2	3	The total no of macrostates for n particles is: a) $n-1$ b) $n$ c) $n+1$ d) $1/n$	K1	CO1
	4	Which of the following variables remains constant in canonical ensembles? a) number of microstate                      b) volume c) potential energy                      d) temperature	K2	CO2
3	5	According to which statistics, the energy at absolute zero cannot be zero a) M-B statistics                      b) B-E statistics c) F-D statistics                      d) none of them	K1	CO1
	6	The total translational energy of n diatomic molecules is ---- a) $nKT$ b) $3nKT$ c) $2nKT$ d) $1.5nKT$	K2	CO2
4	7	What happens to the internal energy of a monoatomic ideal gas when it is heated at constant volume? a) remains the same                      b) decreases c) increases                      d) fluctuates	K1	CO1
	8	The specific heat capacity of a diatomic gas at constant pressure is a) $5/2$ b) $5R/2$ c) $7R/2$ d) $R$	K2	CO1
5	9	Einstein's theory of specific heat a) accepts different frequencies of molecular vibrations b) accepts same frequency of all molecular vibrations c) rejects molecular vibrations d) none of these	K1	CO1
	10	What is the term used to describe the state of matter where negative temperatures occur? a) absolute zero b) Bose-Einstein condensate c) Fermi gas d) superfluid	K2	CO2

Cont...

**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.	State and explain zeroth law of thermodynamics. What is its importance?	K2	CO3
	(OR)			
	11.b.	Define the following (i) Helmholtz free energy and (ii) Gibb's paradox.		
2	12.a.	Define and explain the terms macro state and micro state with the example.	K3	CO3
	(OR)			
	12.b.	Differentiate between micro canonical, canonical and grand canonical ensembles.		
3	13.a.	What is BE statistics? What are the basic postulates used?	K3	CO3
	(OR)			
	13.b.	Discuss about Bose- Einstein condensation.		
4	14.a.	Show that the ratio of specific heats of a diatomic gas is 1.40.	K4	CO4
	(OR)			
	14.b.	Write a note on Quantized linear oscillator.		
5	15.a.	Explain briefly about Pauli's theory of paramagnetism.	K4	CO4
	(OR)			
	15.b.	Write a note on the concept of negative temperature.		

**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	Derive the Maxwell's thermodynamic relations.	K4	CO3
2	17	State and explain Liouville's theorem.	K5	CO4
3	18	Derive an expression for the most probable distribution of the particles of a system obeying BE statistics.	K6	CO5
4	19	Give the experimental verification of Maxwell's-Boltzmann's law of distribution of molecular speeds.	K6	CO5
5	20	Describe the Einstein's theory of the specific heat of a solid.	K5	CO4

Z-Z-Z

END