**22PHU204N**

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

**BSc DEGREE EXAMINATION DECEMBER 2025**
(Second Semester)

Branch- **PHYSICS**

**THERMAL AND 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 thermometer works on the principle of:<br>a) Thermal equilibrium<br>b) Expansion of substances with temperature<br>c) Conduction of heat<br>d) Specific heat capacity | K1 | CO1 |
| | 2 | The SI unit of temperature is _____<br>a) °C b) °F c) J d) K | K2 | CO1 |
| 2 | 3 | The temperature above which a gas cannot be liquefied, however high the pressure applied, is called _____<br>a) Inversion temperature b) Boyle temperature<br>c) Critical temperature d) Transition temperature | K1 | CO2 |
| | 4 | For a real gas, Joule–Thomson coefficient is positive when the gas _____<br>a) cools on expansion<br>b) heats on expansion<br>c) temperature remains constant<br>d) behaves ideally | K2 | CO2 |
| 3 | 5 | The SI unit of thermal conductivity is _____<br>a) $J\ m^{-1}\ s^{-1}\ K^{-1}$ b) $W\ m\ K^{-1}$<br>c) $J\ s^{-1}\ m^{-2}\ K^{-1}$ d) $W\ m^{-1}\ K^{-1}$ | K1 | CO3 |
| | 6 | Stefan's law is expressed as_____<br>a) $E=\sigma T^2$ b) $E=\sigma T^3$ c) $E=\sigma T^4$ d) $E=\sigma KT$ | K2 | CO3 |
| 4 | 7 | The first law of thermodynamics is a statement of Conservation of _____<br>a) mass b) energy<br>c) momentum d) temperature | K1 | CO4 |
| | 8 | The efficiency of a Carnot engine is _____<br>a) $\eta = 1-\frac{T_1}{T_2}$ b) $\eta = \frac{T_1}{T_2}$ c) $\eta = 1-\frac{T_2}{T_1}$ d) $\eta = \frac{T_2}{T_1}$ | K2 | CO4 |
| 5 | 9 | The Maxwell-Boltzmann statistics is applicable to _____<br>a) Indistinguishable particles with half-integer spin<br>b) Indistinguishable particles with integer spin<br>c) Distinguishable classical particles<br>d) Electrons in metals | K1 | CO5 |
| 5 | 10 | Examples of Fermi particles are _____<br>a) Electrons, protons, neutrons b) Alpha particles<br>c) Photons and phonons d) Deuterons | K2 | CO5 |

**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. | Illustrate the errors and correction in a Mercury thermometer. | K3 | CO1 |
| | | (OR) | | |
| | 11.b. | Examine the Seebeck effect. | | |
| 2 | 12.a. | Explain in detail, Super conductivity. | K4 | CO2 |
| | | (OR) | | |
| | 12.b. | Examine the liquefaction of hydrogen with neat diagram. | | |
| 3 | 13.a. | How to determine the thermal conductivity (K) of a rod using Searle's method? | K5 | CO3 |
| | | (OR) | | |
| | 13.b. | Explain distribution of energy in the black body spectrum with neat diagram. | | |
| 4 | 14.a. | Using the first law of thermodynamics, prove that $C_p - C_v = R$ | K3 | CO4 |
| | | (OR) | | |
| | 14.b. | Find the efficiency of the Carnot's engine working between the steam point and the ice point. | | |
| 5 | 15.a. | Examine the Maxwell-Boltzmann distribution law. | K4 | CO5 |
| | | (OR) | | |
| | 15.b. | Explain the term '*photon gas*'. | | |

## 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 | Explain in detail, the construction and working of Platinum resistance thermometer with neat diagram. | K4 | CO1 |
| 2 | 17 | Analyze the critical constants $P_c$, $V_c$ & $T_c$ derived from the Van der Waals equation and discuss their interrelationship. | K4 | CO2 |
| 3 | 18 | Illustrate the thermal conductivity of bad conductor by using Lee's disc method. | K4 | CO3 |
| 4 | 19 | Evaluate the efficiency of a Carnot heat engine with neat diagram. | K5 | CO4 |
| 5 | 20 | Compare the basic postulates of Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics. | K5 | CO5 |

Z-Z-Z END