

U.G. 5th Semester Examination-2025**PHYSICS****[MINOR]****Course Code : PHY-MI-T-5****(Thermal Physics)****[NEP-2020]**

Full Marks : 30

Time : 2 Hours

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

1. Answer any five questions: 1×5=5
- a) State the Zeroth Law of Thermodynamics.
 - b) What is meant by the Joule-Thomson effect?
 - c) Define entropy.
 - d) State Wien's displacement law.
 - e) State Clausius-Clapeyron equation.
 - f) State the Third Law of Thermodynamics.
 - g) What is Bose-Einstein condensation?
 - h) What is Joule's law of equipartition of energy?

[Turn over]

GROUP - B

2. Answer any three questions: $5 \times 3 = 15$

- a) State and explain the First Law of Thermodynamics. Derive the expression for work done in an isothermal process for an ideal gas. $2+3$
- b) Explain adiabatic processes. Derive the relation $PV^\gamma = \text{constant}$ for an ideal gas. $2+3$
- c) Define heat capacities. Derive the relation between C_p and C_v for an ideal gas. $2+3$
- d) Write down four Maxwell's thermodynamic relations and derive anyone using a suitable thermodynamic potential. $2+3$
- e) Write down Planck's law of radiation. Show that both Rayleigh-Jeans and Wien's laws emerge from it as limiting cases. $1+2+2$
- f) Compare Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics. Mention the particles that obey these statistics. $3+2$

GROUP - C

Answer any one question: $10 \times 1 = 10$

- 3. a) State and Explain Maxwell's speed distribution law. $2\frac{1}{2}$

b) Derive the expressions for most probable speed, average speed and RMS speed. $2\frac{1}{2} + 2\frac{1}{2} + 2\frac{1}{2}$

- 4. a) Derive the expression for efficiency of Carnot cycle. 5
- b) State and prove Carnot's theorem. 5