Roll No…….

Name of the Department: Physics
Name of the Course : B.Sc. Prog.-CBCS_Core
Name of the Paper : Thermal Physics and Statistical Mechanics
Semester : III
Unique Paper Code : 42224303_NC
Medium : English
Question Paper Set No. : C

Duration: 3 Hours **Max. Marks:** 75

Instructions for Candidates

I Write your Roll No. on the top immediately on receipt of this question paper.
II All questions carry equal marks. Attempt any **four** questions in all.

Q.1. Differentiate between isothermal and adiabatic processes. Prove that $TP^{(1-\gamma)/\gamma}$=constant for an ideal gas in an adiabatic process where $\gamma = \frac{C_P}{C_V}$. Show that ratio of adiabatic elasticity (E_S) and isothermal elasticity (E_T) is equal to $\frac{C_P}{C_V}$.

Q.2. Calculate work done in a Carnot cycle. Derive an expression for the efficiency of Carnot's engine in terms of the temperature of Source and sink.

Q.3. Derive the expression for Maxwell's law of distribution of the velocities.

Q.4. Prove Maxwell's second thermodynamic relation

$$\left(\frac{\partial S}{\partial V}\right)_T = \left(\frac{\partial P}{\partial T}\right)_V$$

From it, establish Clausius-Clapeyron relation $\frac{\partial P}{\partial T} = \frac{L}{T(V_2 - V_1)}$. How does it explain the effect of pressure on a) Melting point of solids b) Boiling point of liquids?

Q.5. Explain Planck's hypothesis of black body radiation. Derive Planck's formula for the distribution of energy in the spectrum of a black body. Deduce from it, Wein's displacement law and Rayleigh Jean's law.

Q.6. Differentiate between Fermi-Dirac and Bose-Einstein statistics. Obtain an expression for Maxwell-Boltzmann distribution law.