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_OC
Medium **:** English
Question Paper Set No. **:** A

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. State and prove Carnot's theorem. Describe Carnot's reversible heat engine and find an expression for its efficiency. Explain why Carnot's cycle is not a practical possibility.

Q.2. What is Joule-Thomson effect? Obtain thermodynamically an expression for Joule-Thomson coefficient. Explain existence of inversion temperature for a gas obeying Vander Waal's equation.

Q.3. Deduce an expression for the average energy of a Planck's Oscillator and hence derive Planck's formula for spectral distribution of energy in the black-body radiation. Show that the Rayleigh- Jean's formula and Wien's formula are special cases of Planck's formula.

Q.4. Which physical quantity is transported in the phenomena of viscosity? Derive an expression for the viscosity (η) of a gas in terms of mean free path of its molecules. Discuss the effect of pressure and temperature on the coefficient of viscosity.

Q.5. Formulate the first law of the thermodynamics and explain its physical significance. Calculate the external work done when μ moles of an ideal gas undergo expansion (i) isothermally from volume V_1 to V_2 at absolute temperature. (ii) Adiabatically from a temperature T_1 to temperature T_2.

Q.6. Give the experimental verification of Maxwell-Boltzmann's law of distribution of molecular speeds. Using Maxwell-Boltzmann distribution, obtain a relation between the average energy of the particle and its temperature in equilibrium.