[This question paper contains 4 printed pages]

Your Roll No. : .....

Sl. No. of Q. Paper : **211** **I**

Unique Paper Code : 42224303

Name of the Course : **B.Sc.(Prog.)**

Name of the Paper : Thermal Physics and Statistical Mechanics

Semester : III

Time : 3 Hours ***Maximum Marks : 75***

Instructions for Candidates :

(a) Write your Roll No. on the top immediately on receipt of this question paper.

(b) Attempt **five** questions in **all** including Question No.**1** which is compulsory.

(c) All questions carry equal marks.

1. Attempt any **five** of the following : 5×3=15

(a) The entire heat given to an ideal gas in an isothermal process is spent in doing work only. Explain.

(b) Show that for an ideal gas $C_p - C_v = R$.

P.T.O.

(c) Derive an expression for the work done by an ideal gas during an adiabatic expansion.

(d) State law of equipartition of energy and discuss briefly its applications to specific heat of monoatomic gases.

(e) Why is it not possible to obtain absolute zero ? Explain.

(f) There are 'n' molecules of a gas in a vessel. If the number of molecules be increased to '2n'. What will be the effect on (i) pressure of the gas (ii) total energy of the gas ?

(g) What is perfect black body ? How it can be realized in daily life ?

2. (a) Define entropy and give its physical significance. 4

(b) Derive an expression for the entropy of a perfect gas in term of its pressure and volume. 6

(c) Find out the relationship between adiabatic and isothermal elasticities. 5

3. (a) State Carnot's theorem. Prove that the efficiency of a reversible heat engine is maximum. 10

(b) A reversible heat engine converts one-fifth of heat input into work. When the temperature of the sink is reduced by 50°C, its efficiency is doubled. Find the temperature of the source and the sink. 5

4. (a) What are thermodynamic potentials ? Derive Maxwell relations from them. 10

(b) Derive Clausius - Clapeyron equation and discuss briefly its application to boiling and melting process. 5

5. (a) What are transport phenomena in gases ? Apply kinetic theory of gases to obtain an expression for the coefficient of viscosity of a gas. 8

(b) Define mean free path of the molecule of a gas and derive an expression for it. 7

6. (a) What is Joule-Thomson effect ? Discuss it's results. 5

(b) Deduce an expression for Joule Thomson coefficient for van-der-Waal's gas. 10

7. (a) Derive an expression for the most probable distribution of the particles of a system obeying B.E. statistics. 7

(b) Derive Fermi-Dirac distribution formula. How does this distribution tends to classical ? 8

8. (a) Derive Maxwell's law of distribution of velocities for molecules in a gas. Explain graphically how the distribution varies with temperature. 10

(b) Discuss experimental verification of Maxwell's velocity distribution law. 5