

3/12/18

(M)

[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 : $5 \times 3 = 15$

(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 its 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