[This question paper contains 4 printed pages.]

1915 *Your Roll No.* .....

B.Sc. Prog./II **E**

PH-202 : PHYSICS – THERMAL PHYSICS AND OPTICS

(Admissions of 2008 and onwards)

Time : 3 Hours *Maximum Marks : 75*

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

Attempt five questions in all.

All questions carry equal marks.

1. Attempt any **five** of the following:

   (a) Give the Zeroth law of thermodynamics and define temperature.

   (b) Show that the slope of an adiabatic curve is γ times the slope of an isothermal curve, where $\gamma = C_p/C_v$.

   (c) Derive an expression for the entropy of a perfect gas in term of its pressure and volume?

P.T.O.

(d) Air is compressed adiabatically to half its volume, calculate the change in temperature.

(e) Show with the help of an example, that there is always an increase in entropy during an irreversible process.

(f) State law of equipartition of energy and discuss its application to specific heat of monoatomic gases.

(g) Distinguish between Fraunhofer and Fresnel's class of diffraction. (5×3=15)

2. (a) Explain the working of a Carnot heat engine for a perfect gas and calculate its efficiency.

(b) What are reversible and irreversible processes? State conditions for reversibility of a process. (10,5)

3. (a) What are thermodynamic potentials and why are they called so? Derive Maxwell relations from them.

(b) Prove : $C_p - C_v = T\alpha^2 V/\beta$, where the symbols have their usual meanings. (10,5)

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

(b) Show that : $C_{avg} \times (1/C)_{avg} = 4/\pi$ (10,5)

5. (a) What is Transport phenomenon in gases? Apply Kinetic theory of gases to obtain an expression for the coefficient of diffusion of gases. Prove that $D\rho/\eta = 1$

(b) What is a black body? How can it be obtained in practice? Describe the energy distribution of a black body. (8,7)

6. (a) What is a plane transmission grating? Derive an expression for the resolving power of a grating.

(b) Explain Newton's rings experiment to obtain the wavelength of a monochromatic light. (8,7)

7. Write short notes on any **three** of the following:

(a) Isothermal and Adiabatic Elasticity.

(b) Macrostate and Microstate.

(c) Difference between Bose-Einstein statistics and Fermi-Dirac statistics

(d) Third law of thermodynamics.

(e) Thermodynamic probability and Phase space.

(3×5=15)