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Your Roll No. .....

5110

B.Sc. Prog./II B

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 any **five** questions.

Symbols have their usual meanings.

1. (a) Apply Zeroth's law of thermodynamics to thermal systems to show that at equilibrium the systems are at the same temperature.

   (b) Show that the change in entropy of the system during Carnot's cycle is zero.

   (c) A Carnot's engine whose low temperature reservoir is at 7 °C has an efficiency of 50%. By how many degrees should the temperature of the high temperature reservoir be increased to increase the efficiency to 70%. $3 \times 5 = 15$

2. (a) Define Joule Kelvin's coefficient and derive its expression for a
   (i) Perfect gas
   (ii) Real gas
   (b) Discuss thermodynamic potentials.

2 + 5 + 5 + 3 = 15

3. (a) Obtain an expression for coefficient of viscosity (η) of ideal gases on the basis of kinetic theory of gases. Hence prove that $\eta \alpha \sqrt{T}$.
   (b) Define term "Degree of freedom" and state the law of equipartition of energy of a dynamical system. Hence show that
   $C_P/C_V = 1 + 2/f$
   Where symbols have their usual meanings.

9 + 6 = 15

4. (a) Discuss different modes of heat transfer.
   (b) Using Maxwell's relations prove that
   (i) $\left(\frac{\partial C_V}{\partial V}\right)_T = T\left(\frac{\partial^2 P}{\partial + 2}\right)_V$
   (ii) $C_P - C_V = -T\left(\frac{\partial V}{\partial T}\right)_P^2 \left(\frac{\partial P}{\partial V}\right)_T$
   (iii) $U = f - T\left(\frac{\partial F}{\partial T}\right)_V$
   (iv) $\alpha s/\alpha P = 1/1 - r$
   Where symbols have their usual meanings.

3 × 5 = 15

5. (a) Define thermodynamic probability of a system. Establish the relation between thermodynamic probability and entropy. Identify the constant appearing in the relation.

(b) Discuss micro and macro states with examples. $9 + 6 = 15$

6. (a) Explain diffraction of light. Distinguish between Fresnel and Fraunhoffer class of diffraction.

(b) What is diffraction grating ? Obtain an expression for resolving power.

$2 + 4 + 2 + 7 = 15$

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

(i) Half period zone

(ii) Mean free path

(iii) Gibb's paradox

(iv) Planck's law $2 \times 7\frac{1}{2} = 15$
