5402

Name of Course	**:**	**B.Sc. Hons.–(Physics)_NEP: UGCF-2022**
Semester	**:**	**II- Semester (GE Paper)**
Name of the Paper:	**:**	**Thermal Physics**
Unique Paper Code	**:**	**2224001202**
SET	**:**	**A**

Time: 3 hrs. **Maximum Marks: 90**

Instructions for Candidates

Attempt any five questions in all. Question no. 1 is compulsory.
Use of non-programmable Scientific Calculator is allowed.
Symbols have their usual meanings.

Q. 1 Attempt any six of the following: (6x3=18)

(a) Prove that slope of an adiabatic process is γ times the slope of the isothermal process.

(b) Which wavelength of radiation coming out of a surface at 2000 K will have the maximum intensity?

(c) Calculate pressure required to make water freeze at -1 ^{0}C. Given that increase of specific volume when water freezes into ice = 0.091 cc/gm, 1 atm = 10^6 dyne/cm^2, latent heat of ice = 80 cal/gm and J = 4.18 ergs/cal.

(d) A perfect gas is compressed to (1/4)th of its original volume. The initial pressure of the gas is 1 atm. Calculate the final pressure if the compression is adiabatic. Given γ =1.5.

(e) Find the efficiency of the Carnot's engine working between steam point and ice point.

(f) Define phase space.

(g) Find the mean free path for nitrogen gas. Given that viscosity of fas = 1.66 x 10^{-8} dyne/cm^2/(unit velocity gradient) , average velocity =4.5 x 10^4 cm/sec and density = 1.25 x 10^{-3} gm/cc.

Q. 2 (a) Explain how the Kelvin-Planck and Clausius statements of the second law of thermodynamics are equivalent. (12)

(b) State and prove Carnot's Theorem. (6)

Q. 3 (a) Derive Maxwell's four thermodynamic relations. (12)

(b) Derive Clausius Clapeyron equation and use it to show that the boiling point always rises when the pressure is increased. (6)

Q. 4 (a) Establish the relation for Maxwell's law distribution of molecular velocities. (12)

(b) Deduce an expression for the coefficient of viscosity on the basis of kinetic theory. (6)

Q. 5 (a) Discuss Planck's hypothesis for black body radiation. Drive the Planck's formula for the spectral distribution of energy in the black body radiation. (12)

(b) A body losses energy at the rate 20 watt from its surface when the temperature is 600^0C. Calculate the temperature when it losses energy at the rate 320 watt. Assume the body to be perfectly black. (6)

Q. 6 (a) Obtain an expression for thermodynamic probability and the most probable distribution function for a system obeying Maxwell Boltzmann statistics. (12)

(b) Define thermodynamic probability. Establish relation between Entropy and Thermodynamic probability (6)