2081
B.A./B.Sc. (General) Fourth Semester
Physics
Paper – A: Statistical Physics and Thermodynamics – II

Time allowed: 3 Hours   Max. Marks: 44

NOTE: *Attempt* _five_ *questions in all, including Question No.VII (Unit- III) which is compulsory and selecting two questions each from Unit I - II.*

x-x-x

UNIT – I

I.   a) What is Entropy? Starting from its statistical definition show that an infinitesimally small amount of heat is given to a gas produce a change in entropy $ds = \dfrac{d\theta}{T}$.

b) Explain how concept of entropy leads to second law of thermodynamics.   (6,3)

II.   a) What is heat engine? Explain its principle, working and define efficiency? Why is the efficiency of a heat engine cannot be 100%?

b) A Carnot heat engine absorbs heat from source at 500K and rejects a part of heat to a sink at 300K. If the heat absorbed from the source be 1000 cal. Calculate the heat rejected to the sink.   (6,3)

III.   a) What is Thomson effect? How does a thermocouple act like a heat engine? Derive the expression for dE/dT and d^2E/dT^2 for a thermocouple, where E and T have their usual meaning.

b) What is S-T diagram? Explain its importance.   (7,2)

UNIT - II

IV.   a) Derive Clapeyron's equation from Maxwell's relations and explain the change of ice to water on the basis of it. What is physical significance of this equation?

b) I gm of water vapour at 100^0C and 1 atmospheric pressure occupies a volume of 1.64 liters. Find the vapour pressure at 99^0C. Latent heat of vaporization L = 536 cal.   (6,3)

P.T.O.

V. Discuss four thermodynamical potential V,F,H and G and hence derive Maxwell's thermodynamics relations. (9)

VI. a) Discuss the liquefaction of Helium making use of regenerative coaling effect. Prove that the change in temperature due to adiabatic expansion of any substance is given by $dT = -\dfrac{T\beta P}{C_v} dv$.

b) Give the thermodynamic treatment of Joule -Thomson effect. (6,3)

UNIT - III

VII. Attempt any eight of the following:-

a) What is adiabatic demagnetization?

b) What is the significance of thermodynamical potential?

c) Write a note on entropy and disorder.

d) What do you mean by heat death of universe?

e) What is temperature of inversion? What is its value for helium?

f) Second law of thermodynamics is a statistical law. Explain.

g) Why does the entropy increase during free expansion of gas?

h) What do you mean by extensive and intensive parameter? Give example of each.

i) State third law of thermodynamics? (8x1)

x-x-x