Roll No. ..... **Total No. of Pages : 3**

PC 13105-N

L-3/2111
STATISTICAL THERMODYNAMICS—332
Semester—III

Time Allowed : Three Hours] [Maximum Marks : 55

Note :– The candidates are required to attempt *two* questions each from Section A and B. Section C will be compulsory.

SECTION—A

I. (a) Compare Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistical. Under what conditions these become identical ? 3

(b) State law of equipartition of energy. Prove it in terms of statistical considerations. 5

II. (a) Write an explanatory note on speed and energy distribution functions.

(b) Discuss the statistics of Photon gas. 4,4

III. (a) Derive equation of state of non-ideal gases.

(b) Derive expressions for vibrational and rotational contribution to the specific heats of diatomic gases. 4,4

IV. Write notes on the following :

(a) Thermionic Emission

(b) Gas mixture and Entropy of mixing. 4,4

SECTION—B

V. (a) Describe Debye theory of specific heats.

(b) Comment on "Entropy of solids". Also derive equation of state for solids. 4,4½

VI. (a) Show that fluctuation in energy for a thermodynamic system at constant temperature is negligible.

(b) Write a note on theory of Brownian motion. 4½,4

VII. (a) What do you understand by Entropy production ? Why is it called so ? Derive expression for heat entropy production in a mass flow.

(b) Derive Onsager's reciprocal relation. 4,4½

VIII. (a) Derive the relation between equilibrium constant K_p, K_c and K_x (p, c, x stands for partial pressure, molar concentration and mole fraction respectively). Under what condition these become identical ?

(b) Derive thermodynamically law of mass action. 5½,3

SECTION—C

IX. (i) Explain why it is possible to omit the concentrations of pure solids and liquids in calculating K_c for a heterogeneous reaction.

(ii) Explain seeback effect.

(iii) State and explain the terms "Flux and Force" with suitable example.

(iv) Discuss the significance of parameters 'α' and 'β' in Maxwell-Boltzmann statistics.

(v) Discuss the need of Statistical Mechanics.

(vi) Explain steady state with suitable example.

(vii) State the conditions under which partition function can be factorized.

(viii) Explain Canonical and Grand Canonical ensembles with suitable example.

(ix) Discuss the need of Irreversible thermodynamics.

(x) What is meant by "Thermodynamic Probability" ? Explain.

(xi) Explain "Thomson effect". 11×2=22