

Roll No.

Total No. of Questions : 9]
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UG (CBCS) IInd Year Annual Examination

2804

B.Sc. PHYSICS

(Statistical and Thermal Physics)

(DSC-1C)/Core

Paper : PHYS 201 TH

Time : 3 Hours]

[Maximum Marks : 50

Note :- Attempt *five* questions in all, selecting *one* question each from Sections-B, C, D and E and seven sub-questions from Section-A. Question No. 1 is compulsory.

Section-A

(Compulsory Question)

1. Attempt all the seven sub-questions :

CH-104

(1)

Turn Over

(i) Probability of drawing two Kings in Succession from the Pack of cards is :

(a) $\frac{1}{52}$

(b) $\frac{1}{144}$

(c) $\frac{2}{52}$

(d) $\frac{1}{221}$

(ii) Phase space is :

(a) Three Dimensional (b) Six Dimensional

(c) Four Dimensional (d) None of these

(iii) Pauli's exclusion principle applies to :

(a) B-E statistics

(b) M-B statistics

(c) F-D statistics

(d) None of these

(iv) The S.I unit of entropy is

(v) Write expression for temperature of inversion.

(vi) Which of the following is called total heat function ?

(a) Gibbs' function

(b) Enthalpy

(c) Entropy

(d) None of these

(vii) Helmholtz free energy is defined by :

(a) $F = U - TS$

(b) $F = U + PV$

(c) $F = U + TS$

(d) $F = U + TV - TS$

Section-B

2. (a) Discuss the distribution of n -distinguishable particles in k -compartments which are further sub-divided into g -cells of equal a priori probability. 7,2
- (b) What do you understand by most Probable macrostate ?
3. Derive the expression $P_x = P_{\max} e^{-\frac{f^2 n}{2}}$ for a macrostate having a deviation x from the most probable macrostate for a distribution of n particles in two identical compartments. 9

Section-C

4. (a) Define Phase space. Determine the phase space cells in the momentum interval P and $P + dP$ according to Maxwell Boltzmann statistics. 5,4
- (b) Assuming MB distribution of molecular speed derive expression for root mean square speed. 5,4
5. Derive Planck's law for energy distribution of black body using Bose-Einstein distribution law. 9

Section-D

6. (a) What is T-S diagram ? Using it derive expression for the efficiency of the Carnot's heat engine.

- (b) Define isothermal process. Derive an expression for work done during isothermal process. 5,4
7. (a) Explain Peltier and Thomson effects.
- (b) Discuss the meaning and significance of Heat Death of the Universe. 6,3

Section-E

8. (a) Using Maxwell's Thermodynamic relations, prove that for Vander Waals' gas :

$$C_P - C_V = R \left[1 + \frac{2a}{RTV} \right]$$

- (b) Show that the change in temperature in a Joule-Thomson Effect is given by :

$$dT = \frac{V}{C_P} [T\alpha - 1] dP$$

9. (a) Prove that adiabatic stretching of a wire leads to cooling effect. 4,5
- (b) Using thermodynamic potentials, derive the Maxwell's four relations. 5,4