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Total Number of Pages : 01

M.Sc.I  
FPYC503

5<sup>th</sup> Semester Back Examination 2019-20

STATISTICAL MECHANICS-I

BRANCH : M.Sc.I(AP)

Time : 3 Hours

Max Marks : 70

Q.CODE : HB508

Answer Question No.1 which is compulsory and any FIVE from the rest.

The figures in the right hand margin indicate marks.

- Q1 Answer the following questions : (2 x 10)**
- a) How many Sundays are in a leap year ?
  - b) What do you mean by standard deviation, fractional deviation and mean?
  - c) If  $g(p, q, t)$  is the density function of an ideal gas system in  $\mu$ -space then how to get mean energy of the system ?
  - d) If 10 dice are thrown then calculate the number of ways in which an occupation number  $\{3, 0, 1, 0, 5, 1, 0\}$  can be observed
  - e) If entropy of a system is zero, then how many microstates are accessible?
  - f) What happens to the Boson gas at absolute zero temperature?
  - g) What is phase transition?
  - h) What is the difference between photon and phonon
  - i) What is the difference between canonical ensemble and micro-canonical ensemble?
  - j) Explain why the electron gas in white dwarf stars are degenerate.
- Q2 a) Explain what is White dwarf Star. How are these differ from main sequence stars? (5)**
- b) Obtain the expression for mean energy of Fermions at absolute zero Kelvin temperature. (5)**
- Q3 a) Distinguish between micro canonical, canonical and grand canonical ensembles (5)**
- b) State the postulates of classical statistical mechanics (5)**
- Q4 a) Define ensemble average of occupation number  $n_p$  over grand canonical ensemble (5)**
- b) Obtain Grand partition function for classical ideal gas, hence derive equation of state for this gas. (5)**
- Q5 a) Show that there is no energy fluctuation in canonical ensemble (5)**
- b) State the relation between statistical probability and thermodynamics (5)**
- Q6 State and prove Liouville theorem. write details what are the main significance of the theorem. (10)**
- Q7 What is wrong in the expression for entropy and how is it rectified? Hence obtain Sakur-Tetrode equation. (10)**
- Q8 Write short Notes on any TWO : (5 x 2)**
- a) Explain what is Gibbs paradox
  - b) Write short notes on canonical ensemble
  - c) Show that if a closed system  $(E, V, N)$  has  $\Omega$  number of accessible microstates, then its entropy can be given by  $S = K \ln \Omega$  where  $K$  is a constant