Registration No : | | | | | | | | | | |

Total Number of Pages : 02 **M.Sc.**
16MPYC202

2nd Semester Back Examination 2018-19
STATISTICAL MECHANICS-I
BRANCH : M.Sc.(AP)
Time : 3 Hours
Max Marks : 70
Q.CODE : F229

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) Explain Gaussian distribution in statistics.

b) What is Ergodic hypothesis?

c) Why third law of thermodynamics is purely a quantum mechanical effect?

d) Consider a system whose 3 energy levels are given by 0, ε, 2ε. The energy level ε is two-fold degenerate and the other 2 are non-degenerate. Find the partition function of the system.

e) Find the no. of ways in which 6 identical bosons can be distributed in 3 energy levels.

f) What is De-Hass-van Alphen effect?

g) What is the probability that the energy level which is $\Delta\varepsilon$ above the Fermi energy is occupied?

h) What is Chandrasekhar limit ? Explain.

i) Write the equations representing the relationship between statistics and thermodynamics in all 3 ensembles.

j) What is Ginzberg criteria?

Q2 **a)** Derive the expression for entropy of a classical ideal gas. **(5)**

b) State and prove Liouville's theorem. **(5)**

Q3 **a)** Obtain the partition function of a photon gas. Hence derive Planck's radiation formula. **(5)**

b) Obtain the expression for mean energy of Fermions at absolute zero Kelvin temperature. **(5)**

Q4 **a)** Calculate the entropy of ideal Bose gas in quantum mechanical micro canonical ensemble. **(5)**

b) Explain the phenomena of Bose-Einstein condensation. **(5)**

Q5 **a)** Discuss Pauli para-magnetism and derive the expression for magnetic susceptibility. **(5)**

b) Briefly discuss about Landau diamagnetism and obtain the expression for magnetic moment. **(5)**

Q6 **a)** Describe Mean field theory. Discuss Landau theory of phase transition beyond the mean field theory. **(5)**

b) Discuss the discontinuity of specific heat and the change in symmetry for the phase transition of second kind. **(5)**

Q7 What is Gibb's paradox? How is it resolved? **(10)**

Q8 **Write short answer on any TWO :** **(5 x 2)**

a) Statistical ensembles

b) Density matrix

c) Quantized Hall effect

d) Ising model