M.Sc. Physics Examination Semester - 3
Phys-C302 : Statistical Mechanics
Paper Code- 4704

Time : 2 Hours 30 min DEC- 2016 Maximum Marks 70

1. A. Explain the terms: i) Microscopic ii) macroscopic states, iii) Phase space, Phase points and iv) phase trajectory. [10]
   B. Draw the phase space trajectory for the case of a bullet of 5mg fired straight upward against gravity alone with an initial speed of 400 m/s. [04]

OR

1. A. Discuss the three different types of Ensembles with examples. Show how the ensemble averages are computed? Explain the Ergodic hypothesis. [07]
   B. Discuss the Gibb's paradox and explain how is it resolved? [07]

2. Derive the distribution function for an ideal gas in a quantum mechanical microcanonical ensemble. Deduce all the thermodynamic parameters of the system. [14]

OR

2. A. Obtain the distribution function for an ideal Fermi-Dirac system, also show that an ideal Fermi gas even at 0°K exerts a huge pressure. [07]
   B. Derive the Boltzmann limit of the Bose – Einstein and Fermi-Dirac distributions. [07]

3. A. Discuss the thermodynamic properties of an ideal Boson gas at very low temperature. [07]
   B. Discuss the properties of liquid helium and explain the λ- transition. [07]

OR

3. A. Obtain the mean energy per photon in a black body radiation cavity. [07]
   B. Based on the Debye model, show that for temperature greater than the Debye temperature, the lattice gas behaves classically. [07]

4. A. Explain in details the Gibb's paradox and discuss how is it resolved?. [07]
   B. By what factor does the entropy of the conduction electrons change when the temperature is changed from 200K to 600K? [07]

OR

4. A. Show that the ideal neutron gas is degenerate. [06]
   B. Derive an expression of Fermi energy and Fermi momentum for Fermi gas by using Fermi Dirac Distribution. What do you understand by degenerate gas? [08]

5. A. Expalin Ginzburg-Landau theory of second order phase transition. [07]
   B. Derive Clausius-Clapeyron equation and interpret it properly. [07]

OR

5. A. With the help of P-V-T diagram for pure substances, explain different critical parameters representing a typical phase transition. [07]
   B. Discuss a dynamical model of phase transition. [07]