

Statistical Mechanics Examination

Question – 1

Date: 06-11-2017

Time: 10:30AM – 12.30PM

Full Marks: 40

MOBILE IS NOT ALLOWED IN EXAMINATION HALL

All Questions are compulsory:

- (1) Write down Pauli's exclusion principle. 2
- (2) Define ensemble in the context of statistical mechanics. 2
- (3) Discuss how entropy is defined in statistical mechanics. 2
- (4) Explain the meaning of phase space. 2
- (5) Can you expect a condensation process in an electron gas? Explain your answer. 2
- (6) Six distinguishable particles are distributed over three non-degenerate levels of energies 0 , ε and 2ε . Calculate the total number of microstates of the system. Find the total energy of the distribution for which the probability is a maximum. 5
- (7) Compare the Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics. Under what conditions quantum statistics reduces to classical statistics 4+1
- (8) Which particle obeys Bose-Einstein statistics? Derive the BE distribution formula. 1+4
- (9) Obtain an expression for the Fermi energy at $T=0$ K for a system of N -free electrons enclosed in volume V . 5
- (10) Starting from B-E distribution formula establish Planck's law of blackbody radiation. And hence deduce Wien's displacement law. 8+2
- (11) (a) Explain the terms:
Phase space, phase point and phase trajectory. 2+3+5
(b) State giving reasons, whether a phase trajectory can intersect itself and whether two phase trajectories can have a point of intersection.
(c) Find the volume of the phase space of a classical harmonic oscillator of mass m and angular frequency ω bounded by two surfaces of constant energy E and $E+dE$. 2+2+6