

Khatra Adibasi Mahavidyalaya
B.Sc. Internal Assessment 2020

Physics Honours **SHPHS/602/C-14:**
Statistical Mechanics (T14)
Full Marks: 20; Time 1 hr

June 2, 2020

Group A

Answer any *two* questions: $5 \times 2 = 10$

1. A simple harmonic oscillator has energy levels $E_n = (n + \frac{1}{2})\hbar\omega$ where the symbols have their usual meanings. If it is in thermal contact with a reservoir at temperature T, find its mean energy. (5)
2. Consider a rigid lattice of distinguishable spin $\frac{1}{2}$ atoms in a magnetic field **B**. Determine the canonical partition function and total energy of the system. (2+3)
3. State the differences between Bose Einstein and Fermi Dirac statistics. Define Fermi level at absolute zero and a finite temperature. (3+2)

Group B

Answer any *one* question: $10 \times 1 = 10$

4. (a) Obtain Planck's formula for black body radiation using Bose-Einstein statistics. Show that Wien's formula and Rayleigh-Jeans formula can be deduced as particular cases from it. (4+1+1)
(b) What do you mean by microcanonical, canonical and grand canonical ensembles? (4)
5. (a) Derive an expression for the mean occupation number of energy states assuming Fermi Dirac statistics. (4)
(b) Derive the expression for energy density of states of an electron gas in a metal. Hence calculate the Fermi energy of a metal at 0K. (5+1)