Fourth year of Five Years integrated M.Sc (Physics)	**L**	**T**	**P**	**C**
M.Sc. - IV, Semester – VII				
	3	**2**	**0**	**5**

MP 401 :   **Statistical Mechanics**

- **SYSTEM OF PARTICLES: A STATISTICAL POINT OF VIEW**   **(06 Hours)**
  Basic concepts of probability, Maxwell distribution, Macroscopic and microscopic states, Phase space, μ-space, Γ-space, Postulate of equal a priori probability, Ergodic Hypothesis, Liouville's theorem, Condition for statistical equilibrium.

- **STATISTICAL ENSEMBLES**   **(06 hours)**
  Micro-canonical ensemble, canonical ensemble, System with specified mean energy, Mean values and fluctuations in a canonical ensemble, Connection with thermodynamics, Grand-canonical ensemble, Mean values and fluctuations in grand canonical ensemble, Reduction of Gibbs distribution to Maxwell and Boltzman distribution, Barometric formulae, Experimental verification of Boltzman's distribution, Mixture of Gases.

- **APPLICATIONS OF STATISTICAL MECHANICS**   **(06 Hours)**
  Thermodynamics, Statistical interpretation of the basic thermodynamic variables, Physical interpretation of α, Chemical potential in the equilibrium state, Thermodynamic functions in terms of the Grand partition function, Ideal gas, Gibbs paradox, Equipartition theorem and its Simple applications.

- **QUANTUM STATISTICS**   **(06 Hours)**
  Density matrix, Liouville's theorem in quantum statistical mechanics, Condition for statistical equilibrium, Ensambles in quantum mechanics.

- **BOSE-EINSTEIN AND FERMI-DIRAC DISTRIBUTION**   **(06 Hours)**
  Symmetry of wave functions, Quantum distribution functions, Boltzmann limit of Boson and Fermion gases, Evaluation of the partition function, Partition function for diatomic molecules, Equation of state for an ideal gas, The quantum mechanical paramagnetic susceptibility, Specific heat anomaly.

- **IDEAL BOSE SYSTEM**   **(06 Hours)**
  Photon gas, Einstein derivation of Planck's law, Bose-Einstein Condensation, Specific heat, Photon gas – Einstein and Debye's model of solids.

- **IDEAL FERMI SYSTEM**   **(06 Hours)**
  Fermi energy, Mean energy of fermions at absolute zero, Fermi gas in metals, Atomic nucleus as an ideal fermion gas, Fermi energy as a function of temperature , Electronic specific heat, White dwarfs, Compressibility of Fermi gas, Pouli's paramagnetism, A relativistic degenerate electron gas.

(Total Contact Time (Theory) : 42 Hours)

BOOKS RECOMMENDED :

1. **Laud B. B.**   *Fundamentals Of Statistical Mechanics*   New Age International   2007

2. **Reif F.**   *Fundamentals of statistical and thermal physics*   McGraw Hill   1965

3. **Huang K.**   *Statistical mechanics*   Willey   1963

4. **Gopal E. S. R.**   *Statistical Mechanics and Properties of Matter: Theory and Applications*   Ellis Horwood   1974

5. **Davidson** N.   *Statistical Mechanics*   Courier Dover   2003