Course 4: Statistical Mechanics
Course code: MSCPH504   **Credit: 3**

BLOCK 1   CLASSICAL STATISTICS
Unit –1:   **Scope and Aim of Statistical Mechanics:**Basic concepts of statistical mechanics, phase space, ensemble, density of state, Ergodic hypothesis, postulate of equal a priori probability and equality of ensemble average and time average.
Unit –2:**Principles of Statistical Mechanics:** Statistical equilibriums, connection between statistical and thermodynamic quantities, microstates and macrostates, Liouville's theorem.
Unit –3: **Classical Statistical:** Thermodynamical probability, classical Maxwell Boltzmann distribution law, degrees of freedom, principle of equipartition of energy.

BLOCK 2   Ensembles
Unit –4: **Microcanonical Ensemble**: Ensemble Theory, microcanonical ensemble, Gibbs' paradox, partition function and its relation with thermodynamic quantities.
Unit –5: **Canonical Ensemble**:Canonical Ensemble and its features, partition function, fluctuation, relation with thermodynamic quantities, linear harmonic oscillator.
Unit –6: **Grand Canonical Ensemble**: Grand Canonical Ensemble,Equilibrium, partition function, density and energy fluctuation, relation with thermodynamic quantities, comparison of ensembles.

BLOCK 3   Quantum Statistics and Statistics Models
Unit –7: **Quantum Statistics:** Quantum statistics of identical particles, Symmetric and antisymmetricwave functions, average value and quantum statics, F-D, B-E andM-B distribution,Comparison of three statistics, black body radiation and planks radiation law, Ideal Bose-Einstein Gas, degeneracy, degenerate Bose gas, Bose-Einstein condensation, Negative temperature,Ideal Fermi Gas, degeneracy, electron gas.

Unit –8: **Phase Transitions:** Phase transitions, first order Phase transitions, second order phase transitions, higher order phase transitions (elementary idea),Ising model, Landau's theory,Weiss theory of ferro-magnetism, Virial equation of states,

Reference Books:
1. Statistical Mechanics: Patharia.
2. Statistical Mechanics: Haung.
3. Statistical Mechanics: Landau and Lifshitz.
4. Statistical Mechanics: Gupta Kumar, Pragati Publication