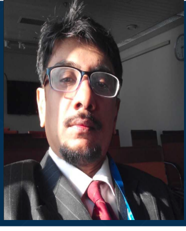

INTRODUCTION TO STATISTICAL MECHANICS

PROF.GIRISH S. SETLUR
Department of Physics
IIT Guwahati

PRE-REQUISITES : Thermodynamics, Classical mechanics, Quantum mechanics

INTENDED AUDIENCE : M.Sc and beginning PhD students and other interested individuals

COURSE OUTLINE :

This is an introductory course in classical and quantum statistical mechanics which deals with the principle of ensembles, Classical, Fermi and Bose ideal gases, Pauli paramagnestim, Debye and Einstein's theory of specific heat and the 1D Ising model.

ABOUT INSTRUCTOR :

Prof.Girish S. Setlur , he works in the field of Theoretical Condensed Matter Physics. He is interested in understanding and accounting for the properties of everyday bulk materials from a knowledge of the fundamental constituents of the substance and the fundamental physical laws governing those constituents. He was the inventor of a new technique called 'non-chiral bosonization' which is uniquely suited to study strongly inhomogeneous Luttinger liquids. He also invented the notion of a non-local particle hole creation operator and showed that it may be used to diagonalize interacting Fermi systems in any dimension. He is also interested in topological materials, specifically their nonlinear optical properties.

COURSE PLAN :

Week 1: Review of thermodynamics, Hamiltonian mechanics of classical and quantum systems.
Week 2: Microcanonical ensemble and the concept of entropy. Examples of systems with finite infinitely many degrees of freedom. Counting of states and entropy in quantum systems.
Week 3: Canonical ensemble and the concept of temperature. Relation between canonical and microcanonical ensembles and partition functions Thermodynamic potentials and Legendre transformations. Examples from classical and quantum systems.
Week 4: Other ensembles and their related thermodynamic potentials Concept of fugacity, pressure of an ideal gas. Equation of state of an ideal classical gas.
Week 5: Equation of state of ideal Bose and Fermi gases. Bose Einstein condensation and Fermi degeneracy pressure.
Week 6: Non-ideal gas: Van der Waals equation of state. Concept of phase diagram
Week 7: Magnetic insulators: Ising model, Potts model Solution on 1D lattice using transfer matrix method. Solution in large dimensions using mean field theory.
Week 8: Pauli paramagnetism and temperature dependent susceptibility, electronic contribution to specific heat of solids. Deybe and Einstein theory of specific heat of solids.