PHYSICS

STATISTICAL MECHANICS

PROF. ASHWIN JOY
Department of Physics
IIT Madras

TYPE OF COURSE : New | Core | UG/PG
INTENDED AUDIENCE : M.Sc/B.Sc/B.E
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 28 April 2019

COURSE OUTLINE :

The course is designed to give the students a firm understanding of statistical mechanics at the advanced undergraduate/beginning graduate level. After a discussion of the concepts of probability, the postulates of classical mechanics are developed in various ensembles of physical relevance. The ideas thus developed for the classical systems will be shown to have serious limitations when applied to quantum systems. Finally, we develop the correct theory of statistical mechanics for quantum systems and show that classical results can be recovered from the quantum theories in the high temperature - low density limit.

ABOUT INSTRUCTOR :

Prof. Joy works as a faculty member at the Department of Physics, IIT Madras and is very much interested in the problems of non-equilibrium statistical mechanics and turbulence. He did his doctoral work at IPR Gandhinagar with Prof. R. Ganesh and post-doctoral work with Prof. Itamar Procaccia, Weizmann Institute of Science, Israel.

COURSE PLAN :

Week 01 : Random Variables
Week 02 : Moments & Cumulants
Week 03 : Important Probability Distributions
Week 04 : Maximum Entropy Principle.
Week 05 : Micro-canonical Ensemble
Week 06 : Canonical Ensemble
Week 07 : Gibbs Canonical Ensemble
Week 08 : Grand Canonical Ensemble
Week 09 : Ideal Gas of Mass-less Particles (Photons & Phonons)
Week 10 : Ideal Gas of Real Particles (Fermions & Bosons)
Week 11 : Electrons in Metals
Week 12 : Classical Limit of Quantum Gases