Semester	AUG 2022
Open to semester	7,13,21
Course code	**CH4144/CH6194**
Course title	**Statistical Thermodynamics**
Credits	4 /4
Course Coordinator & participating faculty (if any)	Anirban Hazra,* Srabanti Chaudhury
Nature of Course	Lectures
Pre-requisites	No formal prerequisites, but a strong familiarity with first year college level mathematics necessary.
Objectives (goals, type of students for whom useful, outcome etc)	The goal is to understand observable macroscopic (thermodynamic) properties such as internal energy, heat, enthalpy, entropy etc. in terms of microscopic (molecular) interactions. The course is essential for physical chemistry students and can be useful for all students pursuing Physics and Chemistry. This course will provide a molecular view to understand and explain thermodynamically observable properties.
Course contents (details of topics /sections with no. of lectures for each)	Section #1- Review of Thermodynamics, with focus on physical understanding and thinking in terms of molecules (9) Topics: Temperature, Heat, Phase transition, Equilibrium, Reversible and Quasi-static processes. First law of thermodynamics. Carnot cycle and the motivation of the concept of Entropy. Second law of thermodynamics. Helmholtz and Gibbs energies. Maxwell relations. Section #2- Review of probability and connection of statistical quantities to thermodynamic variables (9) Topics: Distributions and the importance of the most probable distribution. Origin of the Boltzmann distribution. Boltzmann definition of entropy and connection with the classical definition. Section #3- Statistical Mechanical Ensembles and Thermodynamics (9)

	Classical Statistical Mechanics, Classical Partition Function – Phase Space and the Liouville Equation – Equipartition of Energy Ensembles and Postulates -- Canonical Ensemble -- Grand Canonical Ensemble -- Microcanonical Ensemble -- Other Ensembles -- Partition function-- Equivalence of Ensembles -- Thermodynamic Connection - Fluctuations Section #4 – Quantum Statistics (2) Boltzmann, Fermi-Dirac, Bose- Einstein Statistics Section #5 –Calculation of partition functions of ideal gases and thermodynamic functions (6) Monoatomic gas: Translational Partition Function – Electronic and Nuclear Partition Function – Thermodynamic Functions Diatomic and Polyatomic Gas: Rigid Rotor Harmonic Oscillator Approximation – Vibrational Partition Function – Rotational Partition Function – Thermodynamic Functions Section #6– Chemical Equilibrium (2) Equilibrium Constant and partition functions– Examples
Evaluation /assessment	End-Sem Examination-40% Mid-Sem Examination-30% Others-Quizzes 30%%
Suggested readings (with full list of authors, publisher, year, edn etc.)	1. Physical Chemistry by Peter Atkins and Julio de Paula, 6th edition (1998) or later preferred 2. H. B. Callen, Thermodynamics and Introduction to Thermostatistics, 2nd Edn, (1985). First six chapters 3. Statistical Mechanics, Donald A McQuarrie, University Science Books, California, USA ,Viva Books Private Limited, New Delhi (Indian Edn) [First 7 chapters and some other chapters) 4. An Introduction to Statistical Thermodynamics, Terrell L. Hill, Dover Publications, Inc, New York1.