Semester	JAN 2022
Open to semester	4
Course code	**TD2213**
Course title	**Thermodynamics**
Credits	3 /
Course Coordinator & participating faculty (if any)	Srabanti Chaudhury* Muhammad Mustafa O.T
Nature of Course	Lectures and Tutorials
Pre-requisites	12th standard mathematics. Knowledge of calculus(differentiation) and basic probability
Objectives (goals, type of students for whom useful, outcome etc)	Thermodynamics deals with the changes of matter and the interconversion of various forms of energy. The main objective of this course is to introduce the reason governing the changes of matter through our study of thermodynamics. The most important quantity in thermodynamics is entropy, and this course is all about understanding entropy and related thermodynamic potentials. Classical thermodynamics is based on phenomenological observations and the objective of statistical thermodynamics is to give a molecular basis for it. In this course, both these different approaches (classical and statistical) of thermodynamics will be covered. The objective of this course is to uncover the enigma of entropy and understand the amazing fact that having “more choices” is a fundamental principle of Nature.
Course contents (details of topics /sections with no. of lectures for each)	Thermodynamics in everyday life, System and surroundings, macroscopic and microscopic systems, the concept of equilibrium, the thermodynamic state of the system. Zeroth law, gas thermometers, equation of state, real gas, and virial equation (4 hours) The first law of thermodynamics, work, heat, internal energy, the equivalence of heat and work, expansion/ compression work, isothermal processes, reversible processes, Joule’s free expansion, adiabatic changes, specific heats, enthalpy, Joule-Thompson experiment (5 hours) Thermochemistry, calorimetry (2 hours) Second Law of thermodynamics, the concept of entropy, the direction of time, the equivalence of the statements of the second law, heat engines and efficiency (internal combustion

	engine and external combustion engine), refrigerators, Carnot cycle (4 hours) Definition of entropy, Clausius inequality, calculation of entropy (2 lectures) Statistical formulation of 2nd law, Microscopic interpretation of entropy, the concept of probability, microstates and distribution, two-level and multi-level systems, distinguishable and indistinguishable particles, most probable distribution, Boltzmann distribution, estimation of entropy of various processes, the microscopic equivalent of heat and work, partition function (7 lectures) Fundamental equation, Legendre transformation, Introduction to free energy, Criteria for spontaneous change, Maxwell relations and applications, general thermodynamic relations using Jacobian method (5 lectures) Applications of free energy (1 lecture)
Evaluation /assessment	End-Sem Examination-50% Mid-Sem Examination-50% Others-%
Suggested readings (with full list of authors, publisher, year, edn etc.)	9780471215042. Atkins, P., and J. de Paula. Physical Chemistry. 7th ed. New York, NY: W.H. Freeman and Company, 2001. ISBN: 9780716735397. Hanson, R.M., Green, S. Introduction to Molecular Thermodynamics. University Science Books, 2008. ISBN 978-1-891389-49-8