IISER Pune - Course Content

Semester	JAN 2024
Open to Semester	4
Course Code	TD2213
Course title	Thermodynamics
Nature of Course	LT - lecture and Tutorial
Credit	3
Coordinator and participating faculty (if any)	**Dr. Srabanti Chaudhury** Dr. Muhammad Mustafa O.T
Pre-requisites	12th standard mathematics. Knowledge of calculus(differentiation) and basic probability
Objectives	Thermodynamics deals with the changes of matter and 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 the 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 content	Thermodynamics in everyday life, System and surroundings, macroscopic and microscopic systems, concept of equilibrium, thermodynamic state of the system. Zeroth law, gas thermometers, equation of state, real gas and virial equation (4 hours) First law of thermodynamics, work, heat, internal energy, 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, concept of entropy, direction of time, equivalence of the statements of 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 hours) Statistical formulation of 2nd law, Microscopic interpretation of entropy, 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, microscopic equivalent of heat and work, partition function (7 hours) Fundamental equation, Legendre transformation, Introduction to free energy, Criteria for spontaneous change, Maxwell relations and applications, general thermodynamic relations using Jacobian method (5 hours) Applications of free energy (1 hour)
Evaluation / Assessment	End-Sem: 40 % Mid-Sem: 40 % Others(quizzes):20%
Suggested readings	Silbey, R., R. Alberty, and M. Bawendi. Physical Chemistry. 4th ed. New York, NY: John Wiley & Sons, 2004. ISBN: 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
When Next	Spring 2025
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