

Chemical Engineering Thermodynamics - Web course

COURSE OUTLINE

The present course aims to introduce the principles of *Chemical Engineering Thermodynamics* and illustrate their application to design of chemical process plants. The content comprises the fundamental laws of thermodynamics, the estimation of volumetric and key thermodynamic properties of real fluids and mixtures, solution thermodynamics, phase and chemical reaction equilibria. In addition, select special applications of the principles of phase and reaction equilibria are also illustrated. These include liquid-liquid equilibria, vapour-liquid-liquid equilibria, solid-liquid, and solid-vapour equilibria.

COURSE DETAIL

S.No	Topics	No. of Hours
1	Introductory Concepts of Thermodynamic Systems and variables, Work, Heat, Internal Energy, Thermodynamic Equilibrium, Reversible and Irreversible Processes; Phase-Rule; Significance of Chemical Engineering Thermodynamics	3
2	Equations of State and Generalized Correlations for Prediction of Volumetric Properties of Fluids	4
3	First Law: Closed and Open Systems, Steady and Transient Flow Processes	4
4	Second law and Entropy; Entropy Balance and Availability, Isentropic Efficiency	4
5	Maxwell Relations and Fluid Properties Estimation, Application to Flow Processes	6
6	Single Phase Mixtures and Solutions; Ideal Solutions; Partial molar quantities; Gibbs-Duhem Equation; Criteria for Thermodynamic Equilibrium; Phase Equilibrium Criteria, Non-ideal Solutions; Residual and Excess Properties; Fugacity and Activity Coefficient models	7
7	Pure Component Phase Equilibria, Vapour-Liquid Equilibria (VLE), Raoult's Law and Modified Raoult's Law; High-Pressure VLE; Henry's law	7
8	Chemical Reaction Equilibrium: Homogeneous and Heterogeneous reactions; Multi-reaction Equilibria	
9	Liquid-Liquid Equilibria	2
10	Solid – Liquid Equilibria	1.5

NPTEL

<http://nptel.iitm.ac.in>

Chemical Engineering

Additional Reading:

1. J.M. Smith, H.C. Van Ness and M.M. Abbott, Introduction to Chemical Engineering Thermodynamics, 6th ed., McGraw-Hill, 2001.
2. S.I. Sandler, Chemical, Biochemical and Engineering Thermodynamics, 4th Edition, Wiley India, 2006.
3. J.M. Prausnitz, R.N. Lichtenthaler and E.G. Azevedo, Molecular Thermodynamics of Fluid-Phase Equilibria, 3rd ed., Prentice Hall, 1998.
4. J.W. Tester and M. Modell, Thermodynamics and its Applications, 3rd ed., Prentice Hall, 1999.
5. R.C. Reid, J.M. Prausnitz and B.E. Poling, Properties of Gases and Liquids, 4th ed., McGraw-Hill, 1987.
6. R. Balzheiser, M. Samuels, and J. Eliassen, Chemical Engineering Thermodynamics,

11	Solid – Vapour Equilibria	1.5
TOTAL		40

Coordinators:

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