NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	B. Tech. (Chemical Engineering)
Course Code:	2CH602CC23
Course Title:	Chemical Engineering Thermodynamics
Course Type:	Core
Year of introduction:	2023-2024

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Course Learning Outcomes (CLOs):

At the end of the course, the students will be able to –

1. interpret mathematical expressions of various phase and reaction equilibrium phenomena (BL 2)
2. calculate vapour-liquid equilibrium for ideal and non-ideal binary systems (BL 2)
3. apply the fundamentals of solution thermodynamics to calculate phase equilibrium properties of pure components and mixtures (BL 3)
4. evaluate equilibrium conversion and product composition of chemical reactions (BL 5)

Syllabus: **Total Teaching hours: 30**

Unit	Syllabus	Teaching hours
Unit I	**Phase Equilibrium:** PVT behaviour of pure substances– qualitative discussions, Different equations of state for real gases, Generalised correlations for gases and liquids. Introduction to phase equilibrium, Phase rule, Concept of ideal and nonideal solutions, Qualitative vapour liquid equilibrium behaviour, Simple models of vapour liquid equilibrium estimation for ideal solutions, DePriester chart for vapour liquid equilibrium, Flash calculations, Vapour liquid equilibrium calculations for nonideal solutions at low pressure, Concept of azeotropes, vapour liquid equilibrium from azeotropic data.	**12**
Unit II	**Solution Thermodynamics Theory and applications:** Partial molar properties, Fugacity, and fugacity co-efficient for pure components and for the mixture of gases and liquids, Criteria of phase equilibrium, Liquid phase properties from vapour liquid equilibrium data, Excess Gibbs free energy models, Vapour liquid equilibrium data reduction to obtain the constants for various activity coefficient models.	**08**
Unit III	**Chemical Equilibrium:** Criteria for equilibrium, Evaluation of equilibrium constant, Effect of temperature and pressure on	**10**

equilibrium constant, Evaluation of equilibrium conversion for gas phase reaction and liquid phase reactions.

Self Study

Self-study contents will be declared at the commencement of the semester. Around 10% of the questions will be asked from the self-study contents.

Tutorial Work

Tutorial work will be based on the above syllabus, with minimum 10 tutorials to be incorporated.

Suggested Readings:

1. J. M. Smith, H.C. Van Ness, and M. M. Abott, Introduction to Chemical Engineering Thermodynamics, McGraw Hill Publication.
2. S. I. Sandler, Chemical, Biochemical, and Engineering Thermodynamics, John Wiley & Sons.
3. K. V. Narayanan, A Textbook of Chemical Engineering Thermodynamics, PHI Learning Pvt. Ltd.
4. Y.V.C. Rao, Chemical Engineering Thermodynamics, Universities Press.