CH223	CHEMICAL ENGINEERING THERMODYNAMICS-II	L	T	P	C	Int	Ext
		2	1	-	3.0	30	70

Semester IV [Second Year]

COURSE OBJECTIVES:

1. To understand the concept of adiabatic and theoretical flame temperatures and to explain the effect of temperature on the enthalpy change of a chemical reaction.
2. To introduce the concepts of chemical potential , partial properties ,property relations for ideal gases, fugacity excess properties and to develop the theoretical foundation for applications of thermodynamics to gas mixtures and liquid solutions
3. To perform the phase equilibrium calculations using simple models for VLE, Gamma/Phi approach and equation of state approach
4. To determine the effect of temperature, pressure and initial composition on the equilibrium conversion of chemical reactions

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. To determine the effect of temperature, pressure and initial composition on the equilibrium conversion of chemical reactions
2. Understand the liquid phase properties and to built the models for excess Gibbs energy
3. Apply the Raoults law and modified Raoults law to perform the bubble point and dew point calculations at VLE
4. Evaluate the equilibrium constants and also estimate the equilibrium conversion by using relation between equilibrium constant and composition of species

UNIT I [CO:1] **(12)**

Solution thermodynamics:

Fundamental property relation, chemical potential and equilibrium, partial properties, ideal gas mixture model.

Fugacity and Fugacity coefficients of pure species, and species in solution, generalized correlations for fugacity coefficients.

UNIT II [CO:2] **(12)**

Thermodynamic formulations to VLE:

The ideal solution model, The Lewis/Randall Rule, Excess properties, property changes of mixing. Excess Gibbs energy and activity coefficients.

Data reduction, Thermodynamic Consistency, models for excess Gibbs energy: Margules equations and Van laar equations.The nature of equilibrium, the phase rule: duhems theorem, equilibrium and phase stability

UNIT III [CO:3] **(12)**

Vapor Liquid Equilibrium:

Qualitative behavior of VLE, the Gamma/Phi formulation of VLE, Raoults law, Modified Raoults law: bubble point and dew point calculations, Henrys law and applications.

Topics in Phase Equilibria:

Liquid/Liquid Equilibrium(LLE), Vapor/Liquid/Liquid Equilibrium(VLLE), Solid Liquid Equilibrium(SLE), and Solid/Vapor Equilibrium(SVE).

UNIT IV [CO:4] **(12)**

Chemical Reaction Equilibria:

The reaction coordinate, application of equilibrium criteria to chemical reactions, the standard Gibbs energy change and the equilibrium constant, temperature dependency of equilibrium constant.

Evaluation of equilibrium constants, relation of equilibrium constant to composition, equilibrium conversion for single reactions, Phase rule and Duhems theorem for reacting systems.

LEARNING RESOURCES:

TEXT BOOK:

Introduction to Chemical Engineering Thermodynamics by J.M.Smith, H.C.Vanness and M.M. Abbott, M.T. Swihart 7th Edition (In SI units), Tata McGraw Hill(2004)

REFERENCE BOOK(s):

1. Engineering and Chemcial Thermodynamics by Milo D Koretsky, 2nd Edition, Wiley, 2012
2. Chemical Engineering Thermodynamics by Y.V.C.Rao, University Press(1997)
3. A textbook of Chemical Engineering Thermodynamics by K.V. Narayana, PHI(2009)