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CH306 CHEMICAL ENGINEERING THERMODYNAMICS – II

Course Description & Objectives:

To understand the theory and applications of classical thermodynamics, thermodynamic properties, equations of state, methods used to describe and predict phase equilibria, vapor-Liquid equilibria, Chemical reaction equilibria.

Course Outcomes:

1. *State the thermodynamic equations and explain them for solving actual thermodynamic problems.*
2. *Apply the thermodynamic principles for the chemical process design as well as industrial application.*
3. *Analyse and calculate thermodynamic properties for a given system or process at specified conditions using appropriate thermodynamic approaches.*
4. *Use the Vapor Liquid Equilibrium relations to solve the process separation problems.*
5. *Evaluate the chemical reaction equilibria for the equilibrium conversion/composition calculations.*

UNIT I - Heat Effects

Sensible heat effects, Latent heats of pure substances, standard heat of Reaction, standard heat of formation, standard heat of combustion, Temperature dependence of ΔH° .

UNIT II - Solution Thermodynamics -Theory

Fundamental property relation, The chemical potential and phase equilibria, Partial properties, Ideal gas mixtures, fugacity and fugacity coefficient: pure species, fugacity and fugacity coefficient: species in solution .

UNIT III - Vapor / Liquid Equilibrium

The nature of equilibrium, Phase rule, Duhem's theorem, VLE: Qualitative behaviour, Simple models for VLE, VLE by modified raoult's law.

UNIT IV - Phase Equilibria

Equilibrium and stability, Liquid – Liquid equilibrium, Vapor liquid liquid equilibrium, solid – liquid equilibrium, Solid Vapor equilibrium, equilibrium adsorption of gases on solids.

UNIT V - Chemical Reaction Equilibria

The reaction coordinate, Application of equilibrium criteria to chemical reactions, the Standard Gibbs- energy change and the equilibrium constant, effect of temperature on equilibrium constant, Evaluation of equilibrium constants, Relation of equilibrium constants to composition.

TEXT BOOKS

1. J.M.Smith, H.C.Vanness, "Introduction to Chemical Engineering Thermodynamics", 6th ed., TMH, 2003.
2. Kyle.B.G. "Chemical and Process Thermodynamics", 2nd ed., PHI, 1990.

REFERENCE BOOKS

1. Dodge B.F "Chemical Engineering Thermodynamics", 1st ed., MGH, 1960.
2. Sandler, S.I "Chemical and Engineering Thermodynamics", 2nd ed., Wiley, 1989.