I CHE 351 Chemical Engineering Thermodynamics-II

Course Outlines

- **Title:** Chemical Engineering Thermodynamics-II
- **Code Number:** CHE 351
- **Semester:** 5th
- **Credit hours:** 2
- **Pre-requisites Course:** CHEM125
- **Learning Outcomes:**

  Upon successful completion of the course, the students will be able to:

  1. Understand the phase equilibria and fugacity in the vapour phase, fugacity and activity coefficient in the liquid phase.
  2. Comprehend types of equilibrium, fundamental property relation, the chemical potential and phase equilibria, partial properties, and excess properties.
  3. Solve the thermodynamics properties and phase equilibria problems.

- **Contents**

  Unit I: Equations of State and Intermolecular Forces

  1.1 Introduction
  1.2 Intermolecular Forces, Internal (Molecular) Energy
  1.3 Equations of State
  1.4 Generalized Compressibility Charts
  1.5 Determination of Parameters for Mixtures

  Unit II: Phase Equilibria I: Problem Formulation

  2.1 Introduction
  2.2 Pure Species Phase Equilibrium
  2.3 Roles of Energy and Entropy in Phase Equilibria
  2.4 Pure Component Vapor–Liquid Equilibrium: The Clausius–Clapeyron Equation
  2.5 Thermodynamics of Mixtures
  2.6 The Gibbs–Duhem Equation
  2.7 Property Changes of Mixing

Unit III: Multicomponent Phase Equilibria

3.1 The Chemical Potential—The Criteria for Chemical Equilibrium
3.2 Vapor–Liquid Equilibrium (VLE)
3.3 Fitting Activity Coefficient Models with VLE Data
3.4 Vapor–Liquid Equilibrium Using the Equations of State Method
3.5 Liquid —Liquid Equilibrium: LLE
3.6 Vapor–Liquid — Liquid Equilibrium: VLLE
3.7 Solid–Liquid and Solid–Solid Equilibrium: SLE and SSE

Unit IV: Chemical Reaction Equilibria

4.1 Thermodynamics and Kinetics
4.2 Chemical Reaction and Gibbs Energy
4.3 Equilibrium for a Single Reaction
4.4 Calculation of K from Thermochemical Data
4.5 Relationship Between the Equilibrium Constant and the Concentrations of Reacting Species
4.6 The Equilibrium Constant for a Heterogeneous Reaction

- **Teaching-learning Strategies**

  The teaching and learning strategy has been designed on the understanding of concepts and the ability to critically analyze and apply the learned content through lectures, discussion, activities, case studies using computer, multi-media and writing board instructional aids.
  Lectures: 2 hours per week

- **Assignments- Types and Number with calendar**

  A minimum of two assignments to be submitted before the written exam of Final Term

- **Assessment and Examinations**

Sr. No.	Elements	Weightage	Details

1.	Midterm Assessment	35%	Written examination at the mid-point of the semester.
2.	Formative Assessment	25%	It includes: classroom participation, attendance and assignments.
3.	Final Assessment	40%	Written examination at the end of semester.

- **Textbooks and reference readings**

1. Smith J.M., Van Ness H. C., Abbott M.M., Swihart, M.T. (2022), “Introduction to Chemical Engineering Thermodynamics”, 9th Edition, McGraw Hill.
2. Koretsky M. (2013), “Engineering and Chemical Thermodynamics”, 2nd Edition, Wiley & Sons.
3. Dahm, K.D., Visco, Jr., D.P. (2015). “Fundamentals of Chemical Engineering Thermodynamics, Technology”, Cengage Learning.