

Course Content Prepared By: Dr.V.S.Sistla

1. GENERAL :

1.1 COURSE TITLE: Advanced Chemical Engineering Thermodynamics

1.2 COURSE NUMBER: CH561

1.3 CONTACT HRS: 3-0-0 Credits: 9

1.4 SEMESTER -OFFERED:

1.5 PREREQUISITE: Basic Chemical Engineering Thermodynamics

2. OBJECTIVE: to formulate solutions to phase equilibrium problems for complex systems based on classical and molecular thermodynamics

To relate thermodynamic concepts to applications in the separations, particularly related to petroleum and chemical process industries

3. COURSE CONTENT (Unit wise distribution of content and number of lectures)

Unit-I: Laws of thermodynamics, Entropy calculations, Maxwell relations, Equilibrium and stability (7 lectures)

Unit-II: Thermodynamic properties of single phase, Single and multicomponent systems, Chemical potential, Fugacities, Activities, Activity coefficients (7 lectures)

Unit-III: Solubility of solids/ liquids/ gases in liquids/ gases, Vapour – Liquid equilibria at low and high pressures, Liquid – liquid equilibria, Solid – Vapour – Liquid equilibria, Colligative properties (9 lectures)

Unit-IV: Phase equilibria in polymer solutions, Electrolytes, Chemical equilibria, Equilibrium constants for homogeneous and heterogeneous reactions, Simultaneous reaction and phase equilibria. (8 lectures)

Unit-V: Introduction to molecular thermodynamics, Intermolecular forces, Potential function (9 lectures)

4. READINGS

4.1 TEXT BOOKS:

1. M. Smith, H. C. Van Ness and M. M. Abbott; *Introduction to Chemical Engineering Thermodynamics*, Tata-McGraw Hill (2003).
2. I. Sandler; *Chemical, Biochemical, and Engineering Thermodynamics*, John Wiley & Sons, New Delhi (2007).

3. Koretsky, M. D.; *Engineering and Chemical Thermodynamics*, John Wiley and Sons, New Delhi (2004).
4. Callen, H. B. *Thermodynamics and an Introduction to Thermostatistics*; John Wiley and Sons: New York (1985).
5. Tester, J. W., Modell, M., *Thermodynamics and its Applications*, Prentice-Hall, New Jersey (1996).
6. Y.V. C. Rao; *Chemical Engineering Thermodynamics*, Universities Press (1997).

4.2 REFERENCE BOOKS:

- J. Richard Elliott; Carl T. Lira, "Introductory Chemical Engineering Thermodynamics, 2nd Edition", 2nd edition, Prentice Hall, 2012
- Prauznitz, J.M., R.N. Lichtenthaler, E.G. de Azevedo, "Molecular Thermodynamics of Fluid Phase Equilibria", 3rd ed., Prentice Hall, 1999
- S.M. Walas, "Phase Equilibria in Chemical Engineering", Butterworths, 1985.

5. OUTCOME OF THE COURSE: After the successful completion of the course the students will be able to understand:

- 1.The basic principles of thermodynamics and phase equilibrium
- 2.Understanding fugacity and its application in phase equilibrium calculations
- 3.Handling real world problems with AspenPlus
- 4.Principles and applications of statistical thermodynamics
- 5.Understanding the connections between molecular interactions and thermodynamic properties of fluids