Advanced Engineering Thermodynamics

Review of Basics: First law and Second law analysis – concept of entropy – principle of increase of entropy – entropy generation – Availability – concept of exergy – exergy analysis of combustion processes. Helm Holtz function – Gibb‘s function – OnSagar reciprocity relation. Thermodynamic relations, Maxwell‘s relations, T-dS equations – specific heat relations – energy equation – Joule Thomson effect – Clausius Claperyon Equation. Criteria for Equilibrium – Gibb‘s phase rule – Conditions for stability. Compressibility factor, fugacity and activity, computation from the generalized charts, dependence of fugacity and activity on pressure and temperature, chemical – equilibrium. Phase rule – ideal and real solution of gases, liquids, equilibrium system. Statistical Thermodynamics: Thermodynamics probability, Maxwell statistics, Fermi Dirac and Bose – Einstein statistics, Entropy and probability, Degeneracy of energy levels, Partition functions. Kinetic Theory of Gases: Perfect gas model, Distribution of translational velocities distribution function, molecular collisions and mean free path, equipartition of energy.

Essential Readings:

1. A.S. Michael, *‘Thermodynamic for Engineers’*, Prentice Hall, 1972.
2. P.K. Nag., *‘Engineering Thermodynamics’*, II Ed., McGraw Hill, 1995.

Supplementary Reading:

1. G.J. Van Wylen & R.E. Sonntag., *‘Fundamentals of Classical Thermodynamics’*, Willy Eastern Ltd. 1989 (Unit I, II & III)
2. J.P. Holman, *‘Thermodynamics’*, 4th Ed., McGraw Hill, 1988.
3. J. Hsieg, *‘Principles of Thermodynamics’*, McGraw Hill, 1978.
4. Lee and Sears, *‘Statistical Thermodynamics’*, Addition Wesley, 1976.
5. V. Nastrand, S. Glasstone, *Thermodynamics for Chemists’*, 1974.
6. M.D. Burghardt, *‘Engineering Thermodynamics for Engineers’*, Harper and Row, NY, 1987.
7. K.Wark*, ‘Advanced Thermodynamics for Engineers’*, McGraw Hill, NY, 1987.
8. K. Smith, H.C. Van Ness, *Introduction to Chemical Engineering Thermodynamics*. McGraw Hill, 1987.