

# AMPL05 MATERIAL & ENERGY BALANCE CALCULATIONS

## UNIT-1 MATHEMATICAL PROCEDURES:

- 1.1 Solutions of equations by trial and error,
- 1.2 Simultaneous equations,
- 1.3 Graphical integration and differentiation, use of log-log, semi-log, and triangular graphs, conversion of units.
- 1.4 Stoichiometric and composition relations: Stoichiometric reaction,
- 1.5 Basis of calculations, method of expressing composition of mixture and solutions,
- 1.6 Density and specific gravity.
- 1.7 Behavior of ideal gases and governing equations:
- 1.8 Kinetic theory of gases, application of ideal gas law, gaseous mixtures, gases in chemical reactions.

## UNIT-2 VAPOR PRESSURE

- 2.1 Liquefaction and liquid state, vaporization, boiling point,
- 2.2 Effect of temperature on vapor pressure, vapor pressure plots,
- 2.3 Estimation of critical properties,
- 2.4 Vapor pressures of immiscible liquids and solutions,
- 2.5 Raoult's law and its limitations.
- 2.6 Humidity and saturation: Relative and percent saturation, dew point, wet and dry bulb temperatures, use of humidity charts for solving engineering problems.

## UNIT-3 MATERIAL BALANCES

- 3.1 Law of conservation of mass, mass calculation for chemical and combustion reactions,
- 3.2 Analysis of system with by-pass, recycle and purge-with and without chemical reaction.

## UNIT-4 THERMOPHYSICS:

- 4.1 Concept of energy, energy balance equation, heat capacity of gases, liquids and mixtures in energy balance problems,
- 4.2 Kopp's rule, latent heat, heats of fusion and vapourization,
- 4.3 Trouton's and Kishiyakowsky equations.
- 4.4 Thermochemistry:
- 4.5 Calculation and application of heat reaction, combustion, formation and neutralization in reaction and their heat effect.
- 4.6 Enthalpy concentration charts.

## Reference Books:

1. Basic Principles and Calculations in Chemical Engineering, David Himmelblau Prentice Hall of India
2. Stoichiometry, B. I. Bhatt and Vora, Tata McGraw Hill
3. Stoichiometry and Process Calculations, K. V. Narayanan and B. Lakshmikutty, Prentice-Hall of India Private Limited, New Delhi.