

UCH301 MATERIAL AND ENERGY BALANCES

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3	1	0	3.5

Prerequisite(s): None

Introduction: Role of chemical engineering in industry, Schematic flow sheets including symbols, Unit operations and unit processes with reference to MEB calculations.

Introduction to units systems, Units and dimensions, mole, Specific gravity, Specific volume, Concentrations, Stoichiometry of chemical equations, Mole fraction and weight fraction, Degrees of freedom.

Behaviour of gas and liquid mixtures: Real gases, Bubble point and dew point temperatures, Henry's law, Duhring's plot. Saturation, Partial saturation, Relative saturation.

Material balance calculations: Law of conservation of mass and component. Simple mass balances, Material balance calculations without chemical reactions, Material balance calculations involving chemical reactions, Recycling, Bypass, Purge, Analysis of degree of freedom for material balance problems.

Energy balance calculations: Internal energy, Enthalpy, Heat capacity of gases, liquids, and solids, Latent heats, Heats of formation, combustion, reaction and dissolution, Enthalpy-concentration chart, Fuel heating value, Theoretical flame temperature, Energy balance calculations in unit operations and systems with and without chemical reactions, Humidity and humidity chart, Energy balance calculations in humidification and adiabatic cooling.

Computer aided case studies of material and energy balances of various operations.

Text Books

1. Himmelblau, D.M. and Riggs, J.M., *Basic Principles and Calculations in Chemical Engineering*, Prentice Hall of India (2003) 7th ed.
2. Bhatt, B.I. and Vora, S.M., *Stoichiometry*, Tata McGraw Hill (2004) 4th ed.

Reference Books

1. Hougen, O.A., Watson, K.M. and Ragatz, R.S., *Chemical Process Principles, Volume I*, C.B.S. Publications (2004) 2nd ed.
2. Felder, R.M. and Rousseau, R.W., *Elementary Principles of Chemical Processes*, C.B.S. Publications (2000).