

Mass and Energy Balances

- 1.1 Course Number: CH171
- 1.2 Contact Hours:2-1-0 Credits: 08
- 1.3 Semester-offered: 2nd Year-odd
- 1.4 Prerequisite: Nil
- 1.5 Syllabus Committee Member: Dr. Rakesh Kumar, Dr. Milan Kumar, Dr. Shweta
2. **Objective:** To introduce Chemical Engineering students the basic principles and calculation techniques used in the chemical industries and to acquaint them with the fundamentals of the material and energy balances as applied to Chemical Engineering.

3. **Course Content:**

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-topic	Lectures
1	Introduction	Units and dimensions, Process Parameters and Variables, Material Balances, Basic Features of Chemical Process	2
2	Mass balance in Non-reactive Systems	Material balance calculations for single and multiple units without reactions	4
3	Reactive Systems	Introduction to Chemical Reaction Stoichiometry, Material balance calculations for single units with a single and multiple reactions, Material balance calculations for multiple units with reactions, Combustion reactions, Systems with recycle, bypass and purge	6
4	Multi-phase system	Phase equilibrium, Humidity and Saturation, Psychrometric chart, Condensation and vaporization	3
5	Energy balance in non-reactive systems	Mechanical energy balance, Heat of formation, Single and multi-phase systems, heat of solution, phase change processes, estimating latent heats	7
6	Reactive Systems	Heat of reaction, heat of combustion	3
7	Transient processes	Unsteady state material and energy balances	3
		Total	28

4. Readings

4.1 Textbook:

1. Richard M. Felder, Ronald W. Rousseau, "Elementary Principles of Chemical Processes" 4th Edition", Wiley, 2015
2. David M. Himmelblau, James B. Riggs, "Basic Principles and Calculations in Chemical Engineering", Pearson Education India; 8th Edition, 2015

4.2 Reference books:

1. Mark E. Schlesinger, "Mass and Energy Balances in Materials Engineering", Pearson, 1995

5 Outcome of the Course:

This course will enable students to learn the basics of material and energy balances and their applications in chemical and process industries by using examples primarily based on chemical engineering operations.