

**Module title: Mass and Energy Balances**

**Module Code: 24-18-201-01**

**Module Credit: 4**

**Term:** First Term 1397-98

**Lecturer:** Prof. A. Samimi  
a.samimi@eng.usb.ac.ir

**Lecturing time:** Sat. (7:30-9:30) and Mon. (7.30-9:00)

**Assessments:** 20% mid-term 1 exam  
25% mid-term 2 exam  
40% final exam  
10% Quiz  
5% home works

**Class attendance:** REGULAR ATTENDING IS IMPORTANT AND EACH SESSION YOUR ATTENDANCE WILL BE CHECKED

**References:** **Basic Principles and Calculations in Chemical Engineering (7<sup>th</sup> Edition)**  
David M. Himmelblau  
ISBN: 0-13-305798-4  
©2004  
**Elementary Principles of Chemical Processes (3<sup>rd</sup> Edition)**  
Richard M. Felder  
Ronald W. Rousseau  
ISBN 0-471-53478-1  
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## **Module Subjects:**

### **Introduction to chemical Engineering:**

**1<sup>st</sup>. week:** Introduction to Chemical Engineering and Mass and Energy Balances

**2<sup>nd</sup>. week:** Unit and Dimensions, Unit Conversion and conversion factors, Dimensional Analysis and Dimensional Consistency

**3<sup>rd</sup>. week:** Mole Unit, Density and Specific Gravity, Concentration, mass and mole fractions, Basis, Temperature and Pressure, and their units.

**4<sup>th</sup>. week:** Stoichiometry, Reaction Equation, Limiting and Excess Reactants

### **Material Balances:**

**5<sup>th</sup>. week:** The Concept of Material Balance, Open and Closed Systems, Steady-state and Unsteady-state systems. Program of Analysis of Material Balance Problems and strategy for solving them,

**6<sup>th</sup>. week:** Solving Material Balances with and without Chemical Reactions for single units, *First Mid-Term Exam*,

**7<sup>th</sup>. week:** Solving Material Balances with and without Chemical Reactions for multiple units

**8<sup>th</sup>. week:** Recycle, Bypass and Purge Calculations

### **Gases, Vapors, Liquids and Solids:**

**9<sup>th</sup>. week:** Ideal Gas Relationship, Define the Law of Corresponding State, Critical State

**10<sup>th</sup>. week:** Real Gas Relationships, Reduced temperature and pressure, the compressibility factor

**11<sup>th</sup>. week:** Phase Diagrams, Vapor Pressure, Saturation, Vapor-Liquid Equilibrium, Partial Saturation and Humidity, *Second Mid-term Exam*,

### **Energy Balances:**

**12<sup>th</sup>. week:** The concept of Conversion Energy, Enthalpy Change, Work and Other Types of Energy

**13<sup>th</sup>. week:** Energy Balances With and Without Reactions for open and closed system, Steady and Unsteady States Energy Balances.

**14<sup>th</sup>. week:** Mechanical Energy Balances, Ideal Reversible Processes

**15<sup>th</sup>. week:** Humidity Charts and Their Uses (Psychrometric Charts).

**16<sup>th</sup>. week:** Solving complicated Problems of Mass and Energy Balances, Preparation for *Final Term Exam*