

**Virginia Western Community College**  
**EGR 231**  
**Mass and Energy Balances**

**Prerequisites**

MTH 264, EGR 121, CHM 112 (grade of C or higher in these courses)

**Corequisites**

none

**Course Description**

Introduces the field of chemical engineering and how material and energy balances are applied to chemical processes, and physical and thermodynamic properties of multi-component systems.

**Semester Credits: 3   Lecture Hours: 3   Lab/Clinical/Internship Hours: 0**

**Required Materials****Textbooks:**

Elementary Principles of Chemical Processes 3rd Edition, Richard M. Felder & Ronald W. Rousseau, ISBN: 978-0471687573

**Other Required Materials:**

Engineering paper  
Scientific or graphing calculator

**General Course Purpose**

This course instructs future chemical engineers in integrating knowledge of chemistry, math, and physics to address real-world problems, tackling complex issues by understanding the physical context and formulating the necessary equations.

See: <https://courses.vccs.edu/courses/EGR231-MassandEnergyBalances/detail>

**Course Outcomes**

**At the completion of this course, the student should be able to utilize the following:**

- Civic Engagement
  - Relate chemical engineering concepts to the development and manufacturing of products highly valued by society
- Critical Thinking
  - Break complex processes into component parts
  - Establish relationships between known and unknown variables
- Professional Readiness
  - Integrate knowledge of chemistry, math, and physics to address real-world chemical engineering problems
- Quantitative Literacy
  - Analyze material and energy balances in chemical processes
  - Gather essential chemical process data and solve balances using computational methods

### Topical Description

- Introduction to Chemical Engineering
  - Discuss and appreciate the variety and complexity of problems that chemical, biochemical, and process engineers are asked to solve
- Introduction to Chemical Engineering Calculations
  - Perform basic engineering calculations including converting quantities from one set of units to another
- Processes and Process Variables
  - Define, calculate and estimate properties of process materials including fluid density, flow rate, chemical composition (mass and mole fractions, concentrations), fluid pressure, and temperature
- Fundamentals of Material Balances
  - Perform material balance calculations by drawing and labeling process flowcharts from verbal process descriptions and completing degree-of-freedom analyses
  - Write and solve material and energy balance equations for single-unit and multiple-unit processes, processes with recycle and bypass, and reactive processes
- Single-Phase Systems
  - Apply the principles of physical chemistry and thermodynamics to perform pressure-volume-temperature calculations for ideal and non-ideal gasses
- Multi-phase Systems
  - Perform vapor-liquid equilibrium calculations for systems containing one condensable component and for ideal multi-component solutions
- Energy and Energy Balances
  - Use physical properties of chemical compounds e.g., melting temperature, vapor pressure, heat capacity together with materials and energy balances to solve chemical process problems
- Balances on Non-reactive Systems
  - Write and solve material and energy balance equations for non-reactive processes
- Balances on Reactive Systems
  - Write and solve material and energy balance equations for reactive processes

### Notes to Instructors

- All instructors teaching this course in any given semester will use the same textbooks.
- The content of this course will be updated every few years in collaboration with engineering faculty from across the VCCS.

[ADA Statement](#) (PDF)

[Title IX Statement](#) (PDF)