



ChE 210 Process Analysis

*Dept. of Chemical Engineering and Materials Science
School of Engineering and Science
Spring 2023*

Meeting Times: Tuesdays 12:30 – 01:45 pm
 Thursdays 11:00 – 12:15 pm

Classroom Location: Tuesdays: Burchard 715; Thursdays: North Building 104

Instructor: Professor Adeniyi Lawal

Contact Info: McLean 103C, alawal@stevens.edu, x8241

Office Hours: 03:30 – 05:30 pm Mondays
 02:30 – 04:30 pm Thursdays

Teaching Assistant: Danna Yan

Contact Info: McLean B007, dyan2@stevens.edu, (551) 233-3422

Office Hours: 10:00 am – 12:00 pm Tuesdays
 12:00 pm – 02:00 pm Fridays

Course Web Address: Not Applicable

Prerequisite(s): Ch 116 General Chemistry II

Co-requisite(s) Ma 221 Differential Equations

Cross-listed with: Not Applicable

COURSE DESCRIPTION

The objective of this course is to train students in the application of the basic concepts of material and energy balances in chemical process design. Equations of state for ideal and real gases, including mixtures, will be covered. Multiphase systems will also be studied.

LEARNING OBJECTIVES

After successful completion of this course, students will be able to

- Determine or calculate process variables from direct measurements or physical properties.
- Formulate and solve material balance equations for both physical and reactive processes.
- Determine physical properties and PVT behavior of single-phase systems.
- Sketch, label, and explain phase diagrams for pure-/multi-component multi-phase systems.
- Apply Raoult's law and Henry's law for calculation of any of appropriate state variables such as T, P, mole fractions, given values of the others.
- Formulate and solve energy balance equations for non-reactive processes.
- Formulate and solve energy balance equations for reactive processes.
- Perform mathematical calculations using fundamental problem-solving tools.

FORMAT AND STRUCTURE

- The format of the course will be lectures interspersed with problem sessions. The problem sessions will be held on Thursdays and the questions for the problem session will be assigned from the course text about one week prior to the problem session. Both lectures and problem sessions will be given by the instructor.
- For each chapter of the course text, students will be provided with typewritten lecture notes as handouts. The lecture notes are a summary of the material for each chapter of the text.
- Homework will be assigned each week, starting from about the second week.
- All grading (homework as well as all exams) will be done by the course TA, aided by graders as necessary.

COURSE MATERIALS

Required Textbook: Felder, R. M., Rousseau, R. W. and Bullard, L. G., “Elementary Principles of Chemical Processes”, 4th Edition, John Wiley & Sons, Inc. NY (2016).

Reference Text: Himmelblau, D. M. and Riggs, J. B., “Basic Principles and Calculations in Chemical Engineering,” Prentice Hall PTR, 8th Edition (2012)

Supplementary Material: LearnChemE – Educational Resources for Chemical Engineering
<http://www.learncheme.com/>

COURSE REQUIREMENTS

Policy on Use of Cell Phones in Class

Cell phone use in the class is strictly prohibited. Compliance will be greatly appreciated.

Homework *Homework will be assigned every week starting from week of January 23. The assignments will be posted on Canvas, but submission will be on paper, to the TA. The homework will be due a week from the available date. The homework with the worst grade will be dropped. Collaboration on homework is not allowed and homework assignments cannot be shared with other parties, internal or external to Stevens. Any such action will be treated as Honor Code violation.*

Exams

Exam I	(Chapters 2 & 3; 2 Questions, 1 ¼ hr.)	14 th February
Exam II	(Chapter 4; 2 Questions, 1 ¼ hr.)	21 st March
Exam III	(Chapters 5 & 6; 2 Questions, 1 ¼ hr.)	18 th April
Final Examination	(Cumulative, 4 Questions, 3 hours)	Registrar

All exams are open-book (required text only, see above), open-notes (lecture notes, student’s own hand-written notes), and graded homework (hardcopy only).

A review session will be held on the Wednesday preceding each exam.

GRADING PROCEDURES

Grades will be based on:

Homework (One homework will be dropped)	20%
3 In-semester Exams (15% each)	45%
Final Exam	35%
Total	100%

Extra Credit (1-page summary of each LearnChemE video assignment) 2%
(All assignments submitted)

Possible Total 102%

ACADEMIC INTEGRITY

Undergraduate Honor System

Enrollment into the undergraduate class of Stevens Institute of Technology signifies a student's commitment to the Honor System. Accordingly, the provisions of the Stevens Honor System apply to all undergraduate students in coursework and Honor Board proceedings. It is the responsibility of each student to become acquainted with and to uphold the ideals set forth in the [Honor System Constitution](#). More information about the Honor System including the constitution, bylaws, investigative procedures, and the penalty matrix can be found online at <http://web.stevens.edu/honor/>

The following pledge shall be written in full and signed by every student on all submitted work (including, but not limited to, homework, projects, lab reports, code, quizzes and exams) that is assigned by the course instructor. No work shall be graded unless the pledge is written in full and signed.

"I pledge my honor that I have abided by the Stevens Honor System."

Reporting Honor System Violations

Students who believe a violation of the Honor System has been committed should report it within ten business days of the suspected violation. Students have the option to remain anonymous and can report violations online at www.stevens.edu/honor.

EXAM ROOM CONDITIONS

The following procedures apply to quizzes and exams for this course. As the instructor, I reserve the right to modify any conditions set forth below by printing revised Exam Room Conditions on the quiz or exam.

1. Students may use the following devices during exams. Any electronic devices that are not mentioned in the list below are not permitted.

Device	Permitted?	
	Yes	No
Laptops (to access e-book only)	x	
Cell Phones		x
Tablets (to access e-book only)	x	
Smart Watches		x
Google Glass		x
Other (specify)		

2. Students may use the following materials during exams. Any materials that are not mentioned in the list below are not permitted.

Material	Permitted?	
	Yes	No
Handwritten Notes <i>Conditions: Not copied from sources other than class</i>	x	

Typed Notes <i>Conditions: Only lecture notes provided by instructor are allowed</i>	X	
Textbooks <i>Conditions: Only required text (see above)</i>	X	
Readings <i>Conditions:</i>		X
Other (specify)		

3. Students are not allowed to work with or talk to other students during quizzes and/or exams.

LEARNING ACCOMODATIONS

Stevens Institute of Technology is dedicated to providing appropriate accommodations to students with documented disabilities. Student Counseling and Disability Services works with undergraduate and graduate students with learning disabilities, attention deficit-hyperactivity disorders, physical disabilities, sensory impairments, and psychiatric disorders in order to help students achieve their academic and personal potential. They facilitate equal access to the educational programs and opportunities offered at Stevens and coordinate reasonable accommodations for eligible students. These services are designed to encourage independence and self-advocacy with support from SCDS staff. The SCDS staff will facilitate the provision of accommodations on a case-by-case basis. These academic accommodations are provided at no cost to the student.

Disability Services Confidentiality Policy

Student Disability Files are kept separate from academic files and are stored in a secure location within the office of Student Counseling, Psychological & Disability Services. The Family Educational Rights Privacy Act (FERPA, 20 U.S.C. 1232g; 34CFR, Part 99) regulates disclosure of disability documentation and records maintained by Stevens Disability Services. According to this act, prior written consent by the student is required before our Disability Services office may release disability documentation or records to anyone. An exception is made in unusual circumstances, such as the case of health and safety emergencies.

For more information about Disability Services and the process to receive accommodations, visit <https://www.stevens.edu/sit/counseling/disability-services>. If you have any questions please contact:

Lauren Poleyeff, Psy.M., LCSW - Disability Services Coordinator and Staff Clinician in Student Counseling and Disability Services at Stevens Institute of Technology at lpoleyef@stevens.edu or by phone (201) 216-8728.

INCLUSIVITY STATEMENT

Stevens Institute of Technology believes that diversity and inclusiveness are essential to excellence in education and innovation. Our community represents a rich variety of backgrounds, experiences, demographics and perspectives and Stevens is committed to fostering a learning environment where every individual is respected and engaged. To facilitate a dynamic and inclusive educational experience, we ask all members of the community to:

- be open to the perspectives of others
- appreciate the uniqueness their colleagues
- take advantage of the opportunity to learn from each other
- exchange experiences, values and beliefs
- communicate in a respectful manner
- be aware of individuals who are marginalized and involve them
- keep confidential discussions private

TENTATIVE COURSE SCHEDULE

- The course schedule, if needed, will be revised as the course progresses. Changes will be communicated via Canvas.

Week Starting	Topic(s)	Readings	Assignment
January 15	Introduction to Chemical Engineering; Introduction to Engineering Calculations	Required: Textbook Ch. 2 Sections 2.1 – 2.3	
January 22	Introduction to Engineering Calculations	Required: Textbook Ch. 2 Sections 2.4 – 2.6	
January 29	Introduction to Engineering Calculations; Process and Process Variables	Required: Textbook Ch. 2 Section 2.7; Ch. 3 Sections 3.1 – 3.3	HW #1 due 1/31
February 5	Process and Process Variables; Fundamentals of Material Balances	Required: Textbook Ch. 3 Sections 3.4 – 3.6; Ch. 4 Sections 4.1 – 4.2	HW #2 due 2/7
February 12	Fundamentals of Material Balances	Required: Textbook Ch. 4 Sections 4.3 – 4.4	HW #3 due 2/14 Review for Exam I on 2/08
February 19	Fundamentals of Material Balances	Required: Textbook Ch. 4 Sections 4.5 – 4.7	HW #4 due 2/21 Exam I on 2/14
February 26	Fundamentals of Material Balances	Required: Textbook Ch. 4 Sections 4.8 – 4.10	HW #5 due 2/28
March 5	Fundamentals of Material Balances	Required: Textbook Ch. 5 Sections 5.1 – 5.2	HW #6 due 3/7 Review for Exam II on 3/08
March 12	Spring Break	Spring Break	Spring Break
March 19	Fundamentals of Material Balances; Single-Phase Systems	Required: Textbook Ch. 5 Sections 5.3 – 5.4	HW #7 due 3/21 Exam II on 3/21
March 26	Single-phase Systems; Multi-phase Systems	Required: Textbook Ch. 6 Sections 6.1 – 6.2	HW #8 due 3/28
April 2	Multi-phase Systems	Required: Textbook Ch. 6 Sections 6.3 – 6.4; Ch. 7 Sections 7.1 – 7.4	HW #9 due 4/4
April 9	Multi-phase Systems; Energy and Energy Balances	Required: Textbook Ch. 7 Sections 7.5 – 7.7; Ch. 8 Sections 8.1 – 8.3	HW #10 due 4/11 Review for Exam III on 4/12
April 16	Energy and Energy Balances; Balances on Nonreactive Processes	Required: Textbook Ch. 8 Sections 8.4 – 8.5; Ch. 9 Sections 9.1 – 9.2	HW #11 due 4/18 Exam III on 4/18
April 23	Balances on Nonreactive Processes; Balances on Reactive Processes	Required: Textbook Ch. 9 Sections 9.3 – 9.6.	HW #12 due 4/25
April 30	Balances on Reactive Processes	Required: None	HW #13 due 5/2