Separation and Mass Transfer Operations

ECH 4403 Section 11208
Class Periods: MWF | Period 7 (1:55 PM – 2:45 PM)
Location: FLG 280
Academic Term: Fall 2025

Instructor:

Kirk Ziegler
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Office Hours: MW 11 – 12:30

Supervised Teacher:

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TBD
Office Hours: TBD

Course Description

Theory, design and evaluation of diffusional and staged mass transfer processes, including distillation, absorption and extraction, leaching and membrane separations, computer-aided design methods. (Credits: 3)

Course Pre-Requisites / Co-Requisites

All students should have successfully passed Process Thermodynamics (ECH 3101), Fluid and Solid Operations (ECH 3203), and Energy Transfer Operations (ECH 3223) prior to enrollment.

Course Objectives

Broadly, at the end of this course, a student should be able to do the following:

- Explain the fundamentals of chemical engineering separation processes.
- Design distillation equipment for binary or multicomponent mixtures in continuous and batch operation.
- Design adsorption or stripping operations.
- Design liquid-liquid extraction operations.
- Design distillation equipment for complex (azeotropic) distillation systems.

In addition to these learning objectives, the assignments are designed to develop the following skills, which are characteristic of real-world problems, and therefore essential for any practicing chemical engineer:

- Read, interpret, and follow directions, prompts, and problem statements.
- Detect and disregard superfluous given information.
- Use resources to find extra information, which is needed, but not given.
- Brainstorm reasons for unexpected behavior (troubleshooting).

Materials and Supply Fees

None

Relation to Program Outcomes (ABET):

The contribution of the course to meeting the professional components of the ABET-accredited degree is:

Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	High

2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	High
3. An ability to communicate effectively with a range of audiences	
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	Medium
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	Low

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not covered or assessed in the course.

Required Textbooks and Software

- Title: Unit Operations of Chemical Engineering
  Author: McCabe, Smith and Harriott
  Publication date and edition: 2004 and 7th edition
  ISBN number: 0-07-284823-5

  NOTE: There are some significant edits that are needed, which are available at the E-learning site.

- **Microsoft Excel** and/or Python will be needed for some homework assignments. Therefore, you will need access to this software on your personal laptop.

- Kritik is a software program available at kritik.io. Kritik is a peer assessment tool that will be used for completing homework assignments and assessing the work of other students.

Recommended Materials

- Separation Process Essentials (1st Ed.) by Alan M. Lane (CRC Press), ISBN 978-1138086081

Required Computer

Recommended Computer Specifications: https://it.ufl.edu/get-help/student-computer-recommendations/
HWCOE Computer Requirements: https://www.eng.ufl.edu/students/advising/fall-semester-checklist/computer-requirements/

Tentative Course Schedule

	Week	Lectures	Reading assignments
First Exam	1	Introduction to Separations/ Principles of Mass Transfer	Chapter 17
	2	Principles of Mass Transfer	Chapter 17
	3	Principles of Mass Transfer	Chapter 17
	4	Absorption/Stripping	Chapter 18
	5	Absorption/Stripping	Chapter 18
Tentative	**10/7**	**EXAM (evening E2-E3)**	

	Week	Lectures	Reading assignments
Second Exam	6	Humidification/Drying	Chapter 19
	7	Humidification/Drying	Chapter 19
	8	Equilibrium Stages	Chapter 20
	9	Distillation	Chapter 21
	10	Distillation	Chapter 21
Tentative	**11/6**	**EXAM (evening E2-E3)**	

	Week	Lectures	Reading assignments
Third Exam	11	Multi-Component Distillation	Chapter 22
	12	Liquid-liquid Extraction	Chapter 23
	13	Liquid-liquid Extraction	Chapter 23
	14	Leaching	Chapter 23
	12/2	**EXAM (evening E2-E3)**	

Attendance Policy, Class Expectations, and Make-Up Policy

Attendance of all lectures is highly recommended. It is the student's responsibility to obtain any notes, assignments, etc. that they may have missed during their absence. Repeated absences may lead to a lower grade in the class. Excused absences must be consistent with university policies in the undergraduate catalog (https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/) and require appropriate documentation.

As a courtesy to the other students and to the instructor, the students should turn off the ringers for all cell phones during class and they should not answer incoming calls. If a student is expecting an emergency call, please notify the instructor prior to class.

Students who do not attend an exam at the scheduled time will receive a score of zero for that exam. Exceptions will be made only in extraordinary circumstances, such as religious holidays or emergencies. It is required that, whenever possible, the student notifies the instructor about the situation prior to the exam, preferably at least two weeks in advance.

Evaluation of Grades

Assignment	Percentage of Final Grade
Homework	5%
Quizzes	20%
Exam 1	25%
Exam 2	25%
Exam 3	25%
	100%

Homework: Homework will be assigned throughout the semester. The homework solutions will be posted on the class website after the assignment due date but before any quizzes on the material. Students will submit their assignments through Kritik on the E-learning website. To receive full credit for the assignment, students will need to create the assignment, evaluate the work of other students, and submit feedback. For each assignment, the instructor will select a subset of problems assigned for evaluation.

Quizzes: Quizzes will be assigned throughout the semester. The material on quizzes will cover problems closely related to the previous homework assignment. No make-up quizzes will be given. Excused absences will not count against the final grade. Each quiz is equally weighted. All quizzes will be approximately 15 – 20 min and be closed book and closed notes.

Exams: Each exam will be open book and open notes. No credit will be given for problems that have a solution but all the work leading to this solution is not shown.

Grading Policy

Percent	Grade	Grade Points
93.4 - 100	A	4.00
90.0 - 93.3	A-	3.67
86.7 - 89.9	B+	3.33
83.4 - 86.6	B	3.00
80.0 - 83.3	B-	2.67
76.7 - 79.9	C+	2.33
73.4 - 76.6	C	2.00
70.0 - 73.3	C-	1.67
66.7 - 69.9	D+	1.33
63.4 - 66.6	D	1.00
60.0 - 63.3	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:
https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

Academic Policies & Resources

To support consistent and accessible communication of university-wide student resources, this link contains academic policies and campus resources: https://go.ufl.edu/syllabuspolicies.

Commitment to a Positive Learning Environment

The Herbert Wertheim College of Engineering values varied perspectives and lived experiences within our community and is committed to supporting the University's core values.

If you feel like your performance in class is being impacted, please contact your instructor or any of the following:

- Your academic advisor or Undergraduate Coordinator
- HWCOE Human Resources, 352-392-0904, student-support-hr@eng.ufl.edu
- Pam Dickrell, Associate Dean of Student Affairs, 352-392-2177, pld@ufl.edu

University Honesty Policy

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied:

On my honor, I have neither given nor received unauthorized aid in doing this assignment.

The Honor Code (https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

A non-passing letter grade will be assigned to students who violate academic honesty standards, regardless of the violator's performance on exams, quizzes, and homework assignments. Official sanctions issued by the Office of Student Judicial Affairs will become permanently noted in the student's official transcript.