

CHEN3220 Chemical Engineering Separations - Syllabus

Spring 2026

<u>Class</u>	Lecture 8:30-9:20 MWF in A108	
<u>Class email</u>	CHEN3220@colorado.edu	
<u>Instructor</u>	Cody Ritt	cody.ritt@colorado.edu
<u>Advanced TA</u>	Sam Andrzejewski	samuel.andrzejewski@colorado.edu
<u>TA</u>	Dylan Barton	dylan.barton-2@colorado.edu
<u>CAs</u>	Avery Holdren Rebecca Rhodes Abe Wiletsky Devin O'Donnell	avery.holdren@colorado.edu rebecca.rhodes@colorado.edu abwi2062@colorado.edu devin.odonnell@colorado.edu

Office Hours (subject to change)

- **Monday 5:00-7:00 pm in E1B11***
 - *B231 on Mon 3/2
- **Tuesday 4:00-6:30 pm in A104**
- **Friday 9:30-11:00 am in A108***
 - *A104 on Fri 3/20

Text *Separation Process Principles: With Applications Using Process Simulators, 4th Edition* by J. D. Seader, Ernest J. Henley, D. Keith Roper

Course Description

Studies separation methods including distillation, absorption, and extraction, and graphical and computer-based solutions to separation problems. Applies mass transfer rate theory to packed and tray columns. Prereq., CHEN 3210 and CHEN 3320 or MCEN 3022.

Course Objectives

Students will be able to:

- Explain what constitutes a separation, and use the common metrics for assessing the performance of a separation process (e.g. product purity, product recovery, etc.).
- Apply concepts from mass transfer and thermodynamics to the design and analysis of transport-limited separation processes.
- Classify the major production-scale equilibrium and non-equilibrium separation methods used in industry (e.g. distillation, absorption, stripping, extraction, adsorption, membranes, and others), and explain the principles behind how each method works.
- For a specific separation need, make a preliminary choice of a separation method and predict separation performance using equilibrium data, mass balances, and energy balances.

- Predict qualitatively how changing an operating parameter or design parameter will affect separation performance.
- Utilize commercial simulation software such as Aspen Plus and Aspen HYSYS to model different separation systems.

Grading Breakdown

Clicker Quizzes (drop lowest 4)	10 %
Homework	10 %
Projects	20 %
Peer Reviews	10 %
Midterm Exams	30 %
Final Exam	20 %

Grading Basis

90 / 93.33 / 100 %	A-, A
80 / 83.33 / 86.67 / 89.99 %	B-, B, B+
70 / 73.33 / 76.67 / 79.99 %	C-, C, C+
60 / 63.33 / 66.67 / 69.99 %	D-, D, D+
< 60%	F

Exams

- Midterm Exam 1 on Monday, February 16th from 7-9pm in BIOT (seating chart will be sent to students closer to the exam; students with 1.5x time from 6:00-9:00pm).
- Midterm Exam 2 on Monday, April 6th from 7-9pm in BIOT (seating chart will be sent to students closer to the exam; students with 1.5x time from 6:00-9:00pm).
- Final Exam on Monday, April 27th from 7:30 pm – 10:00 pm.

Projects

Students will complete two projects, one on equilibrium separations and one on non-equilibrium separations. Details on projects will be given in class. Students may work individually or in teams of either two or three students on each project.

Teams

Students may work individually, in groups of two, or in groups of three on homework and projects. No groups of four will be allowed. It is the responsibility of every student to determine their team. Instructors will not determine teams but maintain the option to reorganize teams as necessary, potentially resulting in some students working with fewer team members or on their own.

Peer-Review

Instructors determine the final allocation of points, but heavily consider peer-review input. It is extremely important that everyone contributes to important aspects of group work. Students do not want to receive poor peer reviews because they did not have a lot of responsibility – take responsibility and come through for the team! Students will be asked to turn in written peer-review assessments to the instructors regarding their team effort. It cannot be overemphasized how important it is for the team to be functional and bring out the best in all members.

Homework

Written work must be neat and readable with adequate spacing and margins. Homework written on notebook paper is acceptable, the frills from the edge of the sheets must be removed prior to submission. Multiple sheets must be stapled together. Points will be deducted by TAs if they cannot read homework, find answers (box your answers!), or if the submission formatting detailed above is not followed. Homework will be turned in to Gradescope either individually or in groups of 2 or 3 people. Homework will be graded primarily on the process so showing your work is critical.

Clickers (in-person)

Clickers will be utilized during class. Students must click in person themselves in A108 to receive clicker points; students cannot have someone else click for them unless it has been pre-authorized by the

instructor. Each question is worth two points: one point for answering, one point for getting the correct answer. The lowest four (4) clicker scores will be dropped.

Late Work

If you are having difficulties, please let the instructors know *before* due dates so we can work out a solution together; we understand you have quite a few priorities and are happy to work together so reach out to us! Homework and project folders close at the stated times; no late work will be accepted except in the case of a documented emergency, a medical situation, or when it has been prearranged with the instructors.

Course Communication

All class slides, homework, and videos will be placed on Canvas for students to download.

Use of Artificial Intelligence (AI)

There are many tools that make computations much easier, including AI. The potential problem is if engineers are using these tools without understanding the meaning behind them, which can lead to misinterpretation of results, inaccurate calculations, and flawed design. For this reason, students are NOT allowed to use AI for solving homework problems, though students can use AI to check answers. Be sure you understand how to solve problems by hand; you will NOT be able to use AI tools exams or quizzes, which make up 60% of the points in this course.

University Policies

University Policies can be found [here](#).

Classroom Behavior

Students and faculty are responsible for maintaining an appropriate learning environment in all instructional settings, whether in person, remote, or online. Failure to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, marital status, political affiliation, or political philosophy.

Additional classroom behavior information

- [Student Classroom and Course-Related Behavior Policy](#).
- [Student Code of Conduct](#).
- [Office of Institutional Equity and Compliance](#).
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- [Office of Institutional Equity and Compliance](#).

Accommodation for Disabilities

If you qualify for accommodations because of a disability, please submit your accommodation letter from Disability Services to your faculty member in a timely manner so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities in the academic environment. Information on requesting accommodations is located on the [Disability Services website](#). Contact Disability Services at 303-492-8671 or dsinfo@colorado.edu for further assistance. If you have a temporary medical condition, see [Temporary Medical Conditions](#) on the Disability Services website.

Accommodation for Religious Obligations

Campus policy requires faculty to provide reasonable accommodations for students who, because of religious obligations, have conflicts with scheduled exams, assignments, or required attendance. Please communicate the need for a religious accommodation in a timely manner. See the [campus policy regarding religious observances](#) for full details.

Preferred Student Names and Pronouns

CU Boulder recognizes that students' legal information does not always align with how they identify. If you wish to have your preferred name (rather than your legal name) and/or your preferred pronouns appear on your instructors' class rosters and in Canvas, visit the [Registrar's website](#) for instructions on how to change your personal information in university systems.

Honor Code

All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the [Honor Code](#). Violations of the Honor Code may include but are not limited to: plagiarism (including use of paper writing services or technology [such as essay bots]), cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, clicker fraud, submitting the same or similar work in more than one course without permission from all course instructors involved, and aiding academic dishonesty. Understanding the course's syllabus is a vital part of adhering to the Honor Code.

All incidents of academic misconduct will be reported to Student Conduct & Conflict Resolution: StudentConduct@colorado.edu. Students found responsible for violating the Honor Code will be assigned resolution outcomes from Student Conduct & Conflict Resolution and will be subject to academic sanctions from the faculty member. Visit [Honor Code](#) for more information on the academic integrity policy.

Sexual Misconduct, Discrimination, Harassment and/or Related Retaliation

CU Boulder is committed to fostering an inclusive and welcoming learning, working, and living environment. University policy prohibits [protected-class](#) discrimination and harassment, sexual misconduct (harassment, exploitation, and assault), intimate partner abuse (dating or domestic violence), stalking, and related retaliation by or against members of our community on- and off-campus. The Office of Institutional Equity and Compliance (OIEC) addresses these concerns, and individuals who have been subjected to misconduct can contact OIEC at 303-492-2127 or email OIEC@colorado.edu. Information about university policies, [reporting options](#), and [OIEC support resources](#) including confidential services can be found on the [OIEC website](#).

Please know that faculty and graduate instructors are required to inform OIEC when they are made aware of incidents related to these concerns regardless of when or where something occurred. This is to ensure the person impacted receives outreach from OIEC about resolution options and support resources. To learn more about reporting and support a variety of concerns, visit the [Don't Ignore It page](#).

Mental Health and Wellness

The University of Colorado Boulder is committed to the well-being of all students. If you are struggling with personal stressors, mental health or substance use concerns that are impacting academic or daily life, please contact [Counseling and Psychiatric Services \(CAPS\)](#), located in C4C, or call (303) 492-2277, 24/7.

CHEN 3220 Schedule – Spring 2026 (SUBJECT TO CHANGE!!!)

Look for Screencasts on topics at <https://learncheme.com/screencasts/separations-mass-transfer/>

DATE	COURSE PLAN	ASSIGNMENTS	TEXTBOOK CHAPTERS
January 9 (Fri)	1, Intro; review of separation techniques		Ch 1
January 12 (Mon)	2, Review of Mass Transfer & Batch Distillation		Ch 13
January 14 (Wed)	3, Batch Distillation (cont'd)		Ch 13
January 16 (Fri)	4, Batch Distillation	HW1 – Due Tue 1/20	Ch 13
January 19 (Mon)	NO CLASS – MLK Jr. Day		
January 21 (Wed)	5, Membranes		Ch 14
January 23 (Fri)	6, Membranes (cont'd)		Ch 14
January 26 (Mon)	7, Membranes (cont'd)		Ch 14
January 28 (Wed)	8, Adsorption	HW2 – Due Wed 1/28	Ch 4.8, 15.0-15.6
January 30 (Fri)	9, Adsorption (cont'd)		Ch 4.8, 15.0-15.6
February 2 (Mon)	10, Adsorption (cont'd)		Ch 4.8, 15.0-15.6
February 4 (Wed)	11, Ion Exchange	HW3 – Due Wed 2/4	Ch 15.7
February 6 (Fri)	12, Chromatography		Ch 15.8
February 9 (Mon)	13, Review of Vapor-Liquid Equilibrium (VLE)		Ch 4.0-4.2
February 11 (Wed)	14, Aspen for VLE; K Values	HW4 – Due Wed 2/11	Ch 2.1, 2.11 (2.2-2.10)
February 13 (Fri)	15, Binary Flash Distillation	Review for Exam 1 (TBD)	Ch 4.3.0-4.3.3
February 16 (Mon)	Midterm Exam 1: Monday 7:00 – 9:00 pm		
February 18 (Wed)	NO CLASS		
February 20 (Fri)	17, Multicomponent Flash Dist		Ch 4.3.4-4.3.5
February 23 (Mon)	18, Binary Column Dist, External Balances		Ch 5.0, 5.1, 5.3, 7.0-7.2.0
February 25 (Wed)	19, McCabe Thiele Internal Balances	Project 1 – Due 2/25	Ch 7.2.1-7.2.2
February 27 (Fri)	20, McCabe Thiele Internal Balances (cont'd)		
March 2 (Mon)	21, Feed Stage, Partial vs Total Condensers/Reboilers		Ch 7.2.3, 7.2.4, 7.3.2, 7.3.4
March 4 (Wed)	22, Feed Quality, Total & Minimum Reflux (i.e. Limiting Conditions)	HW5 – Due Wed 3/4	Ch 7.2.5
March 6 (Fri)	23, Multiple Feeds and Side Streams		Ch 7.3
March 9 (Mon)	24, Enriching/Stripping Columns, Open Steam Heating, Efficiency		Ch 7.4, 12.0
March 11 (Wed)	25, Packed Column Dist	HW6 – Due Wed 3/11	Ch 7.6
March 13 (Fri)	26, Packed Column Dist (cont'd)		
March 16 (Mon)	NO CLASS – Spring Break		
March 18 (Wed)			
March 20 (Fri)			
March 23 (Mon)		27, Multicomponent Distillation	
March 25 (Wed)	28, Enhanced Dist & Triangular Graphs	HW7 – Due Wed 3/25	Ch 4.2, 11.0-11.1
March 27 (Fri)	29, Enhanced Distillation (cont'd)		Ch 11.2-11.7
March 30 (Mon)	30, Absorption		Ch 4.7, 6.0-6.6
April 1 (Wed)	31, Absorption (cont'd)	HW8 – Due Wed 4/1	
April 3 (Fri)	32, Absorption (cont'd) & Stripping	Review for Exam 2 (TBD)	
April 6 (Mon)	Midterm Exam 2: Monday 7:00 – 9:00 pm		
April 8 (Wed)	NO CLASS		
April 10 (Fri)	34, Packed Column Absorption		Ch 6.1.2, 6.7-6.9
April 13 (Mon)	36, Immiscible L-L Extraction		Ch 5.2, 8.0-8.1, 10.1
April 15 (Wed)	37, Immiscible L-L Extraction (cont'd)	HW9 – Due Wed 4/15	
April 17 (Fri)	38, Leaching & Washing		
April 20 (Mon)	39, Single Stage Partially L-L Misc Extract		Ch 4.4-4.5, 8.2-8.3
April 22 (Wed)	40, Multiple Stage Partially Miscible L-L Extraction, Min Solvent Rate	Project 2 – Due 4/22	
April 24 (Fri)	41, Review for Final Exam	HW10 – Due Thu 4/23	
April 27 (Mon)	Final Exam, 7:30 – 10:00 pm		

