

Fall 2020

CHE 360-001: Separation Processes I

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ChE 360: Separation Processes I

Fall 2020

Instructor: Dr. Christopher D. Dobrzanski, E-mail: cdd23@njit.edu

Teaching Assistant: Alina Emelianova, E-mail: ae299@njit.edu

Time: Tuesdays, Thursdays, 12:30-1:50 PM.

Location: Webex meetings.

Office Hours: Wednesday 3:30-5:00 PM or by arrangement.

Course Description and Requirements

This is the first course in separations and examines traditional methods and technologies by which Chemical Engineers separate and purify mixtures. Emphasis here is on distillation, strippers, and absorbers. The current course is a co-requisite for ChE 365 and a pre-requisite for ChE 496.

Pre-Requisite Courses: ChE 342, 370

Pre-Requisite Topics: Thermodynamics, Heat/Mass Transfer, Calculus/Diff. Equations

Course Objectives

Taking this course, a motivated student will:

- Have an understanding of methods and technologies by which mixture are separated and purified.
- Be able to design separation processes, such as strippers, absorbers, and distillation columns and incorporate safe, environmental and energy saving considerations in the final process.

Learning Materials

Textbooks: Required: P. C. Wankat, "Separation Process Engineering", 4th edition (3rd is okay), Pearson1, ISBN: 0133443655

Recommended: J. D. Seader, E. J. Henley, D. K. Roper, "Separation Process Principles with Applications Using Process Simulators", 4th edition, Wiley, ISBN: 1119355230

Calculator: A high-end calculator (e.g., TI-83, TI-84, TI-89) is recommended for solving problems.

Computer: A working computer with web camera and microphone is required for exams. Projects using software will require access to Windows OS computer.

Scanner: Some type of scanner or phone application (e.g., CamScanner) is needed to obtain PDFs of hand-written documents, which can then be uploaded to Canvas. Uploaded scanned documents should be in PDF format, not image (i.e., not JPG, BMP, GIF, etc.).

Required Software: Aspen Plus Simulation (Available for students for Windows OS; installation instructions will be provided), Google Chrome or Firefox browser, Respondus Lockdown Browser, Document writer such as MS Word, Spreadsheet such as MS Excel.

Course Outline (Preliminary Subject to Changes)

	Date	Topic	Reading
1	September 1	General Introduction to Separation Processes	Chapters 1
2	September 3	Review of Phase Equilibrium and Aspen Intro	Chapter 2
3	September 8	—Monday Classes Meet—	
4	September 10	Bubble and Dew point Calculations	Chapter 2
5	September 15	Flash Distillation	Chapter 2
6	September 17	Flash Distillation Cont.	Chapter 2
7	September 22	Aspen Plus Exercise	
8	September 24	Binary Column Distillation	Chapter 3
9	September 29	Column Distillation Cont.	Chapter 3
10	October 1	McCabe-Thiele	Chapter 4
11	October 6	McCabe-Thiele Cont.	Chapter 4
12	October 8	Intro to Multi-Component Distillation	Chapter 5
13	October 13	Intro to Multi-Component Distillation Cont.	Chapter 5
14	October 15	Midterm Review	
15	October 20	Midterm Exam	
16	October 22	Short-Cut Multi-Component Distillation	Chapter 7
17	October 27	Short-Cut Multi-Component Distillation Cont.	Chapter 7
18	October 29	Rigorous Multi-Component Distillation	Chapter 6
19	November 3	Rigorous Multi-Component Distillation Cont.	Chapter 6
20	November 5	Staged and Packed Column Design	Chapter 10
21	November 10	Staged and Packed Column Design Cont.	Chapter 10
22	November 12	Distillation Economics	Chapter 11
23	November 17	Absorption and Stripping	Chapter 12
24	November 19	Absorption and Stripping Cont.	Chapter 12
25	November 24	Liquid-Liquid Extraction	Chapter 13
26	November 26	—Thanksgiving Recess—	
27	December 1	Liquid-Liquid Extraction Cont.	Chapter 13
28	December 3	Adsorption and Chromatography	Chapter 18
29	December 8	Adsorption and Chromatography Cont.	Chapter 18
30	December 10	Final Review	
31	December TBA	Final Exam	

Assessment and Grading

Exams: There will be two exams. All exams will be open paper book and open paper notes. Communicating with anyone other than the proctor or instructor during exams will be considered as a violation of academic integrity.

Project: A computer-based project will be assigned midway through the semester.

Homework: Homework assignments will be posted on Canvas. Homework assignments are due one week after they are assigned, and must be submitted electronically on Canvas. No late homework will be accepted. Students must each submit their own homework.

Quizzes: Notification of an impending quiz will be provided the class prior or earlier and announced via Canvas.

There will be no more than twelve homeworks and quizzes. Homework and quizzes are evaluated using the following scale:

✓+ : The solution is 100% correct with proper units and presented in a thorough, logical fashion.

✓: Solutions contain some errors but present a reasonable attempt at solving all problems. Each homework or quiz that receives at least a ✓ will count as full credit (100%) towards your homework and quiz total.

✓- : Solutions contain multiple substantial conceptual errors, and/or give only a cursory attempt at solving some problems. Each homework or quiz that receives a ✓- will count as half credit (50%) towards your homework and quiz total.

Zero : Not submitting a homework is counted as a zero (0%) towards your homework and quiz total.

Final Course Grades: Your grade for the class will be determined from your homework & quiz total plus your exam grades, as follows:

Homework and Quizzes	25%
Project	15%
Midterm Exam	30%
Final Exam	30%
	100%

Note: grades appearing on Canvas may not represent the weights following the table above. Letter grades corresponding to your numerical score will be assigned according to the following:

Percent	Grades
85.0% or higher	A
80.0-84.9%	B+
75.0-79.9%	B
70.0-74.9%	C+
65.0-69.9%	C
55.0-64.9%	D
below 55.0%	F

Policies

NJIT Honor Code: The NJIT Honor Code will be upheld and any violations will be brought to the immediate attention of the Dean of Students.

Special Needs: If you need accommodations due to a disability please contact Chantonette Lyles, Associate Director of Disability Support Services, Fenster Hall Room 260 to discuss your specific needs. A Letter of Accommodation Eligibility from the Disability Support Services office authorizing your accommodations will be required.

Course materials, office hours and correspondence

- The course Canvas page is the main platform for delivering information about the course. All relevant course materials and assignments will be posted on Canvas, so a student should check it regularly.
- The students have to upload a professional-looking head shot for their Canvas profile.
- The students are strongly encouraged to attend Office Hours. Long questions, which require derivations will be discussed only during the Office Hours and will not be answered by email. Questions regarding grades can be discussed only during the Office Hours.
- E-mail and Canvas correspondence is intended only for quick questions. Questions which require a detailed discussion should be discussed during the Office Hours.
- All correspondence should be conducted in a professional style, using formal English.
- To help assure quick response to your emails, please add “CHE360” in the subject of your emails.
- The instructor reserves the right not to respond to emails if the email does not have a greeting or a signature.

Exams, Quizzes, Homeworks and Grades

- A letter grade is based on the final score, calculated using a spreadsheet in accordance with the Tables given in this syllabus. The assigned letter grade is final and cannot be negotiated.
- A student can dispute the exam scores within a week after the announcement of the score. Exam scores can be disputed during Office Hours, not during class time.
- Students will get zero for not coming to quizzes, exams, or any other course activity. If students miss an exam due to extreme circumstances (such as a medical problem), they need to provide proof of the circumstance to the Dean of Student’s office. Only in the case of official approval from the Dean of Student’s office, may a make-up be given at the discretion of the instructor.
- A student must show as many details as possible when solving a problem during an exam or a quiz. Not showing the work will cause losing points even if the final answer is correct.
- Partial credit can be given for solving exam problems.
- No partial credit will be given if there is not enough details to follow.
- The final answer should be always evaluated with respect to its reasonability. No partial credit will be given if the final answer is wrong and unreasonable, and the unreasonability is not noted.
- If a student misses a quiz or homework submission due to a legitimate reason (absence approved by the Dean of Students), this item is excluded from the calculation, and the weights of the remaining items are scaled proportionally.
- Student handwriting must be legible in order to receive points.

Homework Format

- All homework involving Excel, Python, or Matlab calculations must be presented with original worksheets or code.
- All homework submissions must be through Canvas. I will not accept emailed or hard-copy homework. Hand-written homeworks can be scanned and converted to PDFs via app such as CamScanner.
- Headers - The top of each sheet of a homework assignment must contain the following printed information from left to right:

Name	Course & Section No.	Date Due	Page number/total pages
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- Writing Mechanics - All homework should be carefully written using proper English.
- Calculations - All homework calculations should be consistent with the following.
 - Include complete calculations for every calculation presented to demonstrate how results were obtained.
 - Include all units for each term in each equation. The units must balance.
 - Use the appropriate number of significant figures (often two or three) for all results (but use at least two extra significant figures in calculations).
 - Clearly indicate the final solution by boxing it in with a rectangle.
- Problem Order - Problems should clearly labeled, and presented in the order assigned (one, two, three, etc.).
- Problem Essentials - Problem solutions should include the following items in order.
 - Homework problem number listed at the beginning of the problem.
 - Brief problem statement. Provide bullet points of key aspects of the problem if it is longer than a few sentences.
 - The required information - the information or solution that we are looking for.
 - A straight-edge or carefully drawn diagram(s) that clearly illustrates the problem. Optional, but often needed.
 - The boxed solution of the problem including all required steps and calculations.