Separations & Mass Transfer Principles

ECH 4403 Section 12432
Class Periods: M, P9-10 (4:05-6:00) and W, P10 (5:10-6:00)
Location: 100 Griffin-Floyd Hall
Academic Term: Fall 2018

Instructor:

VJ Tocco

I prefer that you call me "VJ", but you may also call me "Dr. Tocco" if you are more comfortable addressing your instructors formally.

E-Mail: vjtocco@ufl.edu

E-mail is my preferred method of communication outside of class time. In order to ensure that I reply, you must use proper e-mail etiquette and put "ECH4403" in the subject line.

Office: 219A Chemical Engineering

Office Hours: Tuesdays 1 PM -2 PM, Thursdays 10 AM-11 AM, or by appointment

I have an open-door policy; if I am in my office with the door open, you are welcome to come in at any time. However, please do not disturb if the door is closed and you are coming by unannounced.

Teaching Assistants:

None

Exam Dates

Midterm 1: Monday, September 24, 4:05 PM – 6:05 PM
Midterm 2: Monday, October 22, 4:05 PM – 6:05 PM
Midterm 3: Monday, November 19, 4:05 PM – 6:05 PM
Midterm 4: Thursday, December 13, 10 AM -12 PM

Course Description

Theory, design, and evaluation of diffusional and staged mass transfer principles including distillation, absorption, and extraction, leaching and membrane separations. Computer-aided design methods.

Course Pre-Requisites / Co-Requisites

Prerequisites: ECH3101 (Process Thermodynamics), ECH3202 (Fluid and Solid Operations) and ECH3223 (Energy Transfer Operations)

Course Objectives

Each lecture will have specific learning objectives that will be announced at the beginning of the lecture. Broadly, at the end of this course, a student should be able to do the following:

1) Explain the fundamentals of chemical engineering separation processes.
2) Design distillation equipment for binary or multicomponent mixtures in continuous operation.
3) Design distillation equipment for complex distillation systems, batch operation, and packed column operations
4) Design adsorption or stripping operations and liquid-liquid extraction separation equipment.
5) Design membrane separation processes and cooling towers

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:

1) Read, interpret, and follow directions, prompts, and problem statements.
2) Detect and disregard superfluous given information.
3) Use resources to find extra information which is needed, but not given.

4) Brainstorm reasons for unexpected behavior (troubleshooting).

Materials and Supply Fees

None

Required Textbooks and Software

Separation Process Engineering (4th Ed.) by Phillip C. Wenkat

Prentice Hall, ISBN 978-0133443653

Note: I will not forbid you from using another edition/version of the textbook, but keep in mind that is your responsibility (and your responsibility alone!) to ensure that the assigned readings/problems match the 4th edition.

Recommended Materials

Any model of scientific calculator (except those with communication abilities) are permitted for exams and homework assignments. During exams, you may not use your cell phone as a calculator, nor may you share a calculator with a classmate.

Some software or web apps, (such as Microsoft Excel, Wolfram Alpha, or Aspen) may be useful/required for some homework assignments. Therefore, you will need access to this software, which is available on most UF machines. You will not need to use your own personal laptop for any assignments, but you might find it useful.

Course Schedule

Day	Date	Topic	Reading	Due
W	08/22	Syllabus coverage & introduction	Ch 1	
M	08/27	Flash distillation & equilibrium data	Ch 2.0 – 2.4	
W	08/29	Multicomponent flash distillation	Ch 2.5 – 2.10	
M	09/03	No Lecture – Labor Day		HW1
W	09/05	Binary column distillation	Ch 3	Essay 1
M	09/10	Binary column distillation (continued)	Ch 4.0-4.8	HW2
W	09/12	Binary column distillation (continued)	Ch 4.9-4.15	
M	09/17	Multicomponent distillation	Ch 5	HW3
W	09/19	Multicomponent distillation (continued)	Ch 6-7	
M	09/24	No Lecture – Midterm #1 during class		HW4
W	09/26	Azeotropes/complex distillation	Ch 8	Essay 2
M	10/01	Azeotropes/complex distillation	Ch 8	HW5
W	10/03	Batch distillation and Rayleigh stills	Ch 9	
M	10/08	Batch distillation and Rayleigh stills	Ch 9	HW6
W	10/10	Packed distillation columns	Ch 10.0-10.5	
M	10/15	Packed distillation columns (continued)	Ch 10.5-10.12	HW 7
W	10/17	Review and catch-up		
M	10/22	No Lecture – Midterm #2 during class		
W	10/24	Adsorption and stripping	Ch 12	
M	10/29	Adsorption and stripping (continued)	Ch 12	HW8
W	10/31	Liquid-liquid extraction	Ch 13	
M	11/05	Liquid-liquid extraction (continued)	Ch 13	HW9
W	11/07	Review and catch-up		
M	11/12	No Lecture – Veteran's Day		Project
W	11/14	Selected project presentations		Essay 3
M	11/19	No Lecture – Midterm #3 during class		
W	11/21	No Lecture – Thanksgiving Break		
M	11/26	Membrane separations	Ch 18	
W	11/28	Membrane separations (continued)	Ch 18	
M	12/03	Cooling towers and other separations		HW10
W	12/05	Review and final remarks		Essay 4
Th	12/13	Final Exam, 10 AM – 12 PM		

Attendance Policy, Class Expectations, and Make-Up Policy

I will not record or document attendance, but you are required to attend all lectures and recitations. Absences will be excused if (and only if) you notify me in advance of your absence via email, your reason for absence is consistent with the UF attendance policy (https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx), and you provide me with the appropriate documentation.

Excused absence work make-up

Make-up work will be considered on a case-by-case basis, commensurate with your circumstances in a manner that is fair to you and your classmates. **There will be no make-up assignments for unexcused absences.**

Evaluation of Grades/Course Assignments

Assignment	Total Points	Percentage of Final Grade
Homework Sets (10)	15 each	15%
Midterm Exams (3)	200 (or 100) each	50%
Final Exam	200	20%
Writing Assignments (4)	25 each	10%
Team-Based Project	50	5%
		100%

Exams: 3 Midterms, 500 points; 200 (or 100) Points Each; 1 Final, 200 Points

Each exam will consist of three questions totaling 100 points, with a total time limit of two hours. The format of the questions will be similar to the homework problems, and may contain multiple parts. I will aim to include a range of "easy" to "slightly difficult" parts for each question, with the point values for each question/part clearly labeled. Exam questions are meant to assess your ability to perform engineering analysis and calculations. During the exam, you are permitted to use a calculator (any model without communication ability; you may not share), but are not permitted to refer to books or notes. The instructor will provide a "crib sheet" of common equations and needed information a few days in advance of the exam.

Your two highest midterm exam grades (out of three) will be doubled in the final calculation of your course points. For example, if your scores are 64, 88 (176), 81 (162); your total exam points would be 402/500.

Homework: 150 points Total; 10 assignments, 15 points Each

Homework will be assigned approximately once per week, and will consist of 5 problems to submit AND an additional 2-4 "practice" problems that will not be collected. The submitted problems will be graded on the following basis:

Not attempted – 0 points
Attempted but not completed – 1 point
Completed but incorrect – 2 points
Completed and correct – 3 points

You should plan to spend at least 5 hours per week on homework (if not more), and expect homework problems to be significantly more difficult than exam questions. You are permitted to discuss the problems and problem-solving strategies with your colleagues, but you may not breach the Academic Honesty Course Policy (see below).

Homework is to be completed on the assignment document (see Canvas page) in neat handwriting (without excessive erasures or cross-outs) on standard-size (8.5" x 11") paper, without frayed edges, folds or excessive wrinkling. Write your answer(s) in the provided answer boxes.

Each problem must be accompanied by a solution (showing all work, which should begin directly beneath the answer boxes. If needed, continue your solution by attaching additional pages of your solution before the next problem. All pages must be stapled in order and contain the following information (you may use the "Extra homework page" on Canvas as a template): your name, UFID, section number, and "page X of Y", where X is the current page, and Y is the total number of pages in

the entire assignment. Begin work for each problem on a fresh page (using the back-sides of paper is permitted). Homework that does not conform to these specifications is subject to a point deduction at the instructor's discretion.

Homework is due (in class) at the beginning of lecture on Mondays (except on holidays, in which case it is due on Tuesday by noon). To incentivize you to finish homework assignments early, homework submissions by noon on the Friday before the due date will receive two automatic bonus points. You may also submit homework to the "homework box" outside my office or electronically via e-mail any time prior to the due date. Late homework will not be accepted.

Reflective Writing Assignments: 4 Total, 100 Points; 25 Points Each

Writing and communication is an essential (although undervalued) skill of successful engineers. Each writing assignment will be a 500-750 word essay in response to the following writing prompts:

1. My professional and academic experiences in ChE thus far (due in first 2 weeks)
2. What type of career would I like? (due before career fair)
3. How did I work and interact in team settings? (due after the class project)
4. What was the most important thing I learned in ECH 4403? (due before last day of class)

I intend for you to use these essays as a way to look at yourself introspectively and start forming career goals. These writing assignments will also allow me a chance to get to know you better.

Each writing assignment will have its own rubric, which will be distributed with the writing prompt.

Team-based Class Project: 50 Points

In the class project, you will work in groups of four to research an industrial separation of your choice. Groups will be assigned, but you will have the option to choose one of your teammates. Topics will be claimed on a first-come, first served basis, and no duplicate topics are allowed.

More details will be given when the project is assigned in October.

Extra Credit: 20 Points Possible

You will have the opportunity to earn a maximum of 20 extra-credit points by submitting an original exam/homework questions (maximum of 10 points/question) or quiz question (multiple choice, true/false, or short answer; maximum of 2 points/question).

You must submit the question statement, an answer key, and an explanation of the concept that the question is testing.

In addition, by submitting these questions, you authorize me to use them in subsequent years (or, if the question is good enough, this year!).

The deadline to turn in extra-credit is one week prior to the last lecture (i.e. you cannot submit extra credit after you see your final exam grade)

Grading Policy

You may earn **1000** possible points in this course by completing assignments (see below). Your final letter grades will be based on your final point total only (no curve). The official thresholds to earn a given letter grade are listed below:

Point Value	Letter Grade
940-1000	A
920-939	Gray
890-919	A-
880-889	Gray
850-879	B+
840-849	Gray
810-839	B
790-809	Gray

Point Value	Letter Grade
760-789	B-
740-759	Gray
700-739	C+
670-699	Gray
620-669	C
600-619	Gray
550-599	C-
0-549	D/F (Gray)

Students in the "gray" areas may earn either the next letter grade up, or the next letter grade down based on their professionalism, participation and effort. Final decisions are based solely on the instructor's discretion.

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

Regrades

Regrade challenges will be considered for exams and quizzes only (i.e. homework, the team project, reflective writing assignments, extra credit, etc. is not eligible for regrade challenges). There will be a two-point penalty assessed to each regrade challenge that is not overturned, and your entire assignment may be regraded as a result.

Regrade requests for simple addition mistakes or systematic grading errors may be submitted without risk of penalty or whole regrades.

To submit a regrade

On a separate sheet of paper (titled "regrade request"), briefly and clearly state the reason for your request and attach it to the front of the exam. DO NOT WRITE ANYTHING DIRECTLY ON ANY PAGE OF YOUR ASSIGNMENT. You must hand-deliver your regrade request to me (in my office or after class) within one week of the date the assignment was returned to the class.

Students Requiring Accommodations

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, https://www.dso.ufl.edu/drc) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Course Evaluation

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at https://evaluations.ufl.edu/evals. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at https://evaluations.ufl.edu/results/.

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 of this class.

I take this honor pledge very seriously. Cheating is repugnant behavior; it undermines the value of your education, and it is not fair to honest students. I will pursue any violations of the honor code to the maximum possible extent.

While I encourage collaboration on homework assignments, this collaboration is limited to discussion about problem-solving strategies and approximate answers. You are not allowed to look at another student's work while completing your own assignment.

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see:
http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html

Campus Resources:

Health and Wellness

U Matter, We Care:
Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: http://www.counseling.ufl.edu/cwc, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Assault Recovery Services (SARS)
Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or http://www.police.ufl.edu/.

Academic Resources

E-learning technical suppor*t*, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. https://www.crc.ufl.edu/.

Library Support, http://cms.uflib.ufl.edu/ask. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. https://teachingcenter.ufl.edu/.

Writing Studio, 302 Tigert Hall*,* 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/.

Student Complaints Campus*:* https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf.

On-Line Students Complaints*:* http://www.distance.ufl.edu/student-complaint-process.