Separation and Mass Transfer Operations

ECH 4403   Section 26649 (OL16)
Class Periods: **MWF; Period 7 (1:55-2:45 PM)**
Location: **N/A (online)**
Academic Term: **Spring 2021**

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. To ensure that I reply, you must use proper e-mail etiquette and include "ECH4403" in the subject line.

Office: 322 Black Hall, (352) 294-1290

Because the semester is online, I do not plan to be in my office very often (if at all).

Supervised Teaching Student: None

Online Course Format

All required course materials and resources (except the textbook) for ECH 4403 are contained on, or linked to, the course Canvas page. It also serves as the primary means of communication with your classmates and instructors (outside of zoom interactions). You should get into the habit of checking this Canvas page regularly for announcements and action items. You should also enable Canvas to send you e-mail notifications, such that you are alerted to any updates or correspondence (the default state is "on", so no action is required unless you've disabled this feature).

Lectures

All course content will be delivered via asynchronous, screen-casted videos. For a usual class day, expect 2-3 short (10-20 minute) videos. These videos will be posted on MediaSite no later than the beginning of the class period, and links posted on the "Modules" page of Canvas.

Office Hours/Problem-Solving Session: Mondays during Class (1:55 – 2:45 PM on Zoom)

These sessions are meant to foster interaction between students and the instructor. Attendance is optional, but highly recommended.

VJ will begin the session by giving a cursory review of lecture material covered since the last review session and field student questions relating to this material. At the end, the floor will open for other student questions.

Portions of the office hour/review sessions will be recorded and posted in a similar manner to the lecture videos for those who are unable to attend.

Online Course Recording

Our class sessions may be audio-visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep

your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

"Quizzam" Sessions: Certain Wednesdays during class (1:55-2:45 PM)

"Quizzams" are quiz/exam hybrids, and will be held approximately every two weeks during the term during Wednesday class periods. The time limit for each quizzam is 50 minutes, with a 10-minute grace period for scanning and uploading your work to Canvas.

Quizzam Dates:
Wednesday, Jan. 27
Wednesday, Feb. 10
Wednesday, Feb. 24
Wednesday, Mar. 3
Wednesday, Mar. 17
Wednesday, Mar. 31
Wednesday, Apr. 14
Wednesday, Apr. 21

Course Description

(3 credits) 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

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 and batch operation.
3) Design adsorption or stripping operations
4) Design liquid-liquid extraction operations
5) 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:

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

Relation to Program Outcomes (ABET):

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

Required Textbook

Separation Process Essentials (1st Ed.) by Alan M. Lane (CRC Press)

Wiley, ISBN 978-1138086081

Note: This textbook was recently published, and it is the clearest text on Separations that I've read. I think you will enjoy reading it, but I do not assign reading as an assignment or textbook problems (although they are strongly encouraged!)

Required Software

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

Recommended Materials

Any model of scientific calculator may be useful for solving homework and exam problems.

Course Schedule

Refer to the "Modules" page on Canvas for more detail

Week	Begins	Topic(s)
1	1/11	Course introduction, equilibrium data, single-stage distillation
2	1/18	Graphical solutions to problems, energy requirements
3	1/25	Multi-stage distillation
4	2/1	Distillation column design and variations
5	2/8	Distillation column practice
6	2/15	Multicomponent distillation, single-stage batch distillation
7	2/22	Multistage batch distillation
8	3/1	Mass-Transfer separations
9	3/8	Absorption and stripping columns
10	3/15	Cross-current liquid-liquid extraction
11	3/22	Counter-current liquid-liquid Extraction
12	3/29	Liquid-liquid extraction designs, Pressure-swing distillation
13	4/5	Azeotropic/non-ideal separations processes
14	4/12	Membranes/Class Project Presentations
15	4/19	Open/review

Attendance Policy and Expectations

Virtual attendance will not be officially monitored or graded. You are required to watch all course content videos at your own pace, and watching recordings of synchronous sessions is optional.

When interacting with fellow students and instructors online, you are expected to maintain professionalism and behave respectfully. The community of ECH 4403 will be supportive and inclusive. Offensive imagery and/or language will not be tolerated in any capacity.

Evaluation of Grades/Course Assignments

Quizzams: 8 quizzams, 100 points each (80% total)

All exams are open-resource (books, notes, internet), and will therefore not be proctored with HonorLock or ProctorU. However, you are not permitted to consult with any other person (or work done by other people) in any capacity while completing exams. This includes, but is not limited to: communication with classmates or previous ECH 3023 students and searching for/referencing solutions online or from previous semesters.

Each exam will last 50 minutes with a 10-minute grace period for scanning and uploading solutions to Canvas.

Homework: 6 assignments, 20 points each (lowest score dropped, 10% total)

Each homework assignment will consist of 5 problems, and occasionally an essay response might replace one of the problems.

Expect the homework problems to challenge you. VJ will answer direct, well-articulated questions relating to the homework, but will not guide you through the solution, troubleshoot your mistakes, or check your answers before submission. You are permitted to discuss the problems and problem-solving strategies with your classmates, but you may not breach the Academic Honesty Course Policy (see below).

Solution Submission: Homework is to be submitted electronically on Canvas. Your homework solution must include the problem statements, with all requested answers reported in the answer box(es) provided.

A good problem solution primarily consists of a description of problem-solving logic in complete sentences, with equations to supplement the logic. Your work should be organized neatly and be easy to read and follow. You may type your solutions, but equations must be typeset with the "Equation Editor" in Word (or equivalent in another program). Because this can become quite time-consuming, I recommend hand-writing your solutions.

There are several free smartphone apps that can scan your work and convert it to a PDF (such as "CamScanner"). Photographs (learn the difference between a PDF and a photograph) are not acceptable. Please let VJ know if access to this technology is unavailable, and accommodations will be made.

Grading: Grading of homework problems occurs on the following basis:

> Blank or minimal effort – 0 points
> Not completed/insufficient work shown – 1 point
> Complete and incorrect, but difficult to follow – 2 points
> Correct, but difficult to follow or incorrect, but presented professionally – 3 points
> Correct and presented professionally – 4 points

Essay responses will be graded for content, concision, clarity, and grammar.

Due Date: Homework is due at 11:59 PM on Fridays and graded *as submitted*.

To incentivize you to start (and finish) homework assignments early, homework submitted by **noon** on the Wednesday before the due date will earn two automatic bonus points.

Late homework will be penalized 4 points per day, up to **three days** after the due date. In other words, assignments submitted from 12:00 AM – 11:59 PM on Saturday can earn a maximum of 16 points, from 12:00 AM – 11:59 PM on Sunday: 12 points, and 12:00 AM – 11:59 PM on Monday: 8 points. Homework solutions will be posted on Tuesday morning, after which no homework will be accepted.

Low Score Drop: Each student's lowest homework score will be dropped at the end of the semester.   This policy covers emergencies and technological issues alike, and no documentation or action is required of the student.

No further accommodations or deadline extensions for homework or quizzes will be granted due to technological issues or emergencies. You should anticipate that these issues will arise at the worst possible time (for example, Wi-Fi always seems to crash 10 minutes before the homework is due), and plan contingencies.

Significant progress must be demonstrated on a minimum of 70% of the homework problems in order to pass the course.

Team-Based Project: 100 Points

In the class project, you will work in groups of 3-4 to give a virtual presentation about a separation technique of your choice. More details will be given when the project is assigned in early March.

Extra Credit: 10 Points Possible (due Monday, 4/19)

Option 1: Write an original exam/homework problem. You must submit the **problem 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 semesters (or, if the question is good enough, this semester!). You may submit as many questions as you like.

Option 2: Submit a creative expression of your experiences in ECH4403. Submissions may include a song, video, poem, craft, artwork, or any other creation. The only constraints are that your submission must be completely original, and your submission must be **shared** with the rest of the class on the last day of class.

Grading Policy

You may earn 1000 possible points in this course by completing assignments (see above). Your final letter grade will be based on your final point total. General point totals needed to earn a given letter grade are listed below:

Point Value	Letter Grade
900-1000	A/A-
800-899	B+/B/B-
720-799	C+/C
700-719	C-
600-699	D+/D/D-
<600	E

Determination of +/—/- letter grades will be based primarily on the distribution of student scores within the tier (with roughly 1/3 in each bin). However, these may also be subject to instructor's discretion, considering professionalism, participation, effort, and performance trajectory. These decisions will be 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:

To submit a regrade, fill out the regrade request form (a blank copy may be found on Canvas). This form will require you to directly state the number of points you think you deserve and a full explanation of the discrepancy (unless it is a simple addition error). **The deadline for regrades is one week from the date the assignment was graded.**

Make-Up Policy

In the case of an emergency, technological issue, or excused absence during an exam, one *comprehensive* make-up exam will be offered at the end of the semester, provided that **adequate proof/documentation is presented in writing**.

Make-up work for extended excused absences will be considered on a case-by-case basis in a manner that is fair for you and your classmates. Excused absences must be consistent with university policies in the undergraduate catalog (https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx) and require appropriate documentation.

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 professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-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://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-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.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:
• Your academic advisor or Graduate Program Coordinator
• Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.ufl.edu
• Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
• Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

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: https://registrar.ufl.edu/ferpa.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 Discrimination, Harassment, Assault, or Violence
If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

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 support, 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.