Management of Unit Operations

(UOM) ECH 4905

Section: 2344
Class periods: W Period 9 (4:05PM-4:55PM)
Location: BLK 315
Academic Term: Spring 2023

Instructor: Dr. Fernando Mérida

• e-mail: fmerida@ufl.edu

 Office hours: In person (CHE 217) or virtual (Zoom link here)

M 11:00 am - 12:00 PM

• You can call me Prof./Dr. Mérida, or "Fernando" if you feel comfortable doing so.

Instructor: Dr. LiLu Tian Funkenbusch

• e-mail: lilu.funkenbusch@ufl.edu

- Office hours: *Virtual Only (link here)*
 M 8am-12pm or by appointment
- Please call me Prof./Dr. Funkenbusch or LiLu. Please do not call me Ms. or Mrs. Funkenbusch

Contacting course instructors:

- E-mail is the preferred communication platforms. Please make sure the subject line of your e-mail message has the label "UOM Question". You should expect a response within 48 hours (M-F) and within 72 hours (weekend).
- Announcements will be periodically posted on Canvas. <u>All students must signed-up to receive notifications</u> <u>Canvas notifications</u>.

Course Description

(1 - 3 credits*)

Student ("peer-tutors") instruction and management of the Chemical Engineering Unit Operations Laboratory for undergraduate students. Depending on the number of credits, students can also conduct a technical project dealing with improvements of unit operations experiments.

Course Pre-Requisites

ECH 4424L (Unit Ops Lab I) or ECH4404L (Unit Ops Lab II)

Course Objectives

This course will introduce students to supervision and management of pilot-plant scale unit operations typical within the chemical industry. Students taking this course will guide experiments of small groups of undergraduate students, troubleshoot equipment problems, and perform a detailed analysis of the lab experiments. The goal is to provide students with fundamentals of lab management and the solid operating principles of unit operations by assisting undergraduate students during experiments thus fostering troubleshooting, decision making, safety, and other management-oriented skills.

Peer-tutor responsibilities:

- Have a good understanding of both the fundamentals and technical operating principles of the operation of the assigned experiment(s).
- Provide undergraduate students taking either of the Unit Operation Labs (ECH4224L or ECH4404L) with a good understanding of the operating principles prior to conducting the experiment.
- Supervise undergraduate students in the execution of experiments, helping them conduct experiments safely and troubleshooting when problems arise.
- Review (but not grade) progress reports, calculations, and preliminary analysis with the undergraduate students thus helping them with data analysis.
- Guide undergraduate students to think and communicate as engineers.

- Participate in weekly meetings (outside of the schedule of experiments) with the course instructors, lab
 engineer, and other lab assistants with the objectives of discussing the progress and improvement of
 experiments, troubleshooting technical problems, assessing safety issues, revising standard operating
 procedures (SOPs) and other technical documents. The first meetings of the semesters are extremely
 important as students will be provided with effective teaching practices, right before they start assisting
 students with experiments.
- Conduct a technical project dealing with improvements to current experiments, in-depth data analysis, identification or characterization of new experiments, assessment of experimental techniques, etc.

Materials and Supply Fees

N/A

Course websites

Canvas website: http://elearning.ufl.edu/

Canvas will be used as the main repository of information and other resources for the supervision of experiments, assignment preparation, safety guidelines, etc. It will also be used for posting of grades, announcements, and general information for the class.

Required Textbooks and Software

There is no required textbook for this class.

Recommended Materials:

There is no required textbook for this class. The following titles are recommended to support fundamentals and theoretical background, physical constants, empirical correlations, and other concepts:

- 1. Geankoplis, C. J., *Transport Processes and Unit Operations* [On reserve in the Science Library].
- 2. Incropera, F. P. and D. P. DeWit, Fundamentals of Heat and Mass Transfer [On reserve in the Science Library]
- 3. Gerhart, Philip M., Gerhart, Andrew L., and Hochstein, John I, *Munson's Fluid Mechanics* [On reserve in the Science Library]
- 4. McCabe, W. L., J. C. Smith, and P. Harriet, *Unit Operations of Chemical Engineering* [On reserve in the Science Library]
- 5. Perry, R. H., D. W. Green, and J. O. Maloney, *Perry's Chemical Engineers' Handbook* [E-book is available through UF Library website]

Professional Component (ABET):

Students taking this course will gain in-depth understanding of equipment used in Unit Operations of Chemical Engineering while reinforcing knowledge of safe operating procedures. In addition, the course provides opportunities to learn how to apply the fundamentals of Chemical Engineering to real-world systems while enhancing communication skills. Students will gain significant experience by leading a team and overall, teaching experience in a lab-based class.

Table of Relation to Program Outcomes (ABET):

Outcome	Coverage*
1. An ability to identify, formulate, and solve 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	Low
3. An ability to communicate effectively with a range of audiences	High
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	High
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	Medium
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	Medium

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

Table of experimental modules* to be taught in ECH4224L: Unit Operations I and ECH4404L: Unit Operations 2 and experiment abbreviation:

Unit Operations 1 (UO1)	Unit Operations 2 (UO2)
 Thin Film Evaporator (TFE) Fluid Flow (FLU) Flow Characteristic Curves (CUR) Filtration (FIL) Heat Exchangers (HEX) Fixed and Fluidized Bed Columns (BED) 	 Batch Distillation (BD) Continuous Distillation (CD) Cooling Tower (CT) Liquid-Liquid Extraction (LLE) Semiconductor Module 1 (SM1) Oxide Growth (SM1A) Photolithography (SM1B) Semiconductor Module 2 (SM2) Wet & Dry Etching (SM2A) Thermal Evaporation (SM2B)

^{*} UO1 and UO2 have a 2-week module rotation

Course schedule

The course schedule is summarized below. Modifications to the schedule might be required depending on the progress of experiments which could be affected by performance of equipment/instrumentation, class cancellation due to atmospheric phenomena (e.g. hurricane season), or other reasons not listed in this document. Announcements will be posted in Canvas regarding any modification of the course schedule.

Course and assignment schedule*

Week	Dates	Meeting Plan [†]	Assignment
1	Jan. 9 – Jan. 13	 Introduction, class info, and policies Overview of UO1 and UO2 schedule 	 Experiment trainings Online trainings (EH&S and FERPA) GatorTRACS risk assessment
2	Jan. 16 – Jan. 20	Basic routines in experimentsSafety I	Safety homework (HW-1)
3	Jan. 23 – Jan. 27	Safety II & emergency proceduresTroubleshooting scenarios	
4	Jan. 30 – Feb. 3	 Instructions for evaluation of preliminary calculations, predictions, etc. Review of proper pipette use 	
5	Feb. 6 – Feb. 10	Confidence, authority, and ethics	Confidence & authority (HW-2)
6	Feb. 13 – Feb. 17	 Internship/Co-Op experiences and applicability to experiment instruction 	
7	Feb. 20 – Feb. 24	• Lab Manual review: Theory	
8	Feb. 27 – Mar. 3	Lab Manual review: SOPs	Theory edits (HW-3)
9	Mar. 6 – Mar. 10	Professional communication	SOP edits (HW-4)
10	Mar. 13 – Mar. 17	Spring Break (no meeting)	
11	Mar. 20 – Mar. 24	Mock report grading	
12	Mar. 27 – Mar. 31	Term Project Presentations I	Suggested peer-tutors (HW-5)
13	Apr. 3 – Apr. 7	Term Project Presentations II	
14	Apr. 10 – Apr. 14	Management wrap-upSuggestions for future semesters	
15	Apr. 17 – Apr. 21	No UOM Meeting	Training of new peer-tutors (HW-6)
16	Apr. 24 – Apr. 28	No UOM Meeting	Training of new peer-tutors (if necessary)

^{*} This schedule is subject to change. Canvas announcements will be posted by course instructors in case modifications to this schedule are required.

Homework, due dates, format, and policies

Instructions to prepare assignments will be available on Canvas. Assignment deadlines will be Fridays until 11:59 via Canvas according to the table above; students must check the course schedule available in the Canvas Home Page for any adjustment or modification throughout the semester. Additional instructions will be given via Canvas announcements or by e-mail. A brief description of assignments is provided below.

[†] In addition to topics listed in the Meeting Plan, we will also discuss any issues encountered in the lab in every meeting.

Assignment description

- Experimental training: peer-tutors will be trained in their corresponding experiments by course instructors of ECH4224L and ECH4404L (or former lab assistants). These in-person trainings will be offered prior to, or during the first week of the semester.
- Online trainings (FERPA and EH&S): peer-tutors will complete online trainings required by EH&S and the College of Engineering. There are three required trainings: a) UF_PRV808_OLT FERPA Basics, b) UF_EHS861_OLT Chem Hygiene Plan (1.4), and c) UF_EHS809_OLT Hazardous Waste Management (1.3). These trainings are available via "My Training", accessed via MyUFL and they must be completed before experiments start. Evidence of completion or training transcripts must be submitted to the course instructor.
- <u>Safety Homework (HW-1)</u>: this assignment deals with general lab safety in the Unit Operations Laboratory as well as safety guidelines in assigned experiment(s). It must be completed before experiments start.
 - Note: students cannot start their role as lab assistants if the three assignments described above have not been completed.
- <u>Confidence, Authority, and Ethics (HW-2)</u>: this assignment includes a list of questions and study cases to assess the relevance of confidence and authority by peer-tutors, along with ethical dilemmas.
- Edited Theory and SOP (HW-3 and HW-4): these assignments aim to review lab manuals used in Unit Operations experiments to identify strengths and potential improvements. Peer-tutors will use a Word version of the lab manual to add comments, changes, or suggestions to improve the quality of lab manuals in sections such as theory and standard operating procedures (SOP).
- <u>Identification/training of future peer-tutors (HW-5 and HW-6)</u>: peer-tutors will identify prospective peer-tutors for subsequent semesters based on student evaluations and interactions in the lab. Once the new peer-tutors have been selected, trainings will be coordinated with course instructors.

Please note the following guidelines regarding assignments:

- 1. Guidelines and rubrics are available in Canvas.
- 2. Written assignments should be prepared using complete sentences, with correct spelling and grammar. All symbols should be defined on their first use. Clarity and brevity will be rewarded; sloppy thinking and writing will be penalized.
- 3. All assignments, forms, and evaluations should be submitted via Canvas either in Word or PDF format. No need to submit hard copies unless otherwise stated. Grading of assignments will be done in a complete/incomplete basis.
- 4. Any assignment with more than five-day overdue will result in a "warning notification" for the student. If after three days of this notification the assignment is still overdue, the student will receive a letter grade reduction.

Student evaluations and qualitative rubrics

In addition to assignments described above, peer-tutors will periodically evaluate the performance of supervised students in experiments via student evaluation forms submitted to course instructors via Canvas. Qualitative rubrics may also be used to evaluate the progress of data analysis, calculations, and preliminary results of supervised students. Peer-tutors will submit these rubrics to course instructors.

- <u>Student Evaluations</u>: peer-tutors will qualitatively rate the participation and involvement of supervised students in the lab. Rubrics (available in Canvas and prepared by course instructors of ECH4224L and ECH4404L) will be submitted via Canvas at the end of each rotation (no later than Friday)
- <u>Preliminary Calculations (PR)</u>: peer-tutors will qualitatively rate the preliminary calculations, predictions, and other data analysis elements performed by supervised students. Rubrics (available in

Canvas and prepared by course instructors of ECH4224L and ECH4404L) will be submitted via Canvas at the middle of each rotation (no later than Friday)

Term Project Schedule (for students enrolled with 2-credits)

Semester week	Date	Details	
2	Sept. 2	Project topics are announced; students will communicate their project choice to course instructors	
3	Sept. 5 - 9	Students will meet with course instructors to discuss the assigned project	
6	Sept. 30	Short proposal - scope of the project, a preliminary timeline, possible resources from literature, and possible obstacles	
9	Oct. 21	<u>Progress report</u> - completed work and a timeline/update on any remaining goals	
12	Nov. 11	<u>Draft of Final Report</u> - preliminary results, updated timeline, and plan-to-finish.	
15	Dec. 7	Final report is submitted	

Attendance Policy, Class Expectations, Tardiness, and Make-Up Policy

- Attendance is described as follows
 - o Weekly meeting: students are strongly encouraged to attend
 - Experimental sessions: students (in their role as peer-tutors) are required to attend all tutored experimental sessions depending on credit enrollment: 1 lab sessions per week for students registered with 1 credit, 2 lab sessions per week (two different days) for students registered with 3 credits
- 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 must let the course instructor know as soon as possible so we can plan for someone else to cover your session. Arrangements between peer-tutors in other sections are possible, but they must be discussed with the course instructor.
- Tardiness will result in a grade reduction (unless there is a valid excuse and they are notified to the course instructor in a reasonable time window). A first tardiness will result in a "warning" for the student. After a 2nd tardiness, one grade of final score will be reduced, a 3rd tardiness an additional grade of final score will be reduced. A 4th tardiness will result in failure in the class.

Evaluation of Grades

The grade in the class will be determined according to the following weighting criteria:

Students registered with 1 or 3 credits

Assignment		% Final Grade
Experimental Training		10%
EH&S, FERPA, and LATCH Assessment		10%
PR Rubrics (6)		25%
Student Evaluations (6)		25%
Homework [†] (6)		30%
	Final Grade	100%

[†]See Homework table (HW-1 – HW-6)

Students registered with 2 credits

Assignment	% Final Grade	
Experimental Training	5%	
EH&S, FERPA, and LATCH Assessment	5%	
PR Evaluation Rubrics (6)	15%	
Student Evaluations (6)	15%	
Homework [†] (6)		20%
Term Project		
 Project Proposal 		5%
 Progress Report 		10%
 First Draft of Full Report 		10%
Final Draft of Full Report		15%
	Final Grade	100%

[†]See Homework table (HW-1 – HW-6)

Important: Grades for assignments and class activities as described in the tables above will be posted in Canvas. However, the final grade will be computed outside Canvas to avoid incorrect weighing frequently observed in Canvas gradebooks.

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	В	3.00
80.0 - 83.3	B-	2.67
76.7 - 79.9	C+	2.33
73.4 - 76.6	С	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	Е	0.00

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

Safety

Peer-tutors are expected to know and follow safe operating procedures of equipment, devices, and materials used in experiments, as well as proper handling of hazardous materials. The students are required to complete the safety homework at the beginning of the semester. **Failure to follow safety guidelines during experiments will lead to significant grade reductions.** Examples of safety violations are listed below (this list is not exhaustive).

Examples of safety violations

Safety violation	Penalty
Leaving the lab without proper shutting down	Failing grade
Not wearing PPE required by an experiment	Letter grade reduction
Not disposing of hazardous waste properly	Letter grade reduction
Not handling a chemical spill properly	Letter grade reduction
Causing a major spill due to negligence	Letter grade reduction
Eating or drinking inside the classroom	Letter grade reduction
Using non-intrinsically safe/non-explosion proof electronic devices in areas restricting the use of electronics	Letter grade reduction

As a peer-tutor, you are responsible for your group's safety. It is expected that peer-tutors create a safe work culture and environment. Safety violations will affect the grades of the group and that of the peer-tutor.

Peer-tutor Evaluations

Students takin unit operations lab classes (ECH4224L or ECH4404L) will evaluate the performance of peer-tutors at the end of each module. These evaluations will be anonymously submitted via Canvas to the course instructor. Subsequently, the course instructor will compile and process these evaluations and will send it to peer-tutors upon request. Even though the ratings/evaluations provided by students to peer-tutors are not part of the grade in Unit Operations Management, peer-tutors are expected to demonstrate responsibility and professionalism during their teaching activities, keeping and fostering a respectful environment, and avoiding biased behaviors. Grade reductions can be applied in case of overall poor performance by the peer-tutor.

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/.

In-Class Recording

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A "class lecture" is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To "publish" means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

Video recordings and pictures in the Unit Operations Lab (rooms 100, 200, 300) will be available upon approval by the course instructor only, and it will require the use of an intrinsically safety camera

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.

Cooperation Policy

- Students are expected to work in teams on their experiments and memos.
- Pre-lab and post-lab homework should be answered by each student individually.
- No consultation among students is allowed during quizzes.

Plagiarism

Students are not permitted to represent as their own work any portion of the work of another person. Plagiarism includes (but is not limited to) submitting a document or assignment which in whole or in part is identical or substantially identical to a document or assignment not authored by the student. All sources used in preparation of the reports should be cited, including the manuals provided on the Canvas webpage. Failure to do so is considered plagiarism.

Falsification of Information

Students are not permitted to use or report any invented or fabricated information or data. This includes both experimental results and theoretical calculations.

Sanctions for Violations of Honor Code

Since ethical behavior in science and engineering is equal in importance to specific knowledge, the instructor will assign a *non-passing letter grade* to students who violate academic honesty standards, regardless of the violator's grade performance in 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/.

COVID-19

- If you are sick, stay home and self-quarantine. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 (or email covid@shcc.ufl.edu) to be evaluated for testing and to receive further instructions about returning to campus.
- Please continue to follow healthy habits, including best practices like frequent hand washing. Following these practices is our responsibility as Gators.

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.