Unit Operations Management

ECH4905 Section 1997
Class Periods: W Period 7
Location: Black Hall 0315
Academic Term: Fall 2023

Instructor: *Dr. Fernando Mérida*
- Email: fmerida@ufl.edu
- Office Hours: *Virtual Only* (link here)
  M 11:00am – 12:00 pm, or by appointment
- You can call me Prof./Dr. Mérida, or "Fernando" if you feel comfortable doing so.

Instructor: *Dr. LiLu Tian Funkenbusch*
- Email: 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 platform. 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 72 hours (weekend).
- Announcements will be posted on Canvas. All students must sign up to receive Canvas notifications.

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 / Co-Requisites: ECH 4424L or ECH4404L and instructor permission.

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 semester 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.

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	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.

Recommended Materials

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

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)
1. Thin Film Evaporator (TFE) 2. Fluid Flow (FLU) 3. Flow Characteristic Curves (CUR) 4. Filtration (FIL) 5. Heat Exchangers (HEX) 6. Fixed and Fluidized Bed Columns (BED)	1. Batch Distillation (BD) 2. Continuous Distillation (CD) 3. Cooling Tower (CT) 4. Liquid-Liquid Extraction (LLE) 5. Semiconductor Module 1 (SM1) o Oxide Growth (SM1A) o Photolithography (SM1B) 6. Semiconductor Module 2 (SM2) o Wet & Dry Etching (SM2A) o 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 on Canvas regarding any modification of the course schedule.

Course and assignment schedule*

Week	Dates	Meeting Plan†	Assignment
1	28AUG-01SEP	Introduction, class info, and policies Overview of UO1 and UO2 schedule	Experiment trainings Online trainings (EH&S and FERPA) GatorTRACS risk assessment
2	04SEP-08SEP	Basic routines in experiments Safety I	Safety homework (HW-1)
3	11SEP-15SEP	Safety II & emergency procedures Troubleshooting scenarios	
4	18SEP-22SEP	Instructions for evaluation of preliminary calculations, predictions, etc. Review of proper pipette use	
5	25SEP-29SEP	Confidence, authority, and ethics	Confidence & authority (HW-2)
6	02OCT-06OCT	Internship/Co-Op experiences and applicability to experiment instruction	
7	09OCT-13OCT	Lab Manual review: Theory	
8	16OCT-20OCT	Lab Manual review: SOPs	Theory edits (HW-3)
9	23OCT-27OCT	Professional communication	SOP edits (HW-4)
10	30OCT-03NOV	Mock report grading	
11	06NOV-10NOV	Term Project Presentations I	
12	13NOV-17NOV	Term Project Presentations II	Suggested peer-tutors (HW-5)
13	20NOV-24NOV	*Thanksgiving Break (no meeting)*	
14	27NOV-01DEC	Management wrap-up Suggestions for future semesters	
15	04DEC-08DEC	*No UOM Meeting*	Training of new peer-tutors (HW-6)

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

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

Homework, due dates, format, and policies

Instructions to prepare assignments will be available on Canvas. Assignment deadlines will be Fridays until 11:59pm 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.

Assignment description

- Experimental Training: Peer tutors will be trained in their corresponding experiments by course instructors of ECH4224L and ECH4404L (or former lab assistants). This in-person training will be offered prior to or during the first week of the semester.
- Online training (FERPA and EH&S): Peer tutors will complete online training 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 are available via "My Training" via MyUFL and must be completed before experiments start. Evidence of completion or training transcripts must be submitted to the course instructor.
- In-Person Safety Training (EH&S): Students supervising experiments located in the Nanoscale Research Facility (the SM sequence) must complete an in-person HF safety training course with EH&S.
- Safety Homework (HW-1): 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 as lab assistants if the assignments above have not been completed.*

- Confidence, Authority, and Ethics (HW-2): 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).
- Identification/training of future peer-tutors (HW-5 and HW-6): 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, training will be coordinated with course instructors.

Please note the following guidelines regarding assignments:

1. Guidelines and rubrics are available on 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 primarily be done on a complete/incomplete basis.
4. Any assignment with more than five days 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.

- Student Evaluations: 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)
- Preliminary Calculations (PR): 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)

Students registered in this course with 2 credits must conduct a term project supervised by course instructors. The different components of the project are summarized in the table below. Students must present the progress of their project during in one of the weekly meetings (see table of course schedule).

Semester week	Date	Details
3	08SEP	Project topics are announced; students will communicate their project choice to course instructors
4	15SEP	Students will meet with course instructors to discuss the assigned project
5	22SEP	Short proposal - scope of the project, a preliminary timeline, possible resources from literature, and possible obstacles
10	27OCT	Progress report - completed work and a timeline/update on any remaining goals
13	17NOV	Draft of Final Report - preliminary results, updated timeline, and plan-to-finish.
15	01DEC	Final report (see specific sections in Canvas)

Attendance Policy, Class Expectations, and Make-Up Policy

- Attendance is described as follows:
  - Weekly meeting: students are required to attend (see excused absences)
  - Experimental sessions: students (in their role as peer-tutors) are required to attend all tutored experimental sessions depending on credit enrollment: 1 lab session 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). 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 for 1 or 3 credits:

Criteria	% Final Grade
Experimental Training	5%
EH&S, FERPA, and LATCH Assessment	5%
Performance in tutored lab sessions (12)	45%
Student Evaluations (6) & and PR Rubrics* (6)	15%
Homework† (6)	20%
Weekly Meeting Attendance	10%
Final Grade	100%

* *UO1 peer-tutors only*
† *See Homework table (HW-1 – HW-6)*

Students registered for 2 credits:

Criteria	% Final Grade
Experimental Training	2.5%
EH&S, FERPA, and LATCH Assessment	2.5%
Performance in tutored sessions (12)	30%
Student Evaluations (6) & and PR Rubrics* (6)	10%
Homework† (6)	15%
Weekly Meeting Attendance	5%
Homework† (6)	10%
Term Project	
• Project Proposal	2.5%
• Progress Report	5.0%
• Draft of Final Report	7.5%
• Final Report	10%
Final Grade	100%

* *UO1 peer-tutors only*
† *See Homework table (HW-1 – HW-6)*

Important: Grades for assignments and class activities as described in the tables above will be posted on 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	B	3.00
80.0 - 83.3	B-	2.67
76.7 - 79.9	C+	2.33
73.4 - 76.6	C	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	E	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 taking 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 evaluations provided by students to peer tutors are not part of their grade, peer tutors are expected to demonstrate responsibility and professionalism during their teaching activities, maintaining 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 who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting https://disability.ufl.edu/students/get-started/. It is important for students to share their accommodation letter with their instructor and discuss their access needs, 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.

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/process/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 varied perspectives and lived experiences within our community and is committed to supporting the University's core values, including the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of race, creed, color, religion, age, disability, sex, sexual orientation, gender identity and expression, marital status, national origin, political opinions or affiliations, genetic information, and veteran status.

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
- HWCOE Human Resources, 352-392-0904, student-support-hr@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: https://counseling.ufl.edu, 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 suppor*t*, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.

Career Connections Center, Reitz Union, 392-1601. Career assistance and counseling; https://career.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://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/;https://care.dso.ufl.edu.

On-Line Students Complaints*:* https://distance.ufl.edu/getting-help/; *https://distance.ufl.edu/state-authorization-status/#student-complaint*.