

# Management of Fluid Dynamics, Mass Separations and Heat Transfer Laboratories

(Management of Unit Operations)

ECH 4905

Sections: 1997 and 26BG

**Class Periods:** Wednesday, period 9 (4:05 pm – 4:55 pm)

**Location:** Little Hall (LIT 0113)

**Academic Term:** Fall 2019

## Instructor:

### Dr. Fernando Mérida

*You can call me Prof./Dr. Mérida, or “Fernando” if you feel comfortable by doing it so. Remember that calling your instructors by their names must encompass the same level of professionalism and respect than using professional titles.*

**e-mail:** [fmerida@ufl.edu](mailto:fmerida@ufl.edu)

**Office:** ChE Building, room # 217, Tel. 352-294-7504

**Office Hours:** Tuesdays, 2:00 pm – 3:00 pm, or by appointment.

\*\*\* Edits to some dates/times may be posted on Canvas

## Contacting Dr. Mérida:

- E-mail is the preferred communication platform. Please make sure the subject line of your e-mail has the label “ECH 4905 – Question”. Please expect a response within 36 hours (M-F) and within 48 hours (weekend).
- I have an open-door policy during office hours, so feel free to come in. Planning office hours meeting via e-mail beforehand is also encouraged.
- Announcements will be periodically posted on Canvas.

## Lab Assistants:

- Lab Assistants will be available to guide peer-tutors in trainings, safety, and general guidelines.
- Please use “peer-tutor” or simply “tutor” as the name for your teaching role in the Unit Ops Lab courses. Avoid the use of “TA” since this refers to a student in a completely different role.
- Please contact through the Canvas website or via e-mail. Modifications in the list below may be necessary and will be communicated through Canvas.

Name	e-mail
Uday Rallabhandi (safety supervisor)	<a href="mailto:udayr23@ufl.edu">udayr23@ufl.edu</a>
Nicolas Valderrama (special trainer*)	<a href="mailto:nicval1996@ufl.edu">nicval1996@ufl.edu</a>

\* During the first three weeks of the semester.

## Course Description

(1 - 3 credits) Supervised teaching and management of the Unit Operations Laboratory. Students taking his course will guide experiments of small groups of students, troubleshoot equipment problems, and perform a detailed analysis of the lab experiments.

## Course Pre-Requisites

At least one of the Unit Operations classes (ECH 4224L and/or ECH 4404L).

## Course Co-Requisites

None.

## Course Objectives

The overall goal is to teach students to think and communicate as engineers, learn how to guide others to conduct experiments in the laboratory, and work with the department's Engineering Technician to improve experiments and troubleshoot technical problems that occur during lab operations.

Specific objectives include:

- Supervise one or two lab session per week (teaching only option), or supervise one lab session per week and perform a technical project (teaching + research option)
- Give presentations and instructions on lab safety, theory, and operating procedures to groups of students taking the Unit Operation courses.
- Coordinate with the Laboratory Manager/Engineer to fully understand safe equipment operation.
- Manage a group of students and guide them to solve problems encountered during the lab.
- Develop quiz questions and proctor quizzes at the beginning of each lab.
- Review (but not grade) pre-lab homework, quizzes, and preliminary calculations/predictions with the students in the lab.
- Participate in weekly meetings with the lab director, instructors, and other students teaching the lab.
- Participate in the lab management by
  - Documenting performance of the experimental equipment, making observations and suggestions.
  - Periodically discussing assigned experiments with other students, lab manager, and the lab director.
  - Performing periodic safety assessments and revisions of SOPs.

### Professional Component (ABET):

The 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.

### 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 both analysis and synthesis in the engineering design process, resulting in designs that meet desired needs	Medium
3. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	High
4. An ability to communicate effectively with a range of audiences.	High
5. 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
6. An ability to recognize the ongoing need for additional knowledge and locate, evaluate, integrate, and apply this knowledge appropriately.	Medium
7. An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty	High

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

**Unit Operations Lab website:** <http://ww2.che.ufl.edu/unit-ops-lab//ech4224L.htm>

- Contains all the documents required for experiments: basic theory, system configuration, standard operation procedures (SOPs), report guidelines, pre-lab homework, etc.
- Additional information available in the website: Safety guidelines, report guidelines and templates, given values for physical measurements/quantities required for calculations, etc.

**Canvas website:** <http://elearning.ufl.edu/>

- This website will be used for announcements, discussions of experiments, share raw data, and other aspects aiming to enhance the quality of teaching in Unit Ops I and II.
- This website will also serve as a repository for various files such as course syllabi, proposals, minutes from weekly meetings, etc.

**Recommended Literature:**

The following titles are recommended to support fundamentals and theoretical background, physical constants, empirical correlations, and other concepts that will be useful when teaching lab sessions or Unit Ops I and II and also as references for technical projects.

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. McCabe, W. L., J. C. Smith, and P. Harriet, *Unit Operations of Chemical Engineering* [On reserve in the Science Library]
4. Perry, R. H., D. W. Green, and J. O. Maloney, *Perry's Chemical Engineers' Handbook* [E-book is available through UF Library website]

There is no required textbook for this class.

**Experimental modules to be taught in Unit Ops I and II, and nomenclature:**

Unit Ops I

- Module 1: Thin Film Evaporator (TFE)
- Module 2: Fluids (FLU)
  - Experiment 1: Fluid flow in pipes (FF)
  - Experiment 2: Small fluid experiments (SFE)
- Module 3: Filtration (FIL)
  - Experiment 1: Batch filtration (BF)
  - Experiment 2: Continuous filtration (CF)
- Module 4: Heat Exchanger and Fluidized Bed (H&B)
  - Experiment 1: Heat Exchanger (HX)
  - Experiment 2: Fluidized Bed (FB)

Unit Ops II

- Module 1: Continuous Distillation (CD)
- Module 2: Batch Distillation (BD)
- Module 3: Cooling Tower (CT)
- Module 4: Liquid-Liquid Extraction (LLE)
- Module 5: Semiconductor Materials 1 (SM1)
  - Experiment 1: Photolithography (PT)
  - Experiment 2: Wet & Dry Etching (ET)
- Module 6: Semiconductor Materials 2 (SM2)
  - Experiment 1: Oxide growth (OX)
  - Experiment 2: Thermal Evaporation (TE)

## Course schedule

Week	Date	Topics and details
1	08/20 – 08/23	<p>Orientation, review of lab safety guidelines, practicing of experiment(s) to be taught. At the end of the first week, the student will demonstrate their proficiency in the experiment(s) to the instructor. Specifically, they will:</p> <ul style="list-style-type: none"> <li>• Submit their solutions of pre-lab homework</li> <li>• Develop several quiz questions and submit them together with the answers</li> <li>• Present theory, operating instructions, and safety rules for the experiment(s)</li> </ul> <p>The students will be allowed to teach an experiment only after they have demonstrated their mastery of the subject and communication skills. In case of unsatisfactory performance, the students will be required to repeat the presentation until their teaching performance is satisfactory. In casa a student needs multiple attempts to pass the presentation, their grade for the presentation will be taken as an average of the grades for each of the attempts.</p> <p>Note: If a student does not pass the presentation before their scheduled teaching time, this student will be required to perform a lab-related project to make up for the missed teaching time.</p> <p>In addition, within the first week of the semester, the students are required to take the following online training modules:</p> <ol style="list-style-type: none"> <li>a) Lab Safety Actions &amp; Reactions</li> <li>b) Hazardous Waste Management</li> <li>c) FERPA Basics</li> </ol> <p>These courses can be accessed through my.ufl.edu: Main menu → My Self Service → Training &amp; Development → My Training</p> <p>The students are required to submit certificates confirming that they have taken this training <b>no later than August 26, 2019</b>. Late submissions will result in a grade reduction for the course.</p>
2 – 13*	08/26 – 11/22	<p>Teaching experiments and working on the term project.</p> <ul style="list-style-type: none"> <li>• The peer-tutor must be at least 5 minutes before the lab starts to make sure that everything is ready to start the experiment.</li> <li>• Pre-lab homework and quizzes are collected before or during the start-up of the experiment.</li> <li>• Provide an overview of the experiment to students for the first 10 – 15 minutes and ask questions to students to confirm their preparation in technical and <u>safety</u> aspects. During the experiment, the peer-tutor must continue asking questions to students and making sure students remain on task.</li> <li>• Once safe shutdown of experiments has been confirmed and the lab session is done, pre-lab homework and quizzes must be dropped in the grader's mailbox. The peer-tutor must add a note indicating the <u>day-section, group number, the code of the experiment, name of peer-tutor, and the current date</u>.</li> <li>• The day an experimental module finishes (i.e. every three weeks for Unit Ops I or every two weeks for Unit Ops II), peer-tutors must submit the Student participation forms. They must be placed in a closed envelope with a note indicating the <u>day-section, group number, the code of the module, name of peer-tutor, and the current date</u>.</li> </ul>
14	11/25 – 11/26	Make up days
15	12/02 – 12/04	Make up days; submit all pending documents and projects.

\*Note that during week 5 (09/23 – 09/27) no lab sessions will be offered due to the Career Showcase activities. Also, please check the Academic Calendar for holidays (i.e. 09/02, 11/11, 11/27 – 11/29). Lab sessions occurring during these holidays will be made up in a different day.

### Term project

The project should be focused on development of a new experiment or improvement and/or detailed analysis of an existing experiment in the lab. Projects may be performed individually or in groups of two depending on the coverage and degree of complexity.

Week	Date	Topics and details
4	09/13	Selection of the project topic. <ul style="list-style-type: none"><li>• Topics will be announced between week 2 and 3 via Canvas and/or via e-mail.</li><li>• The selection of the topic must be confirmed via e-mail</li></ul>
5	09/20	Plan of the proposed work. Submit a plan outlining the scope of the project, work schedule, and resources.
12	11/08	First draft of the project report is due
16	12/04	Final project report is due

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

- Class attendance is mandatory for all weekly meetings and lab sessions to be taught.
- 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 missing their assigned teaching time may be required to perform a lab-related project to make up the missed time.
- Unexcused absences and tardiness will result in a *grade reduction*.
- Moreover, the students taking this course are responsible for enforcing the class attendance policy in the Unit Operations Lab courses. Failure to enforce this policy (e.g. allowing Unit Ops students arriving late to the lab to take a quiz) will result in a *grade reduction*.
- The Unit Ops Lab has an explosion proof requirement for all electronics thus the use of cell phones, tablets and/or laptops is strictly prohibited (rooms 100, 200, and 300). They can be used in rooms 200A and 300A whenever is necessary and it doesn't involve an interruption in the work of others.
- The Unit Ops Lab has a Personal Protective Equipment (PPE) policy that includes the use closed-toe shoes, long sleeve pants, hard hats, and safety glasses at all times. Students taking this course are responsible for enforcing the required PPE in the Unit Operations Lab courses.

### Evaluation of Grades

a) Teaching only option

Assignment	% Grade
<u>Knowledge of experiments in the lab</u> Evaluated by oral presentations of both theory and SOPs of the experiment Pre-lab homework and quizzes	20%
<u>Performance during the lab</u> Assessed by evaluations of students taking the Unit Ops Lab courses and the lab Director. The performance will be evaluated at least twice per semester in order to give the students an opportunity to improve any weak areas	80%
Final Grade	100%

b) Teaching + Technical Project

Assignment	% Grade
<u>Knowledge of experiments in the lab</u> Evaluated by oral presentations of both theory and SOPs of the experiment Pre-lab homework and quizzes	20%
<u>Performance during the lab</u> Assessed by evaluations of students taking the Unit Ops Lab courses and the lab Director. The performance will be evaluated at least twice per semester in order to give the students an opportunity to improve any weak areas	40%
<u>Term project</u> The project report will be graded both on technical content and communication effectiveness. Note that missing the project deadlines (see Term Project section) will result in a <i>grade reduction</i> .	40%
Final Grade	100%

IMPORTANT: Extra credit will be given for lab participation beyond direct assignments. Examples include reporting potential safety issues and suggesting significant improvements to experiments.

**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**

Students are expected to know and follow safe operating procedures of the equipment as well as proper handling of hazardous materials. The students are required to attend a safety orientation session at the beginning of the semester. **Failure to follow safe operating procedures will result in a significant grade reduction.** Examples of safety violations are listed below (this list is not exhaustive):

Safety violation	Penalty
Leaving the lab without shutting down an experimental system	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 spill due to negligence (e.g., by opening wrong valves).	Letter grade reduction
Bringing food or drink into the lab	Letter grade reduction

### **Laboratory Management**

Laboratory management is an important aspect of this course. The students taking this course are required to review results of preliminary analysis (e.g., mass and energy balances, calculations, predictions, etc.) of their groups before the end of each lab and post brief summary of the collected data on the Canvas page of the Unit Ops Management course. This summary should also contain observations that may be useful to other students teaching the same experiment, as well as information on any problems encountered during the lab. The students should review the summaries from recent lab sessions before starting a new lab session. Furthermore, the lab director and/or the lab manager should be promptly informed about any equipment or supplies problems. Failure to do so *will result in a grade reduction*.

The students are also expected to periodically review and, if necessary, update the SOP and hazard analysis for their experiments, as well help maintain an up to date Chemical Hygiene Plan.

### **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.ua.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.ua.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](mailto:rbielling@eng.ufl.edu)
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, [taylor@eng.ufl.edu](mailto:taylor@eng.ufl.edu)
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, [nishida@eng.ufl.edu](mailto: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](mailto: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](mailto: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](mailto: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](https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf).

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