

Advanced Chemical and Biological Process Laboratories

ECH 6937 Sections 2147 and 28C1

Class Periods: Wednesdays (Section 2147) and Friday (Section 28C1), Period 7 - 9

Location: CHE 220 and 300A

Academic Term: Spring 2019

Instructors

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2. Jason Butler (Spin Coating and Fluidized Bed Modules)
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Teaching Assistants

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Course Description

3 credit hours. This is laboratory course providing an overview of advanced chemical and biological processing techniques. Students taking this course will gain hands-on experience in performing experiments and will improve their report writing and oral presentation skills.

Experimental Modules

Biological Applications of Chemical Engineering

- Michaelis–Menten enzyme kinetics
- Polymerase chain reaction
- Separation of DNA under electrophoresis
- Hydrogels: preparation and applications to drug delivery
- Thermodynamics of self-assembly

Advanced Chemical Engineering Systems

- Spin-coating
- Fluidized beds
- Gas absorption
- Cooling tower
- Industrial process control system
- Hydrogen fuel cell

Course Pre-Requisites / Co-Requisites

None.

Course Objectives

- Reinforce classroom theory by collection and use of data in practical experiments with all their inherent problems and limitations.
- Gain hands-on experience in performing experiments for a wide range of Chemical and Biological processes.
- Learn and practice safe laboratory techniques and operating procedures.
- Gain experience in analysis and interpretation of experimental data.
- Improve problem-solving skills.
- Apply critical thinking skills to analysis of problems and cause-effect relationships.
- Gain experience in working in teams.
- Gain proficiency in writing technical reports.
- Gain experience in giving oral presentation, including handling of questions and use of appropriate visual aids.
- Create a sense of professional responsibility for the quality and integrity of engineering work.

Materials and Supply Fees

The material and supply fees are included in the credit fee. The total credit fee (for 3 credits) is \$2250.

Required Textbooks and Software

None. The lab manuals and protocols of the experimental modules are available through Canvas. It is the student's responsibility to let the instructor or graduate assistant know if they have problems accessing the material.

Recommended Materials

The students are encouraged to check all the resources listed in the lab manuals and protocols from the libraries or Internet. Note that most journal articles can be downloaded from a computer connected to the University network.

Course Schedule

Please see Canvas for the group information, schedule, and location.

Attendance Policy, Class Expectations, and Make-Up Policy

- A student must be in attendance for the entire lab period of every module. Excused absences must be consistent with university policies in the [graduate catalog](#) and require appropriate documentation. To make up a missed lab, the students will be required to perform the missed experiment with another group. An unexcused absence will result in **zero points** for the missed module.
- Students will be given a warning for the first tardiness. Each subsequent instance of tardiness will result in a **half letter-grade reduction**.
- Cell phones cannot be used in the lab.

Evaluation of Grades

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

- Lab reports: 30%
- Postlab homework: 35%
- Prelab homework: 10 %
- Quizzes: 5 %
- Participation: 5 %
- Poster: 15 %

The participation grade will be based on the TA feedback, peer evaluations, and the instructor's observations. **A failing grade for participation will result in a failing course grade.**

Important: Failure to follow safe operating procedures will result in a substantial grade reduction (see below).

Grading Policy

The final grading scale will be curved as appropriate. More information on UF grading policy may be found at: <http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades>.

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

Prelab Homework Policy

- Prelab homework should be completed individually by each student and is due at the beginning of each new experiment.
- **A failing grade will be assigned to students whose cumulative prelab homework grade is less than 50%.**
- In addition to the homework assignment for each specific experiment, in the beginning of the semester the students will be assigned a homework on safety (due before your 1st lab session) and a homework on statistical analysis (due before your 2nd lab session).
- Late homework submissions will be accepted only if a student was not able to complete the homework on time due to an acceptable reason (see the attendance policy).

Quiz Policy

- A short quiz will be given at the beginning of each lab session.
- **A failing grade will be assigned to students whose cumulative quiz grade is less than 50%.**
- **Failure to correctly answer safety-related questions will result in a 5% reduction of the course grade per each wrong answer.**
- Quizzes will be rescheduled only for those students who missed them due to an acceptable reason (see the attendance policy). It is required that whenever possible the student notifies the instructor about the situation before the quiz.
- Students arriving late for a quiz will be given only the balance of time remaining to complete their work unless an acceptable reason (see above) is provided.
- Students may not use their notes, manuals, or any other material during the quizzes.

Schedule for each experiment

Before the experiment:

1. Review theory, safety manual, and operating instructions posted on the Canvas website.
2. Answer pre-lab questions posted on the Canvas website. Written answers to the pre-lab questions should be submitted to your TA at the beginning of the lab session.

During the experiment:

1. Get acquainted with equipment.
2. Learn proper start-up and shutdown procedures.
3. Learn how to perform measurements.
4. Learn about limits of the system.
5. Experiment with the system under various conditions (if applicable).
6. Perform basic checks of your data (e.g., mass and energy balances) during the experiment. Avoid a situation in which you collect data just to discover that it does not satisfy the mass or energy balance **after** you are out of the lab and writing your report. It is necessary to perform the basic checks **during** the lab and repeat an experiment, if necessary.
7. Your preliminary analysis will be reviewed by the TAs and will contribute to your lab participation grade.

After the experiment:

Analyze your data and write a report or a postlab homework. All reports and almost all postlab homeworks are group assignments (the only exception is the postlab homework on the introductory module on experimental techniques). You will be required to submit postlab homework for some experiments and reports for others (specific assignments will be posted on the Canvas website).

- Postlab homeworks are **due one week after the experiments**.
- Reports are **due two weeks after the experiment**. The students are encouraged to submit a draft of their report to the instructor for feedback before submitting the final version for a grade. Report drafts should be submitted at least one week before the final submission deadline to ensure timely feedback from the instructor.

Guidelines for the Lab Reports

1. Detailed guidelines and grading rubrics are posted on the Canvas website. Reports will be graded on both technical content and communication effectiveness.
2. Reports should be written 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. Relevant experimental and theoretical background should be explained in your own words. Copying from literature and the internet is not allowed. All reports will be subjected to the Turnitin software to determine their originality. If complete or partial copying is found, **the report grade will be reduced by at least a 50%**.
4. Do not copy theoretical derivations from a textbook or a website. Instead, clearly state assumptions behind a derivation, provide relevant derivation results, and cite your sources.
5. All reports should be submitted via Canvas either in MS Word or PDF format. There is no need to submit hard copies.
6. In addition to a report file, your submission should contain all supporting information, such as spreadsheet files with your data and files with your computer codes. However, your reports should be self-contained, i.e. one should be able to understand your work by reading your report without referring to supporting materials.
7. **Late submissions will be penalized by a 10% grade reduction for each day the report is overdue.**

Guidelines for Experiments and Data Analysis

1. Always perform basic validity checks, such as energy and material balances.
2. Investigate effects of all control parameters on the experimental results.
3. Clearly identify and justify all assumptions in your theoretical calculations.
4. Compare the measured data with your theoretical calculations.
5. Check reproducibility of your data. Whenever possible, **perform at least three runs for each experimental condition** and obtain error estimates by computing standard deviations based on these runs. Report the average values and error estimates in the main text of the report and provide an appendix containing data for all experimental runs.
6. Report any anomalous results and discuss their possible sources.
7. Use spreadsheets (e.g., Excel or OpenOffice) to store your data. Use python, matlab, or another equivalent programming language for data analysis and theoretical calculations. Use of spreadsheets for complex calculations is discouraged due to difficulty of their debugging.
8. Make sure that your objectives can be met with your operating conditions. It is easy to choose conditions that are outside of the performance limits of the apparatus or produce results with no measurable difference. Carefully study the limitations of the existing experimental apparatus as a part of the planning process rather than finding out in the laboratory that the experimental values obtained are useless.

Poster Presentation

- One formal poster presentation will be held in public (exact date and time to be announced later in the semester on Canvas). All students are required to prepare and present a final poster. Two or three students will be grouped as a team for the presentation. In the group, each student will have an opportunity to present his/her poster multiple times.
- The final version of the poster needs to be submitted to the instructor and the professionally printed poster needs to be ready at least 24 hours before the scheduled presentation. The information regarding poster-printing services at UF can be found in the following link: <http://print.at.ufl.edu/labmap.shtml>. The cost for a standard size poster is approximately \$20.00 – \$30.00 at UF (<http://print.at.ufl.edu/printingquestions.shtml>). You can also print the poster at off-campus locations such as Target Copy or Kinkos.
- Professional dress code (formal or semiformal) is required for the presentation.
- The critical dates for the poster development can be found in the Canvas website. Failure to meet any deadlines will result in at least a 10% deduction of the team's presentation score for each deadline missed.

Students Requiring Accommodations

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

Course Evaluation

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

University Honesty Policy

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Software Use

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

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see:

<http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html>

Campus Resources

Health and Wellness

U Matter, We Care:

If you or a friend is in distress, please contact umatter@ufl.edu or 352 392-1575 so that a team member can reach out to the student.

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

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

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

Academic Resources

E-learning technical 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>.