CHEN 4130 Course Syllabus

Chemical Engineering Senior Laboratory

Class Meetings:

Section (001) Monday 1:00-6:00 pm	BIOT B159 (Lecture) B171 (Lab)
Section (002) Thursday 1:15-6:15 pm	BIOT B159 (Lecture) B171 (Lab)

Instructors:

Role	Name	Email	Office Hours
Instructor	Ehsan Keyvani	Ehsan.keyvani@colorado.edu	**Tue 2p-3p/E1B25** **Wed 1p-2p ZOOM**
Head TA	Emma Hollis	emma.hollis@colorado.edu	**Thu 11a-1p ZOOM**
Grad TA	Ivana Tang	ivana.tang@colorado.edu	**Tue 12p-2p ZOOM**

Instructional Videos: https://www.colorado.edu/chbe/academics/course-descriptions/undergraduate-level-courses/chemical-engineering-lab

Text (optional): *Writing Style and Standards in Undergraduate Reports, 3rd Edition*
Donnell et al.; College Publishing; 2016; ISBN-13: 978-1932780093

Other Materials: Safety glasses

Course Learning Objectives

- To work in a pilot scale environment, with emphasis on teamwork, open-ended problem solving, project-style report writing, and effective oral communications.
- To provide hands-on operating experience with typical chemical engineering equipment and to obtain experience with heat transfer, fluid flow, separations, thermodynamics and reacting systems.
- To provide experience with planning and implementing experiments.
- To review and practice chemical engineering principles.
- To provide an understanding of, and practice with, the use of statistics and data interpretation with real experimental data.

Our schedule also includes two computational laboratories (Aspen and COMSOL).

ABET Accreditation Outcomes:

Course-Outcomes Matrix	1	2	3	4	5	6	7
CHEN 4130. Chemical Engineering Laboratory.			X		X	X	X

(1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
(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
(3) **an ability to communicate effectively with a range of audiences**
(4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
(5) **an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives**
(6) **an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions**
(7) **an ability to acquire and apply new knowledge as needed, using appropriate learning strategies**

General Format of Class

Eight experiments will be examined in this course:

1. Continuously Stirred Tank Reactor
2. Distillation Column
3. Draining Tank
4. Heat Exchanger
5. Hilsch Vortex Tube
6. Pressure Drop
7. Refrigeration
8. Reverse Osmosis
9. Steam Jacketed Tank
10. Pumps

Each student group will do Four of these experiments during the semester according to the Course Schedule. For the last 2 weeks of the experimentation, students will be assigned to work on a new project. Please see the Course Schedule for all work deadlines.

Assignments and Grading Basis

See Assignments document for list of points per assignment.

Most, if not all, assignments will be turned in through Canvas (Gradescope).

Turn in your assignments on time!!

- Assignments are due at the time/date shown on the Course Schedule.
- Assignments turned in late will be counted for 50% of possible points for 24 hours after the due date/time.
- ***No credit*** will be given for assignments turned in over 24 hours past the due date.

- There is no penalty for turning in an assignment early!

The letter grade will be assigned based on the final distribution of percentage scores in the class. The final percentage *may* be curved in favor of the average grade of the class.

Attendance

- ALL GROUP MEMBERS MUST ATTEND **ALL** CLASSES.
- Even if you do not need to conduct/evaluate experiments on the 2nd experimental day, you must check in with the instructor at the beginning of class.
- If you must miss a class, work with the instructor ahead of time to see if a make-up is possible.
- **Missing a single lab session results in losing the full points of that lab rotation for the individual.**

Lab Make-Ups

- If ALL group members have attended BOTH experimental sessions for a particular experiment and the group still does not have sufficient data, please work with the instructor to schedule lab time outside normal class hours or ask for data.
- If all group members have NOT attended both experimental sessions, please do not ask to make up a lab outside of the normal class period.

Lab Safety

In conducting the senior laboratory courses, we require the following practices of students, teaching assistants, and faculty.

Note: NO CELL PHONE USE IS ALLOWED IN LAB.

1. **Eye Protection**

   You must wear eye protection in the lab area. Eye protection must meet ANSI standards. Minimum protection consists of spectacles with side shield.

   If you wear glasses, you may obtain safety spectacles with side shields to wear over your glasses. You may also obtain prescription safety glasses with side shields. The lenses in prescription safety glasses are thicker than standard glasses.

   If you are observed in the lab without eye protection, you risk being disenrolled from the course.

2. **Dress and Appearance (from *Safety in Academic Chemistry Laboratories*, ACS, 1992)**

   High-heeled or open-toed shoes, sandals, or shoes made of woven material should not be worn in the lab. **Shorts, cut-offs, or short skirts are not permitted**. Long hair and loose clothing should be constrained. Jewelry such as rings, bracelets, and watches should not be worn, to prevent chemical seepage under the jewelry, contact with electrical sources, catching on equipment, and damage to the jewelry itself.

3. **Chemical Safety**

   Material Safety Data Sheets (MSDS) must be obtained for all experiments using chemicals. Each group member must read and understand the safety precautions and disposal procedures.

Waste chemicals are to be disposed of in appropriate containers located in the Satellite Accumulation Areas (SAA's). They are never to be poured down drains! Chemicals must be stored in approved and labeled containers. Solid materials contaminated by waste chemicals are disposed of in appropriate containers and must not be placed in the standard wastebaskets.

Waste materials, especially "sharps" such as needles and broken glass, must be placed in special containers for these materials. Do not place these items in the standard wastebaskets.

4. Behavior in the Laboratory

Don't

- Run
- Yell, except in an emergency
- Eat, drink, or smoke
- Engage in horseplay or mischief
- Ride anything (bikes, skateboards, inline skates)

Do

- Keep an eye out for hazards
- Think before you act
- Ask, if you have any doubt
- Take your time
- Be careful
- Inform and stay informed

5. Safety Devices

Know where all the fire extinguishers in the vicinity of the lab are and know their type. Know the location of the safety showers and eye washes and how to operate them. Know the escape routes from the lab and where you would call 911 after leaving the lab area.

Submit with First Lab Notebook (Online): Prepare a map of the lab with all fire extinguishers, safety showers and eye wash stations, and show 2 alternate escape routes, using different colors and symbols.

Absolutely no RESUBMISSION is allowed. This means a student cannot resubmit one of his or her own papers – or part of it – whether it was from a different college course or high school.

The following actions will not be tolerated and will be grounds for academic penalty as deemed appropriate by the instructor and in compliance with University Honor Code.

1. Papers submitted by any student, written in part or in whole by someone other than that student; in addition, submitted papers that have already been submitted for a different class ("resubmission").
2. Vandalism, destruction of property, stealing.
3. Violation of CU guidelines and standards.

These actions shall be considered to constitute fraud under the University Honor Code or unacceptable or criminal behavior. The penalties can include, but are not limited to, a reduction in assigned grade, receiving an F on the assignment or for the course, or personal responsibility to correct the violation.

University Policies

Honor Code
All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the Honor Code. Violations of the Honor Code may include but are not limited to: plagiarism (including use of paper writing services or technology [such as essay bots]), cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, **clicker fraud**, submitting the same or similar work in more than one course without permission from all course instructors involved, and aiding academic dishonesty. Clicker fraud in this curse means answering the questions from outside of the class.
All incidents of academic misconduct will be reported to Student Conduct & Conflict Resolution: honor@colorado.edu, 303-492-5550. Students found responsible for violating the Honor Code will be assigned resolution outcomes from the Student Conduct & Conflict Resolution as well as be subject to academic sanctions from the faculty member. Visit Honor Code for more information on the academic integrity policy.

Classroom Behavior
Students and faculty are responsible for maintaining an appropriate learning environment in all instructional settings, whether in person, remote, or online. Failure to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation, or political philosophy.

For more information, see the classroom behavior policy, the Student Code of Conduct, and the Office of Institutional Equity and Compliance.

Disabilities
If you qualify for accommodations because of a disability, please submit your accommodation letter from Disability Services to your faculty member in a timely manner so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities in the academic environment. Information on requesting accommodations is located on the Disability Services website. Contact Disability Services at 303-492-8671 or dsinfo@colorado.edu for further assistance. If you have a temporary medical condition or required medical isolation for which you require accommodation, reach out to your instructor right away and they will walk you through needed documentation. We are dropping 3 clicker grades just to accommodate any kind of personal issue that might be stopping you from attending the class. Also see Temporary Medical Conditions on the Disability Services website.

Religious Holidays
Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with

scheduled exams, assignments or required attendance. *In this class, the student must notify the instructor at least one week in advance of a missed class due to religious observance in order to*

make appropriate arrangements to turn in homework or schedule an alternative time to take an exam. See the campus policy regarding religious observances for full details.

Sexual Misconduct, Discrimination, Harassment and/or Related Retaliation

CU Boulder is committed to fostering an inclusive and welcoming learning, working, and living environment. University policy prohibits protected-class discrimination and harassment, sexual misconduct (harassment, exploitation, and assault), intimate partner violence (dating or domestic violence), stalking, and related retaliation by or against members of our community on- and off-campus. These behaviors harm individuals and our community. The Office of Institutional Equity and Compliance (OIEC) addresses these concerns, and individuals who believe they have been subjected to misconduct can contact OIEC at 303-492-2127 or email cureport@colorado.edu. Information about university policies, reporting options, and support resources can be found on the OIEC website.

Please know that faculty and graduate instructors have a responsibility to inform OIEC when they are made aware of incidents related to these policies regardless of when or where something occurred. This is to ensure that individuals impacted receive an outreach from OIEC about their options for addressing a concern and the support resources available. To learn more about reporting and support resources for a variety of issues, visit Don't Ignore It.

Requirements for Infectious Diseases

Members of the CU Boulder community and visitors to campus must follow university, department, and building health and safety requirements and all public health orders to reduce the risk of spreading infectious diseases.

The CU Boulder campus is currently mask optional. However, if masks are again required in classrooms, students who fail to adhere to masking requirements will be asked to leave class. Students who do not leave class when asked or who refuse to comply with these requirements will be referred to Student Conduct & Conflict Resolution. Students who require accommodation because a disability prevents them from fulfilling safety measures related to infectious disease will be asked to follow the steps in the "Accommodation for Disabilities" statement on this syllabus.

For those who feel ill and think you might have COVID-19 or if you have tested positive for COVID-19, please stay home and follow the further guidance of the Public Health Office. For those who have been in close contact with someone who has COVID-19 but do not have any symptoms and have not tested positive for COVID-19, you do not need to stay home.

Preferred Student Names and Pronouns

CU Boulder recognizes that students' legal information doesn't always align with how they identify. Students may update their preferred names and pronouns via the student portal; those preferred names and pronouns are listed on instructors' class rosters. In the absence of such updates, the name that appears on the class roster is the student's legal name. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records.

Mental Health and Wellness

The University of Colorado Boulder is committed to the well-being of all students. If you are struggling with personal stressors, mental health or substance use concerns that are impacting academic or daily

life, please contact Counseling and Psychiatric Services (CAPS) located in C4C or call (303) 492-2277, 24/7.

Free and unlimited telehealth is also available through Academic Live Care. The Academic Live Care site also provides information about additional wellness services on campus that are available to students.