

# COURSE SYLLABUS

## CHEN 4570 Process Dynamics and Control

*Spring 2025, Nuttelman*

<u>Lecture Time</u>	<u>Location</u>	<u>Instructor</u>	<u>Email</u>
T/Th 1:00-2:15 PM	BIOT A108	C.R. Nuttelman	<a href="mailto:charles.nuttelman@colorado.edu">charles.nuttelman@colorado.edu</a>

<u>Lab</u>			
T/W/Th (Time varies per section)	BIOT B171	Grad TAs	(see below)

NOTE: All in-person lectures will be recorded using Lecture Capture. On occasion there are issues with the recording, so please don't rely on these recordings – I do my best! Lecture Capture should not be a substitute for attending class – each day of class we will work through handouts. Furthermore, there are Clicker questions on most class periods (attendance mandatory for Clicker points, see below).

### Office Hours

I will hold office hours during the following times at the following locations:

- 12:00-1:00 PM on Wednesdays in BIOT E1B11 (starting 1/22/25)
- 11:30 AM – 12:30 PM on Thursdays in BIOT E1B11 (starting 1/23/25)

Rebecca Beswick (advanced TA for the course, see below) will hold office hours 10:30-11:30 am on Fridays in BIOT E125 (starting 1/24/25). There are a few conflicts with this room throughout the semester, so Rebecca will notify you of these conflicts in the Announcements area of Canvas.

No office hours the week of Spring Break.

### Optional Textbook

I find that all textbooks on control theory are WAY too thick and there's no way we'd ever get through even half of these textbooks. Rather than "flooding" and overwhelming you with an overabundance of course material, I prefer to focus on a few core control theory topics. Students in the past have appreciated this approach to focus on depth of a few core topics vs. only a shallow understanding of many topics.

There is no required textbook for this course. However, there is an optional textbook: "Process Dynamics and Control (4th edition)" by Dale E. Seborg, Thomas F. Edgar, Duncan A. Mellichamp, Francis J. Doyle III. ISBN: 978-1-119-28591-5. Publisher: Wiley.

### **Required Software**

Microsoft Excel

MATLAB (Student license available from OIT)

### **Additional Resources (Optional)**

*Practical Electronics for Inventors*, Paul Scherz and Simon Monk.

### **How to Succeed in CHEN 4570**

As with many of your other classes, hard work will pay off in this class. Process Control is not a topic that comes naturally to many students – it is a subject that requires time and energy to succeed. You will be rewarded by persistence and effort. The best way to learn in this course is to be involved with the in-class handouts/examples, complete all homework questions yourself (as opposed to the “divide and conquer” approach for group work), put in the requisite time and energy, attend office hours, and ask questions when you do not understand something.

### **Course Schedule**

See “Schedule - CHEN 4570 Spring 2025.pdf” on Canvas for a list of topics for each class period plus due dates for quizzes, homework assignments, and exams.

### **Lab Instructor/Teaching Assistants**

Dr. Keyvani (Teaching Assistant Professor, [Ehsan.Keyvani@Colorado.EDU](mailto:Ehsan.Keyvani@Colorado.EDU)) will be teaching the lab portion of the course. Two first year graduate student teaching assistants (TAs) and one advanced graduate student TA (ATA) will be assisting in lab (the TAs and ATA will also grade homework assignments in the course).

TAs: Aidan Wegner ([Aidan.Wegner@Colorado.EDU](mailto:Aidan.Wegner@Colorado.EDU)) and Henry Lutz ([Henry.Lutz@Colorado.EDU](mailto:Henry.Lutz@Colorado.EDU)). Aidan took the course last year as a senior in ChBE.

ATA: Rebecca Beswick ([Rebecca.Beswick@Colorado.EDU](mailto:Rebecca.Beswick@Colorado.EDU)). Rebecca was a TA in the course last year. Rebecca will also be teaching several lectures in the course and will be holding weekly office hours (see previous page).

<b>Name</b>	<b>Lab section</b>
Henry Lutz and Aidan Wegner	Tuesdays, 2:30-4:50 PM
Aidan Wegner and Henry Lutz	Wednesdays, 3:00-5:20 PM
Rebecca Beswick	Thursdays, 2:30-4:50 PM

## **Homework Assignments**

There will be 6 required homework assignments throughout the semester. Please see the Course Schedule for due dates. Most HW assignments are due on Friday by 11:59 PM. In the past, I had HW due on Thursday nights but last year I had them due on Friday nights, which students seemed to prefer. Many Fridays I am home taking care of my son Logan (while my wife works) and therefore I am unable to help w/ last minute HW questions. Note that if you require help from me, please know that I won't be able to help you on Fridays. If you do need help from me, you may want to set a personal deadline for yourself to try to wrap up HW assignments by Thursday of the week that HW is due. Homework assignments are to be submitted via Gradescope (more information on this later).

*If and only if the response rate on the FCQs at the end of the semester is >90%, I will drop the lowest HW assignment.*

## **Labs**

There is a lab component to the course that makes up 15% of your final grade in the course. Each student is enrolled in a weekly lab, which meets in the Undergraduate Lab (same place as Senior Lab/across the hall from Bio Lab). The lab does not meet every week. Rather, there are three 3-week rotations spaced apart by a week. Please see your course schedule for which lab you signed up for (Monday, Tuesday, etc.). The rotations meet the following weeks:

- Rotation 1: 2/4 - 2/20 (3 weeks)
- Rotation 2: 3/4-3/20 and 4/1-4/3 (4 weeks; note the week break between Rotations 1 and 2)
- Rotation 3: 4/8-5/1 (4 weeks)

*Lab attendance is absolutely required.* No labs are dropped in the calculation of your final grade.

Make-Up Lab Sessions: If you happen to miss a lab (sickness, grad school visit, job interview), please let your TA know ahead of time and they will work with you to schedule a make-up time and date. Note that you will likely need to attend a different session/day than your typical lab. Note that make-up labs should only be for special occasions and illnesses.

## **Clicker Questions**

We will be using iClicker to enhance active learning and participation in the course. You will need to have an iClicker student app account, register your clicker there (<https://buffportal.colorado.edu/card/cuclicker>), and download and set up the app BEFORE you get to class. Most days in class (but not every day), I'll ask one to several Clicker questions. Clickers are worth 5% of your final grade in the course and I will drop the lowest 10% of scores at the end of the semester due to absences (illness, job interviews, grad school visits, conferences, etc.) and for Clicker responses not going through (it will happen to everyone). No need to let me know if you will be absent unless you have an extended absence; in that case, we can discuss alternate arrangements.

Please visit this link to join the course: <https://join.iclicker.com/LHTX>

## Weekly Quizzes

At the end of each week of class, excluding exam weeks, there will be an online Weekly Quiz due by Friday at 11:59 pm. Quizzes will have approximately 5-10 multiple choice and/or short answer/calculation questions and are cumulative in nature (i.e., they will ask questions related to the entire semester to date). Quizzes are to be done individually, and it is an Honor Code violation to work together on the quizzes or provide assistance to another student.

Of the 13 quizzes, the lowest 3 are dropped automatically in calculating your final grade. The remaining 10 are each worth 1.5% of your final grade (15% total grade for quizzes).

You have 60 minutes to complete each quiz and you MAY look at previous notes, course slides, classroom capture, homework, etc. In other words, each quiz is open note. However, you MAY NOT, under any circumstances, use the assistance of other students or assist other students with these quizzes - they are completely independent.

## Exams

There will be 2 evening exams during the semester (plus the final exam). The following outlines the times/places of the exams:

Exam	Time	Location
Midterm Exam 1	Wednesday, 2/19, 7:00-9:00 p.m.	BIOT A115
Midterm Exam 2	Monday, 4/7, 7:00-9:00 p.m.	BIOT A115
Final Exam	Saturday, 5/3, 1:30-4:00 p.m.	BIOT A115

All exams are cumulative! As such, there is a progressive weighting for the exams:

- Midterm Exam 1 covers classes 1-10 (1/14-2/13) and is worth 10% of your final grade in the course.
- Midterm Exam 2 covers classes 1-18 (1/14-3/20) and is worth 15% of your final grade in the course.
- The cumulative Final Exam has roughly 50-60% emphasis on classes 19-25 and 40-50% emphasis on Exam 1/2 material (classes 1-18). The Final Exam is worth 20% of your final grade in the course.

NOTE: For each of the midterm exams, one class is cancelled. On the following days, there will be no class:

- Thursday, 2/20
- Tuesday, 4/8

## **Grading**

<b>Element</b>	<b>Percentage</b>
Labs	15%
Clicker Questions	5%
Homework	20%
Weekly Quizzes (13 of these)	15% (1.5% each of the best 10 results; lowest 3 dropped)
Exams (2 of these)	25% (see above)
Final Exam (cumulative)	20%

## **Learning Goals:**

1. Apply concepts of automatic control, including measurement, feedback and feedforward regulation for the operation of continuous and discrete systems.
2. Design and implement systems utilizing analog and/or digital control devices.
3. Apply the concepts of chemistry, physics, and electricity/electronics to measurement and control systems.
4. Apply the concepts of digital and microprocessor systems and functionality of system components/devices for the automation of processes.
5. Apply the concepts of measurements and sensor selection.
6. Communicate the technical details of control systems using current techniques and graphical standards.
7. Apply the concepts of mechanics, fluid mechanics, and heat transfer to the design of process control systems.
8. Understand and utilize programmable logic controllers (PLC) for control of manufacturing and processing systems.

## **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, marital 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](#).

## **Accommodation for Disabilities, Temporary Medical Conditions, and Medical Isolation**

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](mailto:DSinfo@colorado.edu) for further assistance. If you have a temporary medical condition, see [Temporary Medical Conditions](#) on the Disability Services website.

## **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.

## **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, 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. All incidents of academic misconduct will be reported to Student Conduct & Conflict Resolution ([honor@colorado.edu](mailto: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. Additional information regarding the Honor Code academic integrity policy can be found on the Honor Code website.

***IMPORTANT – Academic sanctions from the Department of Chemical and Biological Engineering:*** If you are caught for academic dishonesty associated with any assignments (lab, homework, exam, other), the Department of Chemical and Biological Engineering recommends that

1. All involved students **fail the course**.
2. The incident is reported to the Honor Code Council [honor@colorado.edu](mailto:honor@colorado.edu).

### **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 abuse (dating or domestic violence), stalking, and related retaliation by or against members of our community on- and off-campus. The Office of Institutional Equity and Compliance (OIEC) addresses these concerns, and individuals who have been subjected to misconduct can contact OIEC at 303-492-2127 or email [CUreport@colorado.edu](mailto:CUreport@colorado.edu). Information about university policies, [reporting options](#), and [support resources](#) including confidential services can be found on the [OIEC website](#).

Please know that faculty and graduate instructors must 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 outreach from OIEC about resolution options and support resources. To learn more about reporting and support for a variety of concerns, visit the [Don't Ignore It page](#).

### **Religious Accommodations**

Campus policy requires faculty to provide reasonable accommodations for students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. Please communicate the need for a religious accommodation in a timely manner.

See the [campus policy regarding religious observances](#) for full details.

### **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.

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