UNIVERSITY OF CALIFORNIA, DAVIS
Department of Chemical Engineering
ECH 158C Section 2: Plant Design Project
Spring 2026 Syllabus

Instruction Team

Professor Matt Ellis, mjellis@ucdavis.edu, 3112 Bainer Hall

Office Hours: Weekly Meetings as Scheduled with Groups in 3090 Bainer Hall; Open Office Hours Wednesdays 2-2:30 PM & Thursdays 3:20-4 PM in 3090 Bainer Hall

Connecting Remotely: By Appointment, https://ucdavis.zoom.us/j/3452292360

Professor Jason White, jarwhite@ucdavis.edu, 3098 Bainer Hall

Office Hours: Weekly Meetings as Scheduled with Groups in 3090 Bainer Hall; Open Office Hours Wednesdays 9-10am & Fridays 1-2pm in 3098 Bainer Hall

Connecting Remotely: By Appointment, https://ucdavis.zoom.us/j/3138743818

Frank Vilimek, Course Tutor

Office Hours: Mondays & Wednesdays 11am-12pm in Acad Surge 1033, Tuesdays & Fridays 3-5pm on Zoom on Zoom (https://ucdavis.zoom.us/j/99651170558)

Professional Mentors (UCD ChE Alumni)

Cody Caldwell, cacaldwell@ucdavis.edu, www.linkedin.com/in/cody-caldwell

5 years in Chemical manufacturing with direct experience with process improvement, process safety, reliability, and environmental regulations.

Remote Office Hours: Mon 6-7, Wed 4-5. Attendance should be coordinated via email and confirmed with a zoom meeting.

Eric Taurone

Eric has been working in Industry since graduating in 2018. He's worked as a High Volume Manufacturing (HVM) Process Engineer at Intel's 10nm plant, a

Technology Process Engineer in Amazon, and a Software Engineer with Amazon.

Office Hours: 5-6 p.m. Fridays (or 4:30-5:30 p.m. Fridays)

Course Information

Discussion: M/W 1:10pm – 2:00pm, 3218 Teaching & Learning Complex

Prerequisite: ECH 158AN & ECH 158BN

Senior design experience for chemical and biochemical processes. Impact of multiple realistic constraints. Design, costing, and profitability analysis of complete plants. Use of computer-aided design techniques. GE credit: SciEng | OL, QL, SE, SL, VL, WE.

Course Content and Requirements

The course will focus on the conceptual design of chemical processes, with emphasis on the flow-sheeting, costing and economic evaluation of complete industrial plants. Team projects that will address real-world plant design problems will be assigned. The successful completion of the projects will require thoughtful and creative integration of the knowledge and skill sets acquired in previous chemical engineering courses (thermodynamics, transport phenomena, reaction kinetics, reactor design and separations), as well as extensive use of design tools (Aspen Plus® Process Simulator). As chemical engineers, you will face the challenge of combining basic technical principles learned in the general chemical engineering curriculum with practical elements of economics, business practices and organization, along with principles of safety, environmental and sociological issues to design an integrated chemical process plant.

Suggested Reference Materials

1. R Turton, JA Shaeiwitz, D Bhattacharyya and WB Whiting, *Analysis, Synthesis, and Design of Chemical Processes*, Pearson, 5th Ed., 2018.
2. MS Peters, KD Timmerhaus, and RE West. *Plant Design and Economics for Chemical Engineers*, McGraw Hill, 5th Ed, 2003.
3. WD Seider, JD Seader, DR Lewin and S Widagdo, *Process Design Principles: Synthesis, Analysis and Evaluation*, Wiley, 4th Ed., 2017.
4. DW Green and MZ Southhard, *Perry's Chemical Engineers Handbook*, McGraw-Hill, 9th Ed., 2019 (available electronically via UC Davis Library).
5. CCPS, *Introduction to Process Safety for Undergraduates and Engineers*, Wiley, 2016.
6. TA Adams II, *Learn Aspen Plus in 24 Hours*, McGraw Hill, 2nd Ed., 2022.

- Available electronically via UC Davis Library (requires VPN on an off-campus connection)
- https://www.accessengineeringlibrary.com/content/book/9781264266654

7. KIM Al-Malah, *Aspen Plus: Chemical Engineering Applications*, Wiley, 2017.
8. Chaves, IDG *et al.*, *Process Analysis and Simulation in Chemical Engineering*, Springer, 2016.
    - Available electronically via UC Davis Library (requires VPN on an off-campus connection)
    - https://link.springer.com/book/10.1007/978-3-319-14812-0
9. Learn ChemE Process Design Page: http://www.learncheme.com/screencasts/process-design

Computer Software

- Aspen Plus® (see access options below)
- Document Preparation Software (e.g., Google Doc, LibreOffice, Microsoft® Word, LaTeX)
- Spreadsheet Software (e.g. Microsoft® Excel, Google Sheets)
- PDF Viewer (e.g., zathura, Evince, Okular, Adobe® Reader)
- Zoom (optional)
- Slack or similar app (optional, for intra-team communication and file sharing)
- DWSim (optional)
- Python and/or MATLAB® (optional but helpful)

Aspen Plus Access

You may access Aspen Plus using one of the three options below:

- Installation on personal computer (Windows only)
- Physical computer lab (2061 Bainer)
- Virtual lab (limited capacity)

For instructions on how to install Aspen Plus on your computer, or for how to access the virtual lab, see https://kb.ucdavis.edu/?id=6739.

Course Outcomes

Upon successfully finishing this course, the students are expected to acquire or improve upon the ability to…

- Design a chemical process that meets desired specifications.
- Work effectively in a team.
- Use ASPEN Plus to model the primary processing equipment in their proposed chemical plant.

- Evaluate their design concept using a techno-economic analysis as well as using appropriate environmental, social, and safety considerations.
- Effectively communicate their design and analyses through written design memoranda and written design reports as well as an oral presentation and a poster presentation.

Associated ABET Student Outcomes

- an ability to identify, formulate, and solve complex engineering problems by applying principals of engineering, science, and mathematics
- 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
- an ability to communicate effectively with a range of audiences
- an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
- 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
- an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Course Website

Project assignments, meeting schedules, class announcements, handouts, and supplementary material will all be posted on the course webpage which you can access by visiting https://canvas.ucdavis.edu/ and logging in using your Kerberos username and password. If you don't know your login information (or you have other computer related problems, e.g. the Aspen license server is down), please contact our System Administrator at coeithelp@ucdavis.edu.

Grading

- Progress reports (3) = 30%
- Midterm oral presentation = 20%
- Draft and final written design reports = 35%
- Senior Design Showcase poster presentation = 5%
- Evaluation of group work = 10% (scale is -10% to 10%, see more details below)

Reports will be evaluated as if you were in a professional setting. You will receive detailed feedback from your PM on each assignment as well as categorical grades of

“Excellent”, “Good”, “Acceptable”, or “Unacceptable”. For the full design reports, these categorical grades will be assigned to each grading category (defined in the rubric for this assignment). If work from your group is typically excellent, you can expect an A level grade in this course. If work from your group is typically good, you can expect a B level grade in this course. If work from your group is typically acceptable, you can expect a C level grade in this course. If any work submitted is considered to be unacceptable, it must be resubmitted or will be considered to be failing. Instructions will be provided detailing what is expected for each assignment, and examples of past reports will be provided.

Peer evaluation consists of evaluating your group, and the relative contribution of team members. As all deliverables in this course are group deliverables, active participation in your group is essential. Outstanding teamwork will be rewarded and poor effort with regards to group work will be heavily penalized. Group members who receive an average rating of 4/5 across all evaluation categories on a given evaluation will receive full credit. Other scores will be assigned according to the following scheme:

Peer Evaluation Grading Scheme (out of 5 pts) x 2 surveys

Average rating >= 4/5:	5 pts
Average rating >= 3.5/5 && < 4/5:	3.5 pts
Average rating >= 3/5 && < 3.5/5:	2 pts
Average rating >= 2/5 && < 3/5:	0 pts
Average rating >= 1/5 && < 2/5:	-5 pts

If you fail to submit an evaluation, or your comments are incomplete or unprofessional, you will receive at best a 0 for that evaluation (each is worth 5 pts for a total of 10 pts).

If your group members report that you did not earn your fair share of the credit, this may be referred to Student Judicial Affairs (SJA) as this may constitute plagiarism (see more on this below).

Example progress and final reports will be provided to give you a general idea of what is expected and how students have previously approached these assignments. These examples are by no means perfect, and they are project specific. As you review these you may get some good ideas, but you should also critique and improve upon these past submissions.

If you find this example library of previous team deliverables to be a helpful reference, please consider contributing your team’s deliverables to our example library. Your team can contribute all or some of your team’s deliverables. To contribute, please send an

email to one of the instructors with the deliverable materials that your team would like to contribute. If you would like to remove any identifying information, please remove this and create a PDF without this information.

Policy on Scholastic Conduct

As a team, you are encouraged to discuss concepts and ideas related to the project. However, the work that each group submits for a grade in this course must be its own. Evidence of any violations of the UCD Code of Academic Conduct (see http://sja.ucdavis.edu/index.htm) will be sent directly to Student Judicial Affairs (SJA). The following illustrates only a few examples of academic dishonesty:

- Plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained. This includes (i) representing data, analysis, or writing as being your own work when it is not; and (ii) using materials taken from the web, from the literature, or from other groups, without giving proper attribution.
- Improper collaboration in group work. For group projects, the names of all students who contributed to the work should be placed on the report. All group members whose names appear must review and agree with the entire submission, and they accept full responsibility for the context and honesty of the entire submission. The instructor reserves the right to examine the group in cases where fraud is suspected.
- Accepting credit for group effort if you did not do your share of the work.

Policy on Use of AI Tools

Successful completion of 158C means that you have acquired or improved the specific abilities articulated in the Student and ABET outcomes (see above). Excessive or inappropriate use of AI-based tools can impede the development or improvement of these abilities, thereby hindering achievement of the learning objectives. For example, excessive reliance on AI to write technical progress reports or the final report may prevent you from improving your ability to communicate effectively. Excessive or inappropriate use of AI tools may adversely affect the evaluation of deliverables. Students should know that TurnItIn, a tool built into the Canvas SpeedGrader, runs both a plagiarism check and AI check on submissions. Your project manager will inform you of suspected excessive or inappropriate use of AI tools. In these cases, you will be encouraged to schedule a meeting with your project manager to discuss and, if needed, provide evidence of successful completion of the learning objectives. In severe cases, students may be referred to Student Judicial Affairs (refer to the Policy on Scholastic Conduct section).

Project Guidelines

- Groups will be assigned to either Prof Ellis or Prof White who will serve as the project manager (PM) for the design project. The project manager will be responsible for assessing that group's work, but the groups may use either professor's open office hours.
- Design groups will consist of four or five students. Each group will regularly meet with their PM. It is highly recommended that each member of the group comes to these meetings, and that the group is well-prepared to discuss critical questions and challenges.
- Effective teamwork is crucial in this course. A well-coordinated effort and good communication among the group members will be keys to the success of the project. Students will evaluate group effort periodically. Submission of peer evaluation forms is mandatory, and failure to submit will result in students receiving no credit for that component of their grade. Peer evaluation forms need to be submitted electronically on the day they are due before the listed deadline.
- Groups will report to the PM via the following formats: (a) three written progress reports, (b) a comprehensive written design report (draft and final), and (c) a group oral presentation to be held during week 7. For each progress report, each group will be asked to submit a short update on a certain phase of the project. The comprehensive written reports should provide details of the proposed conceptual design and economic evaluation package. Additional instructions on the scope and format of both the written and oral reports will be provided in class and/or published on the course website.
- Electronic copies of the progress reports, in pdf format, need to be submitted by the group leader to the PM via Canvas on the day they are due before 11:59pm (the end of the day). No late submissions will only be accepted with PM permission. A group should give sufficient notice if an extension is to be requested.
- The comprehensive written reports, in pdf format, need to be submitted electronically by the group leader to the PM via Canvas on the day they are due before 11:59pm. Late submissions will not be accepted unless there is a serious reason that the deadline must be missed. The group should submit the main report file as well as all simulation (Aspen Plus®) and supplementary files (Excel spreadsheets, Python code, etc) used in the preparation of the report.

Tentative Course Schedule

Week	Monday	Wednesday
1 (March 30/ April 1)	Welcome & Course Information, Progress Report 1 Requirements, Process Modeling - Upstream	Group Discussion & Informal Presentations
2 (April 6/8)	Discuss Senior Design Showcase, AI Generated Writing, Review: Process Fluid Dynamics, Process Heat Transfer	Group Discussion & Informal Presentations
3 (April 13/15)	Review: Separations, Progress Report 2 Requirements	Group Discussion & Informal Presentations
4 (April 20/22)	Review: Process Safety and Inherently Safer Design Principles	Group Discussion & Informal Presentations
5 (April 27/29)	Review: Economic Analysis, Progress Report 3 Requirements	Review: Economic Analysis, Continued
6 (May 4/6)	Group Discussion & Informal Presentations	Oral Presentation Prep
7 (May 11/13)	Oral Presentation Prep - Office Hours during Class Time	Major Oral Presentations, each group will be scheduled a presentation time
8 (May 18/20)	HAZOP, Discussion on Written Design Reports, Draft Report Requirements, and Posters	Office Hours Session @ Profs Offices
9 (May 25/27)	No Class - Memorial Day Holiday	No Class - Draft Report Review
10 (June 1/3)	Office Hours Session @ Profs Offices	Senior Design Showcase (on Thursday 5/4)

Important Deadlines

Assignment	*Due Date*	*Submission Location*	*Format*
Progress report #1	April 11	Canvas	PDF only
Register for Design Showcase & Sandia Competition	April 19	Event Website	Webform
Progress report #2	April 25	Canvas	PDF only
Progress Report #3	May 11	Canvas	PDF Only

Peer evaluation report #1	May 11	Google Form	Google Form
Sandia Award Submission (optional)	May 12	To College	See instructions from college
Presentation slides	May 12/13	Canvas	PDF or PPT
Draft of design report	May 21	Canvas	PDF + Aspen File(s) + Economics Spreadsheet(s) + Other Supplementary Files
Abstract & Poster for Design Showcase	May 25	Canvas and To College	PDF and/or PPT
Final design report	June 8	Canvas	PDF + Aspen File(s) + Economics Spreadsheet(s) + Other Supplementary Files
Peer evaluation report #2	June 8	Google Form	Google Form

Important Events

Event	*Date*	*Time*	*Location*
Oral Presentations	May 12/13	TBA	3118 Bainer
Engineering Design Showcase	June 4	1-4pm	U Center

Rich Anderson Award for Best Student Design

This award is given each year to a chemical engineering design group in ECH 158C who demonstrates outstanding creativity and rigor in their design project. The award was established by the former Department of Chemical Engineering and Materials Science in 2010 to honor the memory of Mr. Richard Anderson, following his passing on December 14, 2009. Mr. Anderson worked at Conoco-Phillips, Bartlesville, OK, and helped our department with the set-up, guidance, and evaluation of the design projects for more than twenty years. He was an integral part of the education of our students and a valued mentor for them. The award will be a cash prize and the students' names will be placed on a plaque to be displayed in the Bainer Hall corridor where the photographs of graduating seniors are displayed.

College of Engineering Senior Design Showcase

On June 4, the College of Engineering will be hosting its annual Senior Design Showcase event. This event is the culminating experience for design and project teams around the whole College to highlight their senior project and exhibit the design process. Participation in this event includes the presentation of a poster in order to demonstrate your projects and typically the opportunity to discuss with guests your design process and experience. Guests invited to this event include industry representatives, faculty, current students, families, and College benefactors. This is a great opportunity for students to network with potential employers and highlight their undergraduate experiences. To participate in the event, each team must register online and submit a 250-word abstract that concisely explains the project's purpose and the intended audience. Additional details on the planning, preparation, and logistics of your participation will be given in class in coordination with the COE Dean's office. You may also visit (https://engineering.ucdavis.edu/undergraduates/student-life/engineering-design-showcase) for further details on this event.

Donate Your Deliverables!

If you find the example library of previous team deliverables to be a helpful reference, please consider contributing your team's deliverables to our example library. Your team can contribute all or some of your team's deliverables, by emailing the instructor with the materials you would like to contribute. If you would like to remove any identifying information, please remove this and create a PDF without this information. On behalf of future cohorts, thank you for contributing to our growing library!

Accessibility

Regardless of disability status, we all have access needs. Access needs are anything you require of your community or environment in order to participate fully, healthfully, and meaningfully. We value diversity in learning modalities, approaches, and access needs.

We are committed to creating a learning environment that is as accessible and inclusive as possible. We will make every effort to ensure that course materials, activities, and technologies are accessible to all students. That said, we may not be perfect in our efforts.

If you encounter any barriers to access in this course, or if you need course content in an alternative or remediated accessible format—please let us know as soon as possible. We welcome feedback and will work promptly to address accessibility needs.

Contact the UC Davis Student Disability Center if you need, or suspect you may need,

accommodations as soon as possible at sdc@ucdavis.edu.

Join the Disabled Student Union or the Aggie Neurodiversity Community for community, support, and advocacy.

Here's a map of campus that shows locations of accessible and power-assist entryways in campus buildings.

Here are some accessibility tools that you might find useful:

- Canvas Immersive Reader (Chrome extension for web viewing)
- Otter Transcription/Captioning
- Text-to-speech (Chrome extension)
- Speech-to-text tools: Google Docs Voice Typing feature (under File)
- Zamzar document to audio file converter (listen to your course readings while commuting!)
- Pomodoro time/task management tool