



ECH 4604

Process Economics and Optimization

Academic Term: Spring 2021

Course Section(s):

Find your section and make sure to take note of your class time and location.

Class #/Section	Meeting Info	
26670/ OL22	T Period 6 - (12:50 PM - 1:50 PM)	Online (100%)-
	R Period 6 - 7 (12:50 PM - 2:45 PM)	Synchronous

Instructor:

Sindia M. Rivera-Jiménez, Ph.D. (Call me Dr. Rivera or Prof. Rivera)
Lecturer, Department of Engineering Education
Affiliate Faculty Chemical Engineering Department

- Pronouns: she, her, hers
- Office Location: Online. Check Canvas for Zoom links.
- Telephone: 352-846-1974 (Check Canvas for Zoom links.)
- Email: rivera.jimenez@eng.ufl.edu.
 - Before emailing me, check on our Microsoft Teams Site.
 - You MUST use ECH4644 in the subject heading to receive an answer. It makes it more efficient for all.
 - Expect 24 hrs. response time from M-F and 48 hrs. for weekends.
- Online office hours and Microsoft Teams Support: To be announced on Canvas within the first week of class. You can email to make an appointment with your instructor. Also, I am available immediately after class. This has worked very well for students in the past. On certain weeks, I will post EXTRA office hours as well.

Teaching Assistant/Peer Mentor/Supervised Teaching Student:

- TBA

Course Description

Credits: 3. *Description:* Introduction to the principles of process economics including specifications and costing of equipment, operations costing and economic evaluation of processes

Course Pre-Requisites / Co-Requisites

Prereq: ECH 3203 (Fluid and Solid Operations), ECH 3223 (Energy Transfer Operations)

Coreq: ECH 4403 (Separations and Mass Transfer Operations)

Course Learning Objectives (CLO)

Upon completion of this course, a student should be able to:

- CLO 1. Recognize the nature and methodology of the design process, and its application to design diverse chemical and manufacturing processes.
- CLO 2. To apply knowledge of fundamental science and chemical engineering concepts to describe, analyze and improve processes that will benefit society.

Inclusion Statement

It is my intention that students from all backgrounds and perspectives will be well served by this course, and that the diversity that students bring to this class will be viewed as an asset. I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, socioeconomic background, family education level, ability – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class. Your suggestions are encouraged and appreciated.

Lived Name/Pronoun Statement

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.

- CLO 3. Evaluate the economic, environmental, safety, and ethical implications that are involved in developing different new or improved processes.
- CLO 4. To justify the selection of reliable processes designs by evaluate multiple optimization criteria that relates economic performance with process conditions and equipment selection, arrangement, and sequencing.
- CLO 5. To use tables, charts, or software to estimate physical property data needed for design and economic data to estimate costs
- CLO 6. To function effectively in a team by applying professional practices such as leadership, collaborative and inclusive environment, project management, and communication in both oral and written forms.

Materials and Supply Fees: None

Professional Component (ABET):

(ABET) Skills acquired during course: (1) Engineering problem solving and critical thinking that includes basics of Chemical Engineering.

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.	Low
2. An ability to apply both analysis and synthesis in the engineering design process, resulting in designs that meet desired needs.	High
3. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.	Medium
4. An ability to communicate effectively with a range of audiences	Low
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. Shaded box indicate that outcome is assessed in this course.

The ABET objectives are supported as follows:

- Students develop the ability to apply knowledge of mathematics, science and engineering in context of economic analysis including specifications and costing of equipment, operations costing and economic evaluation of processes.
- Student will learn and apply principles of design to analyze a chemical engineering process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- Students must seek out the information (knowledge) needed for developing the design solution in appropriate references or other repositories of knowledge.
- Students are assigned in teams so as to mix personalities and abilities and work on a 10 weeks-long project.
- Students will be taking online certification on Teamwork, project management, Business Ethics, and Diversity, Equity and Inclusion.
- Students are required to perform an economic analysis by optimizing specific function for a given process– thus identifying, formulating and solving engineering problems.
- Written communication will be evaluated during weekly homework, deliverables and final report.
- An ability to engage in lifelong learning is fostered through the different course activities. Students will be presented with software tools, online resources, and case studies.

- Through video class tutorials and homework students will become proficient in the use of the software Aspen HYSIS and Aspen Plus.
- Lectures review safety concepts like flammability and toxicity. Information gathering includes obtaining MSDS sheets for all components involved in the design, as well as flammability limits. Safety and environmental impact are factors that students consider when selecting design.

Required Textbooks and Software

- A. Main course text (required)-Two semester investment because it will be used for Process Design
 - i. Title – Product & Process Design Principles – Synthesis, Analysis and Evaluation.
 - ii. Author – Seider, Seader, and Lewin,
 - iii. Publication date and edition – Any edition will work (I will have 4th Ed, 2017). First edition is great.
 - iv. ISBN number 9781119282631 (4th edition)
- B. Required Software: Microsoft Office, access to a scanner (or pdf converted), and access to Internet for Canvas LMS. Also, UniSim, HYSYS and ASPEN (Go to Canvas for instruction for installation).
- C. Computer requirements:



- All students must have a computer for this class. Make sure that your computer meets the minimum requirements established by the College of engineering: <https://www.eng.ufl.edu/students/resources/computer-requirements/>
- If your computer is almost full or lack memory, ChemE IT personnel have some recommendations for you (Find it on Canvas).
- A Windows laptop is required. Emulators will not work. For Mac users, ChemE IT personnel have some recommendations for you (Find it on Canvas).

Recommended Materials

- Online Resources: Learn ChemE, Educational Resources from ChemE from University of Colorado Boulder. Available at: <http://www.learncheme.com/screencasts/process-design>
- Book: Gavin Towler and Ray Sinnott (2nd Edition, 2012). Chemical Engineering Design. Butterworth-Heinemann, ISBN: 978-0-08-096659-5. Available via UF Libraries: DOI: <https://doi.org/10.1016/C2009-0-61216-2>

Course Schedule

- Course logistics/structure:
 - Lecture: 3 days per week (except holidays)
 - COW Days=Completing Online Work days will be a time for the students to catch up. Instructor will be available for office hours on those days to answer questions about the videos, homework, or project support.
 - Zoom Meetings= We will apply online content into activities to build progress toward the final course project. Links will be available on Canvas.
 - Video HYSYS tutorials: average time per homework should be ideally 2 hour/week. Student must submit homework in Canvas.
 - Teams of 3-4 students will be formed to work on a final project.

Online Course Recording

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

THE DETAILED SCHEDULE BELOW MAY CHANGE ACCORDING TO NEEDS AND CIRCUMSTANCES. Any revisions will be announced in class and will be posted on Canvas and Microsoft Teams

Unit 1. PROCESS ENVIRONMENT: CONCEPTUALIZATION AND ANALYSIS	
Module 1. Project Management Skills Module 2. The Design Environment Module 3. Chemical Process Development	~ 3 weeks
Unit 2. ENGINEERING ECONOMIC ANALYSIS OF CHEMICAL PROCESSES	
Module 4. Cost Accounting in Engineering Module 5. Equipment Sizing and Capital Costs Module 6. Operational Costs Module 7. Annual Costs and Profitability	~ 6 weeks
Unit 3. ENGINEERING CONSIDERATIONS AND DECISION MAKING	
Module 8. The Plant Environment Module 9. Process Optimization	~ 4 weeks

- Important dates and changes will be posted on Canvas and Microsoft Teams. Make sure to check periodically.

Attendance Policy, Expectations, and Make-Up Policy

a) Attendance

- Regular attendance expected in addition to class discussions and satisfactory performance on class activities.
- Attendance will be taken in class periodically. Make sure to be in class or send an excuse to your instructor by email.
 - Signing an attendance on behalf of an absent or tardy student is in violation of the academic honesty policy and will result in disciplinary action. A first violation will result in a letter grade reduction for all involved parties. A second violation will result in course failure for all involved parties.
- **HOW TO SEND AN EXCUSE:**
 - Email Dr. Rivera at rivera.jimenez@eng.ufl.edu
 - Use the Following Subject line: **ECH 4604: Absence Excuse**
 - What constitute a valid excuse? Excused absences are consistent with university policies in the [undergraduate catalog](#) and require appropriate documentation. Absences will be excused under the following conditions:
 - 24 hours ahead of time that you have a legitimate, unavoidable absence (such as an exam conflict for a higher-numbered academic course)
 - A verifiable medical or family emergency
 - Travel for a student conference—provided all excuse request prior to travel
 - Need to come to class late or leave early for a legitimate reason
 - Email instructor at least 24 hours before missing class due to interview confirmation email; conference email; UF official sporting event.

b) Basic Responsibilities Expected from You:

- Attendance is critical! The material you will learn is invaluable. In case of absence, you can ask a class mate for lecture material, use your book, and access supporting slides on Canvas. Note: supporting slides are NOT the complete lecture material, these are diagrams and pictures that I use to support the lecture.
- Don't be afraid to ask for help during class or office hours.
- Be an active learner - ask yourself questions during lectures, as you read, and as you attempt problems.
- Study in advance and go to office hours. Don't wait until the day before the exam, homework, or report to get clarification on the material.
- Check Canvas for class updates, assignments, announcements, lessons, calendar, and resources. If using a laptop and other devices in class, you shouldn't be on Facebook, Netflix, Hulu, etc. or do other things that are not class-related. When instructor asks you to put your device away, please do so.
- Recording the lecture is not allowed using any type of media. If you need special accommodations, please contact your instructor.

- You need to notify your instructor if you need accommodation from the Disability Resource Center. I would love to help you out.
- c) Expectation from team and individual on each team: Conflict Resolution
- **Be Aware That Conflict Occurs**-Knowing that conflict may and will occur is the first step to resolving it, especially if you know that certain team members may disagree with each other.
 - **Set the Ground Rules**-At the beginning of your project set some ground rules in your first meeting. Be sure to address what process will be taken to address conflicts, as they are bound to rise and will need to be taken care of before they spiral out of control. Remember that everyone's ideas for the project are valid and that they shouldn't be dismissed, even if you do not agree with them.
 - **Document Team Dynamics**- teams must submit a weekly summary of each team member technical contributions, distribution of tasks, accomplishment of tasks, attendance to group meetings (besides instructor's meetings), and overall project status.
 - **Stop Conflict When It Happens**-Conflict should be addressed immediately before it can grow. If a discussion grows heated during a meeting, do not wait until the next meeting to address the issue. Instead, discuss the issue while in the meeting; even if members disagree, they are still able to see each other's points of view. Your instructor can serve as a moderator for these discussions.
 - **Discuss Both Sides of a Perspective**-Even if you are inclined to agree with one side of the conflict, do not make a final judgment until each person has had their say. Ending a discussion without hearing each person out can escalate the problem. Explain the pros and cons of both ideas, so that both people can consider the opposing view.
 - **Make Compromise a Goal**-Compromising between parties is helpful, as it can allow for both conflicting parties the ability to use their ideas. Most times, points can be combined in order to make a better idea or solution.
 - **Avoid Falling into Groupthink**-Groupthink is when a group suppresses the opposing views of members in order to create harmony. While it is always good to maintain harmony within a group while working on a project, this idea of keeping opposing viewpoints at bay because they will disrupt the norm will end up doing more harm than good. To avoid this, make sure that there is one or two members that bring up constructive criticism to ideas.
 - **Don't Try to Change a Team Member**-This final tip might be the most important. Just as in any type of relationship, do not try to change a member of your team. They are an individual person with unique ideas and forms of expression. Trying to change their feelings or viewpoints will only lead to resentment. You can propose to them alternatives, or list benefits of other ideas, but in the end you may just have to accept that they will disagree with an outcome.
- d) Handling problems between a team member and the rest of the team
1. Team must create and submit a team charter appended to their second deliverable. At the beginning of your project set some ground rules in your first meeting. Be sure to address what process will be taken to address conflicts, as they are bound to rise and will need to be taken care of before they spiral out of control. A template will be provided in class to facilitate the charter creation.
 2. In all weekly reports, teams must submit a weekly summary of each individual member's technical contributions, distribution of tasks, the accomplishment of tasks, attendance to group meetings (besides instructor's meetings), overall project status. Every team member must sign the report. This will allow your team to document relevant information in case we need it for a conflict resolution meeting.
 3. The team leader or any other member are welcome to discuss any concerns with your instructor by appointment or during the weekly meetings with your instructor. Your instructor will ask about team dynamics on every meeting.
 4. Each team member must complete all 3 peer evaluations that will be available on Canvas. This will allow each team member to have the opportunity to evaluate their peers and themselves. All information obtained from peer-evaluation will be used by your instructor to provide performance reviews to each team member. Only the last peer-evaluation will be used for the final grade adjustment.
 5. Team dissolution or changing individuals to another team are highly discouraged. The main goal of this class is that each student learns how to manage conflict to increase team performance towards an engineering goal. In case that a dispute between an individual cannot be resolved, this student will not be moved to another group.

The student must have a formal meeting with the undergraduate coordinator and the faculty to establish a plan for assessment without significant changes in the overall project objectives.

e) Emails, Announcements, Feedback, and Communications

- Announcements will be shared periodically during class and on Canvas. It is your responsibility to attend to class and read the emails/announcements from Canvas.
- After each assignment is graded, you are responsible for reviewing your instructor's feedback.
- Emails, announcements, and feedback may occur outside business hours.
- Your instructor should respond within 24 hrs during workdays (M-F). There is no guarantee of response during weekends. Plan accordingly.

Grading Policy:

• **Evaluation of Grades:**

Categories	Percentage of Final Grade	Approximate number of points	Rules
Course Activities (Individual Grade)	15%	Expect ~15-20 activities ~1-10 pts each	Drop 2 low score from selected assignments. See Canvas for details.
Professional Track Assignments (Individual Grade)	15%	Expect ~10 activities 10 pts each	Drop 1 low score
Simulation Trainings (Individual Grade)	15%	Expect ~10 activities ~20 pts each	Drop 1 low score
Unit Level Assessments (Individual)	20%	Expect ~6 activities ~50 pts each	No grade drops.
Project Deliverables (Group)	See next row	Expect ~6-8 activities ~10 pts each	No grade drops. A multiplication factor will be used to adjust this grade to individual grade.
Final Project Grade (Individual) ***	20%	Expect ~2 activities ~100 pts each	No grade drops.

*** Final Project Grade is based on the following:

- Final Oral Presentation Grade (Individual)
- Final Project Grade after adjustment using individual ratio as follows:

Assignment	Percentage of Final Grade
Deliverables progress reports	25%
Final design report	25%

- The individual team members' grade is adjusted according to peer evaluations as follows:
 - Individual grade = team grade * (0.5+0.5*Individual Ratio)
 - Individual Ratio= average of student's evaluation excluding self eval)/(team average)
 - Note: For a student that is removed from a team, deliverables completed as part of the team will be adjusted as described above using the latest peer-evaluation. The rest of the deliverables will not include the Individual Ratio.

- **Grading Scale:** The students are sorted in the order of decreasing overall points. Grades are then decided as follows:

Division between A and A-	Largest gap between two students with 90 >= overall points > 85
Division between A- and B+	Largest gap between two students with 85 >= overall points > 80
Division between B+ and B	Largest gap between two students with 80 >= overall points > 75
Division between B and B-	Largest gap between two students with 75 >= overall points > 70
Division between B- and C+	Largest gap between two students with 70 >= overall points > 65
Division between C+ and C	Largest gap between two students with 65 >= overall points > 55

Division between C and C-	Largest gap between two students with 55 >= overall points > 45
Division between C- and D+	Largest gap between two students with 45 >= overall points > 30
Division between D+ and D	Largest gap between two students with 30 >= overall points > 10
Division between D and D-	Largest gap between two students with 10 >= overall points >= 0
E	Given to students for honesty violations.

More information on UF grading policy may be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Institutional Policies:

Students Requiring Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, 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.aa.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.aa.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
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, 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 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

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>.