

Green Chemical Engineering Syllabus

CHE 596-320/601

Spring 2024

Instructor: Dr. Concepción Jiménez-González - e-mail: cjimene@ncsu.edu

Office hours: Tue 5:30-6:30 pm Eastern time. Through **the instructor's zoom's link**. Office hours may change occasionally, but enough notice will be given.

Teaching assistant: Logan Williams – email: lwilli25@ncsu.edu

Office Hours: Wed 5:30-6:30 pm Eastern time through [the TA Zoom's link](#).

Course Objectives

1. To learn the fundamentals of green Chemical Engineering and apply these principles during the design, retrofit and management of chemical processes for a more sustainable chemical manufacturing.
2. To understand the interactions between green chemistry and green chemical engineering by identifying key components of chemistry that will contribute to the achievement of more sustainable chemical reactions and processes.
3. To apply practical approaches to materials selection that promotes the overall greenness of a chemical manufacturing process without diminishing the efficiency.
4. To understand the life cycle thinking perspective by providing background and context for placing a particular chemical process in the broader chemical enterprise, including its impacts from raw materials extraction to recycle/reuse or end of life considerations.
5. To apply life cycle assessment and industrial ecology concepts, techniques and principles in the chemical engineering design context.
6. To develop technical, team and creative skills necessary to apply key green chemical engineering concepts for designing of greener chemical processes.
7. To demonstrate critical thinking and creativity in the course, through discussion, design, and analysis of relevant topics.

Required Text: Green Chemistry and Engineering: A Practical Design Approach. C Jimenez-Gonzalez and D J C Constable. Wiley, 2011

Other References

- Green Chemistry: Theory and Practice. PT Anastas and JC Warner. Oxford University Press, 2000
- Green Chemistry Metrics: Measuring and Monitoring Sustainable Processes. A Lapkin and DCJ Constable, Wiley-Blackwell, 2008
- The Hitchhiker's Guide to LCA. H Bauman and AM Tillman. Studentlitteratur AB, 2004

Course Grading

Your course grade will be based on the scores earned on the following components. Grades are contingent upon progress and improvement of subsequent submittal of both written and oral assignments.

Homework	10%
Participation	10%
Semester project	25%
Midterm exam	25%
Final Exam	30%
Total	100%

The following grading scale will be used:

97 ≤ A+ ≤ 100, 93 ≤ A < 97; 90 ≤ A- < 93; 87 ≤ B+ < 90, 83 ≤ B < 87, 80 ≤ B- < 83, 77 ≤ C+ < 80, 73 ≤ C < 77, 70 ≤ C- < 73, 67 ≤ D+ < 70, 63 ≤ D < 67, 60 ≤ D- < 63, less than 60 = F

Participation

Participation is a vital part of the course counting 10% of your grade. Participation credit will be achieved through online discussion fora in the Moodle site, participation through the synchronous activities (e.g., office hours), or through your interactions with the professor (e.g., email, phone, online, etc.). Participation also will be then taken into consideration if your grade is on the border line between two grades (see Course Grading).

Homework

Homework will be submitted through the class Moodle site by 6pm Eastern on Thursdays. Homework assignments with a grade of 70% or better will get full credit (100%), but there will be no extensions granted for deadlines.

You can prepare your homework in a computer, or by hand and then scan your work into a *.pdf file to submit it through Moodle. Homework is accepted on either MSWord or *.pdf files, and you can attach MExcel files for calculations. If you are preparing your homework by hand, make sure that your writing is bold and clear so that the *.pdf scan is legible.

Project Teamwork

You will work in a team project during the semester. You will need to form teams by the due date, otherwise we will assign you a team at random.

Midterm Test and Final Exam

Both the midterm and the final exam are open book, open notes. You will need to download and submit the exam through the class Moodle site.

The midterm is a timed assignment; the final exam will be “take home”.

Tentative Course Schedule

The dates are tentative and subject to change but provide a general overview of the topics and preparation required during the course.

Week – tentative date	Subject	Reading
1 – Jan 11	Green Chemistry and Engineering in the Context of Sustainability Green Chemistry and Green Engineering Principles	Ch 1 and 2
2 – Jan 18	Integrating Environment, Health and Safety into Chemical Process Design	Ch 3
3 – Jan 25	Green Chemistry and Engineering Metrics	Ch 4
4 – Feb 1	Green Chemistry 1: Chemistry Selection and reaction conditions	Ch 5 and 7
5 – Feb 8	Green Chemistry 2: Material Selection	Ch 6
Feb 13	Wellness Day – no office hours	
6 – Feb 15	Bioprocessing	Ch 8
7 – Feb 22	Green Chemical Engineering 1: Unit Operations	Ch 10, 11 and 23
8 – Feb 29	Green Chemical Engineering 2: Synthesis and Integration	Ch 12, 13 and 15
Mar 1-7	Midterm exam window – covering weeks 1-6	Ch 1-8
Mar 11-15	Spring break – no class	
9 – Mar 21	Inherent Safety	Ch 14
10 – Mar 28	Life Cycle Assessment and eco-footprinting	Ch 16
11 – Apr 4	Impacts of procurement, energy and waste	Ch 17, 18 and 19
12 – Apr 11	Total Cost Assessment, Industrial Ecology Project Presentations and reports due	Ch 20, 24 and 25
13 – Apr 18	General Review	
Apr 19 -26	Final exam window	

Student code of conduct

The instructor implicitly assumes the highest level of integrity and honesty in the students taking this course. The student must be familiar with and comply with the NCSU Student Code of Conduct. [Code of Student Conduct](#)

Course material dissemination Disclaimer. All documents made available the course, both electronic and hard-copy, including (but not limited to), copies of lecture notes, videos lectures, homeworks, exams, or any handouts provided, are intended only for the student's personal use. The students are not allowed to share any content of the class ChE-596 website with a third party (i.e., any person not signed up for the course this semester, a personal website, a public website, or any other news or advertising media) without a written permission of the course instructor.