

AGEN/BSEN 303 Principles of Process Engineering

The Basics:

Credits:	3 hour
Prerequisites:	MATH 221 (Fluids is recommended as pre-req or parallel, but not required)
Time and place:	Tuesday and Thursday, 12:30 – 1:45 pm in Chase 112
Course website:	Available on https://canvas.unl.edu/

Your instructor:

Dr. Deepak R. Keshwani
222 Chase Hall | dkeshwani2@unl.edu | (402) 472-6714

How can you connect with me? Email is a great way for general questions. You'll typically get a response within 24 hours. I have an open-door policy. If you drop by my office and I am free, we can meet. I recommend scheduling an appointment via email or talking to me after class.

What will you learn? Upon completion of these course, you will be able to:

1. Define and distinguish between batch, semi-batch, and batch processes
2. Develop basic process flow diagrams, and conduct mass balances
3. Identify relevant biological kinetics for process design and solve kinetics equations
4. Identify and account for relevant material properties in process design
5. Appropriately size equipment for a process engineering application
6. Identify and analyze ethical considerations relevant to food and bioprocess engineering
7. Define sustainability in the context of process design
8. Describe circular food and bioeconomy systems and identify opportunities for circularity within existing systems
9. Describe the steps involved in life cycle analysis (LCA) and use a LCA tool to evaluate and compare environmental impacts of bio-based products

Course relevance to ABET program outcomes: This course helps achieve the following ABET outcomes:

Outcome 1: an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

Outcome 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

Outcome 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

Outcome 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

Outcome 7: an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

This is how your grade will be determined (tentative):

Personal bio/career statement:	5 points
In-class assessments (5 x 20 points):	100 points
Ethics assignment:	15 points
Rapid process design:	50 points
LCA project:	60 points
Self and peer assessment (CATME):	10 points
Attendance and participation:	10 points

You can earn a maximum of 250 points. Final letter grades will tentatively be determined as follows:

>242	A+	224-217	B+	199-192	C+	174-167	D+	<150	F
242-232	A	216-207	B	191-182	C	166-157	D		
231-225	A-	206-200	B-	181-175	C-	156-150	D-		

Since this an engineering course, you cannot take the course for Pass/No Pass (PNP) grading option.

Description of assignments, projects, and assessments:

The **personal bio/career statement** is a 1-page single-spaced document that is intended to help me get to know you and your career aspirations.

There will be five **in-class assessments**, each worth 20 points. These assessments will cover approximately 2 weeks’ worth of content. You can used a single-page of notes (front and back)

The **ethics assignment** is a 2-page single spaced document that contains an analysis of hypothetical ethical issue in a food and or bioprocess engineering context. More information on this will be provided in class.

The **rapid process design assignment** (50 points) is a team-based challenge to conceptualize a novel process or product connected to Nebraska’s bioeconomy. More information on this will be provided in class.

The **LCA project** (60 points) is a team-based project that will involve using GREET software to evaluate environmental impacts of bio-based products. More information on this will be provided in class.

You will be working in teams for the rapid process design and the LCA project. We will use CATME for **peer and self-evaluation**. CATME evaluation results in an adjustment factor score that ranges from 0.5 to 1.05. The adjustment factor will be multiplied by 10 points to determine your peer and self-evaluation score.

Attendance and participation in all in-class activities is expected. Throughout the semester, there will be opportunities to earn 10 points based on your **attendance and participation**.

Things you need to have

There is no required textbook. When appropriate, we will use hand-outs and external links that will be available on canvas. Lecture materials (or versions of it) will be posted on canvas as needed. You are strongly encouraged to take notes during class. You will need access to a laptop with Microsoft Office (or

comparable software) that you should bring to class every week. Later in the semester, we will be using the following open-source software package:

GREET 2022.Net Software

Download link: <https://greet.es.anl.gov/net>

General course policies:

Some collective values that we will embrace in this course:

- Never compromise our integrity
- Respect each other
- Share responsibility for our learning
- Have fun!

Make-up assignments at my discretion and typically are reserved for extenuating personal or professional circumstances. I typically use the [UNL Class Attendance Policy](#) as a guide for these decisions.

Unless otherwise indicated, all assignments are due in Canvas by midnight on the due date. Late assignments are accepted on a case-by-case basis based on extenuating personal or professional circumstances. Please communicate with me in a timely manner to discuss late assignments.

Attendance and engagement: Attendance and participation in all class activities is expected. You are expected to follow the [class attendance policy](#) of the University. We recognize that personal and professional commitments may sometimes conflict with class activities (i.e. life happens). Engage with me when you anticipate such conflicts so we can work together to resolve them.

Instructional continuity: If in-person classes are cancelled, you will be notified of the instructional continuity plan for this class via an announcement on Canvas. More information on instructional continuity can be found at: <https://executivevc.unl.edu/academic-excellence/teaching-resources/instructional-continuity-guidance>.

UNL COVID-19 information: All faculty, staff, and students on campus are expected to follow all campus policies and procedures related to Covid-19 which can be found at <https://covid19.unl.edu/>.

I expect us to adhere to guidelines concerning academic integrity outlined in Section 4.2 of the [University's Student Code of Conduct](#). The BSE Department has some resources related to [academic integrity](#) and our [appeals process](#). Contact me if you have questions or need clarification.

The University strives to make all learning experiences as accessible as possible. If you anticipate or experience barriers based on your disability (including mental health, chronic or temporary medical conditions), please let me know immediately so that we can discuss options privately. To establish reasonable accommodations, I may request that you register with Services for Students with Disabilities (SSD). If you are eligible for services and register with their office, make arrangements with me as soon as possible to discuss your accommodations so they can be implemented in a timely manner. SSD contact information: 117 Louise Pound Hall; 402-472-3787

Tips to succeed in this class:

- Show up to class and be engaged!
- Take good notes during class. Your notes combined with the content will Canvas will be helpful to you.
- Stay organized with your course materials. Keep a physical or electronic binder with course notes, assignments, etc.
- Engage with your team. It is your responsibility to learn from each other when working on team-based assignments.
- All your work will be graded for both content and how the content is presented. Engineering work that is not communicated well is not considered complete or useful.
- Refer to the resources on canvas related to assignment and assessment guidelines.

Classroom Emergency Preparedness and Response Information:

- Fire Alarm (or other evacuation): In the event of a fire alarm: Gather belongings (Purse, keys, cellphone, N-Card, etc.) and use the nearest exit to leave the building. Do not use the elevators. After exiting notify emergency personnel of the location of persons unable to exit the building. Do not return to building unless told to do so by emergency personnel.
- Tornado Warning: When sirens sound, move to the lowest interior area of building or designated shelter. Stay away from windows and stay near an inside wall when possible.
- Active Shooter
 - Evacuate: if there is a safe escape path, leave belongings behind, keep hands visible and follow police officer instructions.
 - Hide out: If evacuation is impossible secure yourself in your space by turning out lights, closing blinds and barricading doors if possible.
 - Take action: As a last resort, and only when your life is in imminent danger, attempt to disrupt and/or incapacitate the active shooter.
- UNL Alert: Notifications about serious incidents on campus are sent via text message, email, unl.edu website, and social media. For more information go to: <https://unlalert.unl.edu/>
- Additional Emergency Procedures can be found here: <https://emergency.unl.edu/>

Tentative class schedule (subject to change)

Week	Day	Date	Topic	Out of Class Assignment Due
Week 1	Tue	24-Jan	Course goals and expectations	
	Thu	26-Jan	Context of Food and Bioprocess Engineering	Personal Bio/Career Statement
Week 2	Tue	31-Jan	Process classifications	
	Thu	2-Feb	Process classifications: industry applications	
Week 3	Tue	7-Feb	Process Flow Diagrams and Mass Balances	
	Thu	9-Feb	In-class Assessment 1	
Week 4	Tue	14-Feb	Bioprocess kinetics	
	Thu	16-Feb	Bioprocess design considerations	
Week 5	Tue	21-Feb	Bioprocess industry applications	
	Thu	23-Feb	In-class Assessment 2	
Week 6	Tue	28-Feb	Material properties and process design	
	Thu	2-Mar	Material properties and process design	
Week 7	Tue	7-Mar	Guest Lecture - Food engineering industry perspectives	
	Thu	9-Mar	In-class Assessment 3	
Week 8	Tue	14-Mar	spring break	
	Thu	16-Mar	spring break	
Week 9	Tue	21-Mar	Sizing equipment: capacity, power, and energy considerations	
	Thu	23-Mar	Sizing equipment: grain drying example	
Week 10	Tue	28-Mar	Sizing equipment: grain drying example	
	Thu	30-Mar	In-class Assessment 4	
Week 11	Tue	4-Apr	Engineering ethics in context	
	Thu	6-Apr	Engineering ethics in context	
Week 12	Tue	11-Apr	Sustainable Process Design Considerations	Ethics assignment
	Thu	13-Apr	Circular Food and Bioeconomy Systems	
Week 13	Tue	18-Apr	Life Cycle Analysis	
	Thu	20-Apr	In-class Assessment 5	
Week 14	Tue	25-Apr	Process Design Challenge	
	Thu	27-Apr	Process Design Challenge	
Week 15	Tue	2-May	Intro to GREET as an LCA Tool/ LCA Project Overview	Process Design Challenge Report
	Thu	4-May	Project Work Time	
Week 16	Tue	9-May	Project Work Time	
	Thu	11-May	Project Work Time	
Finals week	Tue	16-May		LCA Project Due