

Biochemical Engineering (155:411)

Department of Chemical and Biochemical Engineering

Spring Semester, 2025

Instructors:

Dr. Haoran Zhang

Email: haoran.zhang@rutgers.edu

Instructor Office Hour:

Thursday 10-11 am (virtual)

<https://rutgers.zoom.us/j/91789338770?pwd=x3F4dlt3YlfbL0gOzFyNhX68ViUfUb.1>

Course Description:

This course includes (1) introduction to basics of biochemistry, biology, and microbiology with applications in biochemical engineering, (2) discussion on how biochemical engineering is used for the analysis, control, and development of diverse biological, biochemical, and industrial bioprocesses, and (3) quantitative and problem-solving approach to solve biochemical engineering problems.

Course Objectives:

In this course, students will learn the basics of biochemical engineering, and apply this knowledge to answer the questions such as

- What are the major components of cells? How do they transfer genetic information?
- How do various industrially relevant cells grow (e.g., bacteria, yeast, mammalian)?
- How do metabolic pathways impact formation of small and large biomolecules?
- How to engineer cells genetically and re-route metabolic pathways?
- How to design and engineer proteins (or enzymes) relevant to cell engineering?
- How can bioprocesses be established and scaled up?

Textbook:

Bioprocess Engineering-Basic concepts (2nd Edition) M.L. Shuler, F. Kargi OR Bioprocess Engineering-Basic concepts (3rd Edition) M.L. Shuler, F. Kargi, M. DeLisa

Canvas:

Lecture notes and homework assignment will be posted on Canvas (<https://rutgers.instructure.com/courses/335615>).

Course Material Copyright Policy:

All course material posted on the Canvas course website is copyrighted and may not be posted on any other web site at or outside of Rutgers without permission from the course instructor. Noncompliance with this policy will be treated as a violation of the Code of Student Conduct and will be referred to the Office of Student Conduct for action.

Grading Policy:

There are 5 homework assignments, two mid-term exams, and one final project.

For the project, undergraduate students cannot team up with graduate students in the course.

All homework assignments and project will be posted on the Canvas course webpage.

Total Grade 100%: Homework (30%); Exam 1 (20%); Exam 2 (20%); Project (30%).

Homework should be submitted via Canvas before the beginning of the class on the designated date. There is a 30% penalty for late submission. Homework submitted one week after the due day will NOT be graded. All students are required to participate in the project at the end of the semester.

Academic Integrity Policy:

Students are expected to familiarize themselves with and adhere to the University policy on academic integrity at: <http://academicintegrity.rutgers.edu/policy-on-academic-integrity>.

It is understood that a student's name on any individual homework assignment, quiz, or exam indicates that he/she neither gave nor received unauthorized aid. On individual homework assignments, *authorized* aid includes discussing: 1) interpretation of the problem statement, 2) concepts involved in the problem, 3) approaches for solving the problem. Anything beyond this constitutes unauthorized aid and violates the academic integrity policy.

A student's name on a group assignment indicates that he/she contributed to the assignment. Quizzes and exams are tests of individual performance. The student is not permitted to obtain assistance from any other person (or persons) during quizzes or exams. The student must adhere strictly to the instructions provided by the professor regarding what is permissible to be used during the exam. Use of lecture notes, computers, laptops, and cell phones for quizzes or exams without prior authorization of instructor is **PROHIBITED**.

Students caught cheating on homework, quizzes, projects, or exams will be reported to the undergraduate program director for disciplinary action in accord with the university policy on academic integrity.

Course Schedule (subject to change):

lecture #	date	lecture topic	textbook chapter	HW assign	HW due
1	1/22/2025	Introduction/overview of Biology 1	1,2		
2	1/27/2025	Overview of Biology 2	2		
3	1/29/2025	Cell metabolic pathways and cell growth 1	5,6		
4	2/3/2025	Cell growth 2	6		
5	2/5/2025	Cell growth 3	6	Hw1	
6	2/10/2025	Stoichiometry of Growth	7		
7	2/12/2025	Cell growth regulation	4		Hw1
8	2/17/2025	Genetic alteration 1	8		
9	2/19/2025	Genetic alteration 2	8	Hw2	
10	2/24/2025	Bioreactors 1	9		
11	2/26/2025	Bioreactors 2	9		Hw2
	3/3/2025	Exam 1			
12	3/5/2025	Cell culture scale up	10		
13	3/10/2025	Sterilization & Media formulation	10.4		
14	3/12/2025	Enzymes	3	Hw3	
	3/15-3/23	Spring recess			
15	3/24/2025	Enzyme immobilization	3.4		Hw 3
16	3/26/2025	Bioseparations 1	11		
17	3/31/2025	Bioseparations 2	11	Hw4	
18	4/2/2025	Bioseparations 3	11		
	4/7/2025	Exam and HW review			Hw4
19	4/9/2025	Exam 2			
20	4/14/2025	Using genetically engineered microbes 1	14		
21	4/16/2025	Using genetically engineered microbes 2	14	Hw5	
22	4/21/2025	Animal cell engineering	12		
23	4/23/2025	Metabolic engineering	14.8		Hw5
24	4/28/2025	Protein engineering			
25	4/30/2025	special topic			
	5/5/2025	Project presentation			