

**USKEGEE UNIVERSITY
COLLEGE OF ENGINEERING
CHEMICAL ENGINEERING DEPARTMENT
Fall 2023**

COURSE: CENG 400 – Introduction to Biochemical Engineering
SCHEDULE: MWF 11 am - 12 pm
INSTRUCTOR: Dr. Shamim Ara Begum
OFFICE: 522E Luther Foster Hall
TELEPHONE: ext. 8795
FAX: (334) 724-4188
E-MAIL: sbegum@tuskegee.edu
OFFICE HOURS: MW: 9-11; 1-3:30; Th: 11:30-12:30
TEXT: Bioprocess Engineering 3rd ed. by Shuler, Kargi and Delisa

CATALOG DESCRIPTION

Introduction to biochemical and microbiological applications to commercial and engineering processes, including fermentation, enzymology, ultra filtration, food and pharmaceutical processing and resulting waste treatment, enzyme kinetics, cell growth, energetic and mass transfer.

COURSE OBJECTIVES:

| Objectives | | Tasks | |
|-------------------|---|--------------|--|
| 1 | Develop an understanding of biological basics and enzyme kinetics | 1 | Demonstrate an appreciation for the terminology of biology essential to the biochemical engineer |
| | | 2 | Demonstrate an appreciation for the terminology and history of enzymology |
| | | 3 | Apply Michaelis-Menten Kinetics and the Lineweaver-Burk plot to extract enzyme kinetics parameters |
| 2 | Understand genetic engineering | 3 | Demonstrate an appreciation for the terminology of genetic engineering |
| | | 4 | Determine the DNA products from PCR techniques |
| 3 | Design bioreactors | 5 | Demonstrate an appreciation for the terminology of bioreactors |
| | | 6 | Determine the products from a bioreaction |
| | | 7 | Calculate growth rates and other relevant biochemical engineering parameters for various organisms |
| 4 | Understand product purification and recovery | 8 | Demonstrate an appreciation for the terminology and tools for bioreactor product purification and recovery |
| | | 9 | Calculate cell death rates and other relevant parameters for sterilization processes |

COURSE OUTCOMES:

| Outcomes | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|-------------|---|---|---|---|---|---|---|
| Objective 1 | X | | | | | | |
| Objective 2 | X | | | | | | |
| Objective 3 | X | | X | | | | X |
| Objective 4 | X | | | | | | |

1. An ability to identify, formulate and solve complex engineering problems by applying principles of engineering, science, and mathematics.
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.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering solutions and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
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.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

PREREQUISITES: CENG 360 (Chemical Reaction Engineering)

HOURS: 3 credit hours

GRADING:

| | | | | |
|------------------|----------------------------|-----|---------------|--------------|
| Criteria: | Term Paper/Design | 10% | Scale: | A = 90 - 100 |
| | Homework/Quizzes | 20% | | B = 80 - 89 |
| | Attendance & Participation | 10% | | C = 70 - 79 |
| | Exams | 40% | | D = 60 - 69 |
| | Final Exam | 20% | | F = 0 -59 |

COURSE POLICIES:

You will need to sign the class roster each day to be counted as attending the class. If a student is late to class by **10 minutes or more**, the student will not be able to give signature in the attendance sheet. Sometimes, instructor reserves the right to turn the student away to minimize disruption of the ongoing class.

If students are unable to attend a meeting or miss any assignment, it is their responsibility to present a written valid excuse to the instructor. Valid excuses include serious illness, death in the immediate family, and participation in University-sponsored events. Any other excuse will be evaluated by the instructor. An excused absence allows students to make up any work they missed without any late penalties. Failure to contact the instructor and present her with a valid

excuse will result in an unexcused absence. An unexcused absence means that any homework/term paper/design problems they missed can be turned in for 25% deduction in a week of the missed due date.

In the event of an excused absence, make up assignments (tests, quizzes, homework, term paper/design problems) must be done by the next class meeting following the date of the excused absence (unless scheduled with the instructor). Student is responsible for his/her own missed assignments. Student will receive a full credit for class participation for an excused absence.

It is critical that all homework, quizzes, and exams be completed on time.

Students need to submit their homework/design etc. by themselves. They should not give their homework/design etc. to another student to submit to the instructor. The instructor will not accept this type of submission.

Quizzes may or may not be announced.

No make-up exams or retests will be taken without a valid written excuse.

Final exam will be done in the exam book given by the instructor in **pen**.

Final exam will be held on the day, which will be scheduled by the university.

For close book exam, one/two pages formula sheet is allowed. However, formula sheets, which include any steps to solve the problem will be cancelled.

Cheating will not be tolerated. Any student caught cheating will get a zero for that assignment.

All **electronic devices** (i.e. cell phones, iPad, laptop etc.) must be **turned off** and **put away** during quizzes, exams and final exams. Otherwise, it will be considered a form of cheating. All **electronic devices** also must be **turned off** and **put away** during class time to avoid disruptions.

Food of any kind, including chewing gum, is not allowed in class.

Students are not allowed to talk with each other during lecture, quizzes, exams, and final exam. If there is an emergency, students need to go outside of the class to talk for maintaining a better learning environment in the classroom.

The instructor has the right to establish the rules and regulations for the classroom for it to be a conducive place for teaching and learning. The classroom is the place for the beginning of professional training.

Effective Spring 2018, the outlook 365 (tuskegee.edu) email system at Tuskegee University is REQUIRED for all instructional administrators, faculty, staff and students.

Head gear and dark sun shades are not allowed in class, unless they are of religious significance.

The student is expected to attend regularly all classes in an attire that meets the College's Dress Code Policy of Business Casual. Students who are not attired appropriately will be asked to leave class and may return with appropriate dress. Students may return with the tardy noted; however, students who do not return will receive an absence. The instructor has the right to establish the rules and regulations for the classroom for it to be a conducive place for teaching and learning. The classroom is the place for the beginning of professional training.

COVID Policy:

“Excuses related to **Covid infection** as well as exposure have to be received from the Dean of Students office. Students should request the excuse for absence from the Dean of Students office as soon as they become aware of covid infection or exposure. Students may request a classes missed memo by completing this form (<https://forms.gle/4ozusHX2tTCUW4yK6>) and then contact the Office of the Dean of Students and Student Conduct (334) 727-8421, via e-mail THarper@Tuskegee.edu or by going into the office located in suite 203 Tompkins Hall.”

Additional policies will be issued, if they are necessary.

Course Outline

- What is a Bioprocess Engineer? (Session: 1)
- An Overview of Biological Basics (Session: 2 - 6)
- Term Paper/Design Outline Due
- Enzymes (Session: 7 - 12)
- Exam 1*
- Genetic Engineering (Session: 13 - 20)
- Bioreactor Design and Operation (Session: 21 - 33)
- Exam 2*
- **Term Paper/Design Due and Presentation**
- Product Recovery and Purification (Session: 34 - 42)
- Exam 3*
- Final exam

Note: *Tentative

STATEMENTS OF COE EXPECTATIONS REGARDING STUDENTS' ACADEMIC PROFICIENCY

Academic excellence is a tradition of the Tuskegee University College of Engineering, (COE). Students and faculty must collectively and proactively guard this tradition. The college hereby renews its commitment to the tradition by stating as follows:

1. Students are expected to develop self-confidence through acquisition of in-depth knowledge in all subjects through, as a minimum:

- a. Studying to understand rather than studying to get by.
 - b. Challenging oneself to solve problems independent of textbooks or formulae sheets
 - c. Attempting diverse and multiple problems, multiple times, for depth and breadth of knowledge
2. Students are expected to be self-motivated through setting their own goals & schedules, spending time to study, and sharing their knowledge with peers.
 - a. Students should invest a minimum of two hours of study-time per week for every credit hour taken.
 - b. Students should seek or establish environments that encourage positive social interaction and engages in active learning.
3. COE is committed to providing support systems to students for higher achievement through the following avenues:
 - a. Direct access to instructors
 - b. Archives of faculty recorded course lectures
 - c. Dedicated peer tutors by fellow students at all academic levels
 - d. Periodic visits by alumni and industry subject matter experts
 - e. Opportunities for local and national academic related competitions
4. All COE students are expected to take advantage of all support systems. Students are particularly expected to adopt the notions of “self-confidence through knowledge acquisition” and “self-motivation to bring out best in self” as the COE fundamental culture for success.