The University of Western Ontario
Faculty of Engineering
DEPARTMENT OF CHEMICAL AND BIOCHEMICAL ENGINEERING

CBE 2290A – Fundamentals of Biochemical and Environmental Engineering

Course Outline 2023-2024

This course provides an introduction to the biological and biochemical principles of cell and enzyme-based engineering systems and bioprocesses from a Chemical Engineering perspective. The objective of this course is to develop knowledge of the molecular and metabolic nature of prokaryotes and eukaryotes and to learn how to apply this knowledge to solve problems related to the environment, industrial practice, and medicine. In addition, students will gain basic laboratory skills in biochemistry and microbiology.

Pre-requisites:
Chemistry 1024A/B or the former Chemistry 1050, 1020 or 023.

Unless you have the prerequisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

Co-requisites: None

Anti-requisites: Biology 1222 or Biology 1223.

Contact Hours: 3 lecture hours, 3 laboratory hours, 0.5 course.

Lectures		Tuesday	10:30 – 11:30
		Wednesday	11:30 – 12:30
		Thursday	5:30 – 6:30
Lab Sections	004	Monday	1:30 – 4:30
	003	Tuesday	1:30 – 4:30
	002	Wednesday	1:30 – 4:30

Instructor:

Dr. Arghya Paul (TEB 433); Email: arghya.paul@uwo.ca

Laboratory Supervisor:
TBA

Undergraduate Assistant:
Brandy Hunter (TEB 477), Tel: 519-661-2111 ext. 82131, Email: cbeugrad@uwo.ca

Highly Recommended Text:
J. Willey, L. Sherwood, C. Woolverton. Prescott's Microbiology. 11th or 12th Edition. McGraw-Hill, Boston, MA. ISBN: 978-1-265-12303-1.

Course Notes and Lab Handouts:
Course notes and lab handouts will be available on the course's OWL site.

Laboratory:
Attendance and participation are required in all laboratories.

Units: SI and other engineering units will be used.

Course Learning Objectives:

This course is intended to introduce Engineering students to the fundamental concepts underlying Biochemical Process Engineering and Design. No prior knowledge of microbiology or biochemistry is expected or required. Following completion of this course, students will be able to:

1. Explain basic concepts in microbiology and biochemistry including the structure and function of prokaryotes/eukaryotes and the molecules of life (nucleic acids, proteins, carbohydrates, lipids).
2. Apply knowledge of cell nutrition, growth, and bioreactors to design simple model systems for bacterial cell expansion.
3. Solve enzyme kinetics problems and demonstrate an understanding of the major metabolic pathways in prokaryotes.
4. Illustrate the key steps involved in DNA replication, transcription, and translation.
5. Compare microscopy and learn molecular biology techniques that can be used for the characterization and manipulation of micro-organisms and mammalian cells.
6. Explain how biological systems are being applied to solve engineering problems in the environment, industry, and medicine, and critically evaluate the most recent advances in each field, including the strengths and limitations of each approach.
7. Demonstrate laboratory skills and expertise with microbiological and biochemical techniques.

Evaluation:
The final course mark will be determined as follows:

Quizzes (**Best 2 of 3** at 5% each)	10%
In-Class Active Participation	5%
Laboratory Report (5 labs; 4% each)	20%
Laboratory Active Participation	5%
Mid-term Test	20%
Final Exam	40%

* The quizzes, midterm and final exam will be **closed book**. Non-programmable calculators will be permitted.

Note:

1. **Students must pass the final examination to pass this course.** Students who fail the final examination will be assigned 48% if the aggregate mark is higher than 50%, or the aggregate mark.
2. **Students must turn in all lab reports, and achieve a passing grade (50%) in the laboratory component, to pass this course.**

Repeating All Components of the Course:

In accordance with Senate and Faculty Policy, students who have failed an Engineering course (i.e. <50%) must repeat all components of the course. No special permissions will be granted enabling a student to retain laboratory, assignment or test marks from previous years. Previously completed assignments and laboratories cannot be resubmitted for grading by the student in subsequent years.

Use of English:

In accordance with Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments, tests, and examinations for the improper use of English. Additionally, poorly written work with the exception of the final examination may be returned without grading. If resubmission of the work is permitted, it may be graded with marks deducted for poor English and/or late submission.

Attendance

Attendance at all lectures and laboratories is mandatory. Any student who, in the opinion of the instructor, is absent too frequently from class or laboratory periods in any course, will be reported to the Dean (after due warning has been given). On the recommendation of the Department concerned, and with the permission of the Dean, the student will be debarred from taking the regular examination in the course.

Cheating

University policy states that cheating is a scholastic offence. The commission of a scholastic offence is attended by academic penalties, which might include expulsion from the program. If you are caught cheating, there will be no second warning (see Scholastic Offence Policy in the Western Academic Calendar).

Plagiarism

Students must write their essays and assignments in their own words. Whenever students take an idea, or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. Plagiarism is a major academic offence (see Scholastic Offence Policy in the Western Academic Calendar).

The University of Western Ontario has software for plagiarism checking. Students may be required to submit their work in electronic form for plagiarism checking.

Conduct:
Students are expected to arrive at lectures on time, and to conduct themselves during class in a professional and respectful manner that is not disruptive to others.

Sickness and Other Problems:
Students should immediately consult with the Undergraduate Services if they have any problems that could affect their performance in the course. Where appropriate, the problems should be documented (see attached). The student should seek advice from the Instructor or Associate Chair (Graduate) regarding how best to deal with the problem. Failure to notify the Instructor or Associate Chair (Graduate) immediately (or as soon as possible thereafter) will have a negative effect on any appeal.

Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.

Notice: Students are responsible for regularly checking their email and notices posted on the dedicated OWL site.

Consultation: Students are encouraged to discuss problems with their instructor by appointment. When needed, office hours will be arranged for the students to see the instructor and teaching assistants. Individual consultation can also be arranged by appointment with the instructor.

Accreditation (AU) Breakdown
Science = 60%
Engineering Science = 40%

Graduate Attribute	Indicator	Assessment tool	Assessment Level
Problem Analysis	PA2: Demonstrate ability to define an engineering problem	Evaluate, analyze and synthesize given information to frame the problem and develop a problem statement	I: Introduced
Impact of Engineering on society and the Environment	IESE2: Demonstrate understanding of the concept of sustainable design and development.	Evaluate and suggest approaches where microbial systems or their components can be applied for sustainable process design	I: Introduced
Ethics and Equity	EE2: Application of Ethical Behavior	Evaluate a situation and apply judgment to select appropriate actions	I: Introduced