Western Engineering

DEPARTMENT OF *CHEMICAL & BIOCHEMICAL* ENGINEERING

CBEE 2290a – FUNDAMENTALS OF BIOCHEMICAL AND ENVIRONMENTAL ENGINEERING
Course Outline Fall 2025

Professor Arghya Paul
Lab Instructor: Annika Tyszak
TAs: Alap Ali Zahid, Wei Luo, Jiaqi Huang, Rakshya Panta, Emma Punkari, Abdulla Al Mamun

LECTURES:	Wednesday, 10:30 AM – 12:30 PM Thursday, 11:30 AM – 12:30 PM
LABS:	Section 002: Friday, 9:30 AM – 12:30 PM Section 003: Tuesday, 9:30 AM – 12:30 PM Section 004: Wednesday: 1:30 PM – 4:30 PM Section 005: Thursday: 4.30 PM – 7.30 PM
OFFICE HOURS	Wednesday, 12:30 PM – 1:30 PM * or by email request
ANTIREQUISITE(s):	Biology 1222 or Biology 1223.
PREREQUISITE(s):	Chemistry 1024A/B or the former Chemistry 1050, 1020 or 023.
CEAB Academic Units:	Science 60%, Engineering Science 40%
Recommended Textbook	J. Willey, K. Sandman, D. Wood. Prescott's Microbiology. 12th Edition. McGraw-Hill, Boston, MA.
Course Notes and Lab Handouts:	Course notes and lab handouts will be available on the course's Brightspace site.

DESCRIPTION
This course introduces the biological and biochemical principles of cell- and enzyme-based engineering systems and bioprocesses. Students will gain knowledge about prokaryote/ eukaryote biology and learn how to apply it to solve problems related to industrial practice, the environment, and health. In addition, students will gain basic microbiology laboratory skills.

General Learning Objectives (CEAB Graduate Attributes)

Knowledge Base		Engineering Tools		Impact on Society	I
Problem Analysis		Individual & Teamwork		Ethics and Equity	I
Investigation		Communication		Economics and Project Mgmt.	
Design		Professionalism		Life-Long Learning	I

Rating: I – The instructor will introduce the topic at the level required. It is not necessary for the student to have seen the material before. D – There may be a reminder or review, but the student is expected to have seen and been tested on the material before taking the course. A – It is expected that the student can apply the knowledge without prompting (e. g. no review).

CEAB Graduate Attribute Assessment

Graduate Attribute	Indicator	Assessment tool	Assessment Level
Impact on Society	IESE1: Ability to analyze the interactions of engineering with economic, social, health, safety, legal and cultural aspects of society.	Lab 3 report	I: Introduced
Ethics and Equity	EE1: Demonstrates knowledge of professional ethics.	Lab 5 report	I: Introduced
Life-long Learning	LL2: Demonstrates the ability to learn independently.	Final exam	I: Introduced

Primary Learning Outcomes

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. The primary **learning outcomes** for the student are to:

- Combine knowledge of microbial cell biology with engineering analysis and judgement to explain how humans can utilize and harness microbes and their products through bioprocess engineering.
- Develop lab skills in basic microbiology and biochemistry techniques.

Specific Learning Objectives

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. Recommend specific approaches for microbial control in a range of contexts.
3. Apply knowledge of cell nutrition, growth, and bioreactors to design simple model systems for bacterial cell expansion.
4. Solve basic enzyme kinetics problems and demonstrate an understanding of the major metabolic pathways in prokaryotes.
5. Illustrate the key steps involved in DNA replication, transcription, and translation.
6. Compare microscopy and advanced molecular biology techniques that can be used for the characterization and manipulation of micro-organisms.
7. Explain how biological systems are being applied to solve engineering problems in industry, the environment, and medicine, and critically evaluate the most recent advances in each field, including the strengths and limitations of each approach.
8. Demonstrate laboratory skills and expertise with microbiological and biochemical techniques.

Lecture - Course Modules

Module 1: Introduction of Biochem.
Module 2: Microbial Classification
Module 3: Introduction to Microscopy
Module 4 Prokaryotes/Bacteria
Module 5: Control of Micro-organisms
Module 6: Microbial Nutrition
Module 7: Microbial Growth
Module 8: Enzymes
Module 9: Environmental Pollution and Prevention
Module 10: Recombinant Protein Production
Module 11: Bioreactors and Operation Conditions

Labs

Lab 1: Lab Safety + General microbiological techniques – Introduction to staining	**Week 3** **Lab 1 Reports Due at the end of the lab**
Lab 2: General microbiological techniques – Introduction to aseptic technique and bacterial cell culture	**Weeks 4 & 5** **Lab 2 Reports Due at the end of the lab**
Lab 3: Bacteriological examination of water	**Weeks 6 & 7** **Lab 3 Reports Due at the end of the lab**
Lab 4: Enzyme kinetics	**Week 9** **Lab 4 Reports Due at the end of the lab**
Lab 5: Bacterial transformation	**Weeks 12 & 13** **Lab 5 Reports Due at the end of the lab**

Assessment

The final course mark will be determined as follows:

Quizzes (**Best 2 of 3** at 5% each)	10%
Quiz 1 – Wed. Sept. 24, 2025, 10:30 AM	
Quiz 2 – Wed. Oct. 15, 2025, 10:30 AM	
Quiz 3 – Wed. Nov. 26, 2025, 10:30 AM	
In-Class Active Participation	5%
Laboratory (5 labs: 2% for active participation + 2% for individual lab report)	20%
Midterm Exam **(Thursday Oct. 23, 2025, 11:30 AM – 12:30 PM)**	25%
Final Exam (Schedule TBD during final exam period)	40%

* The quizzes, midterm and final exams are closed book. Non-programmable calculators are permitted.

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.
3. **Supporting documentation must be provided for students who miss the midterm.** If academic consideration is granted (following verification of proper documentation), the weight of the midterm will be transferred to the final exam.

EXTRA COURSE INFORMATION

Policy Framework: Missed Classes, Late Work, and Academic Integrity

I. Absence/Late Accommodation Policy

1. Students must familiarize themselves with the University Policy on Academic Consideration – Undergraduate Students in First Entry Programs posted on the Academic Calendar:
https://www.uwo.ca/univsec/pdf/academic_policies/appeals/academic_consideration_Sep24.pdf
This policy does not apply to requests for Academic Consideration submitted for attempted or completed work, whether online or in person. The policy also does not apply to students experiencing longer-term impacts on their academic responsibilities. These students should consult Accessible Education.

2. Students missing a test/assignment/lab or examination will report the absence by submitting Academic Consideration Request form through STUDENT ABSENCE PORTAL.

3. **All requests for Academic Considerations must be made within 48 hours after the assessment date or submission deadline. All Academic Consideration requests must include supporting documentation. However, recognizing that formal documentation may not be available in some extenuating circumstances, the policy allows students to make one Academic Consideration request without supporting documentation in this course. However, the following assessments are excluded from this, and therefore always require formal supporting documentation:**
   - **Examinations scheduled during official examination periods.**
   - **Midterm Tests and other designated assessments as noted on the course outline.**
   - **Any assessment already covered by a flexible deadline.**
   - **If a student mistakenly submits their one allowed Academic Consideration request without supporting documentation for the assessments listed above that do not require academic consideration, the request cannot be recalled and reapplied. This privilege is forfeited.**

4. **Requests without supporting documentation are limited to one per term per course.**

5. **An undocumented absence is only valid for a 24-hour period, from midnight on the day specified to midnight of the following day.** An appropriate use of an undocumented absence would be for an in-class assessment that takes place that day. Where the time given to complete the assessment is longer than 24 hours, an undocumented absence will not cover a student for the full time given to complete the assessment, and flexibility considerations in submitting the assessment will override the undocumented absence.

7. NOTE: Forged notes and certificates will be dealt with severely. To submit a forged document is a scholastic offence.

8. It is the student's responsibility to check the date, time and location of the Special Examination.

II. Religious Accommodation

When scheduling unavoidably conflicts with religious holidays, which (a) require an absence from the University or (b) prohibit or require certain activities (i.e., activities that would make it impossible for the student to satisfy the academic requirements scheduled on the day(s) involved), no student will be penalized for absence because of religious reasons, and alternative means will be sought for satisfying the academic requirements involved. If a suitable arrangement cannot be worked out between the student and instructor involved, they should consult the appropriate Department Chair and, if necessary, the student's Dean.

It is the responsibility of such students to inform themselves concerning the work done in classes from which they are absent and to take appropriate action.

III. Academic Integrity

In the Faculty of Engineering, we encourage students to create a culture of honesty, trust, fairness, respect, responsibility, and courage, befitting the professional degree you are pursuing.
Please visit Academic Integrity Western Engineering for more information

IV. Academic Offences

Plagiarism means using another's work without giving credit. The university has rules against plagiarism and other scholastic offences. Western Engineering has a zero-tolerance policy on plagiarism. The minimum penalty is zero on the course work and a repeat offence will earn you zero on the course. A third offence may lead to expulsion from the university.
Scholastic Discipline for Undergraduate Students & Cheating, Plagiarism and Unauthorized Collaboration: What Students Need to Know

Students must write their reports, 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. University policy states that cheating, including plagiarism, 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.

All required papers may be subject to submission for textual similarity review to commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted will be included as source documents on the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between the University of Western Ontario and Turnitin.com (http://www.turnitin.com). Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, in the relevant section of the Academic Handbook: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf

V. Faculty of Engineering AI Policy

The use of generative Artificial intelligence (GenAI) tools won't be discouraged in the Faculty of Engineering. As we pride ourselves on building the future we can't hide from the use of GenAI tools to contribute to the understanding of the course materials. You are able to use GenAI tools as follows:

- For any written assignment, except take-home exams and personal reflections, you may use a GenAI tool to help you brainstorm or frame your initial ideas and grammar. However, your final submission must be entirely in your own words and demonstrate your individual experience and insight.
- For any written or practical project AI tools may be used across your workflow. Use them responsibly and reflect in your final presentation on how these tools supported or challenged your creative thinking.

- All GenAI tools used at any point of the course with the intent of helping with homework, assignments or any other assessment content must be disclosed and referenced appropriately.

GenAI tools use won't be permitted in any type of examination or other assessments where the faculty have prohibited their use. If use of GenAI tools is detected by the instructor in these instances, academic offences penalties might be imposed against the student.

VI. Accessibility

Western is committed to achieving barrier free accessibility for persons with disabilities studying, visiting and working at Western. As part of this commitment, there are a variety of services, groups and committees on campus devoted to promoting accessibility and to ensuring that individuals have equitable access to services and facilities. To help provide the best experience to all members of the campus community, please visit the Accessibility Western University for information on accessibility-related resources available at Western.

Students with disabilities may arrange for academic accommodation at Western. For a more detailed explanation, please visit Academic Support & Engagement -Academic Accommodation.

VII. Inclusivity, Diversity, and Respect

The Faculty of Engineering at Western University is committed to creating equitable and inclusive learning environments that value diverse perspectives and experiences. We recognize that university courses often marginalize students based on social identity characteristics such as, but not limited to, Indigeneity, race, ethnicity, nationality, ability, gender identity, gender expression, sexuality, age, language, religion, and socioeconomic status. Understanding this, we strive to facilitate equitable experiences and inclusion within the classroom by respecting and integrating multiple ways of knowing, being, and doing. Please visit the Office of Equity, Diversity and Inclusion.

VIII. Health and Well-Being

- Health & Wellness Services – Students - Offers appointment-based medical clinic for all registered part-time and full-time students.
- Mental Health Support - Provides professional and confidential services, free of charge, to students needing assistance to meet their personal, social and academic goals. Services include consultation, referral, groups and workshops, as well as brief, change-oriented psychotherapy.
- Crisis Support - For immediate assistant, please visit Thames Hall Room 2170 or call 519-661-3030. The crisis clinic operates between 11:00 am - 4:30 pm. For after-hours crisis support, click here.
- Gender-Based Violence and Survivor Support - "Western is committed to reducing incidents of gender-based and sexual violence (GBSV) and providing compassionate support to anyone who is going through or has gone through these traumatic events. If you are experiencing or have experienced GBSV (either recently or in the past), you will find information about support services for survivors, including emergency contacts at the following website: https://www.uwo.ca/health/student_support/survivor_support/gethelp.html To connect with a case manager or set up an appointment, please contact support@uwo.ca.

Important Contacts

Engineering	SEB	519-	engugrad@uwo.ca

Undergraduate Services	2097	661-2130
Office of the Registrar/Student Central	WSSB 1120	519-661-2100

Important Links

- WESTERN ACADEMIC CALENDAR
- ACADEMIC RIGHTS AND RESPONSIBILITIES
- ENGINEERING PROGRESSION REQUIREMENTS AND ACADEMIC REGULATIONS
- UNIVERSITY STUDENTS' COUNCIL (USC) - SERVICES
- IMPORTANT DATES AND DEADLINES
- ACADEMIC CONSIDERATION FOR MEDICAL ILLNESS - UNDERGRADUATE STUDENTS
- ACCOMMODATIONS FOR RELIGIOUS HOLIDAYS
- SCHEDULING OF ASSIGNMENTS, TESTS, AND EXAMINATIONS
- STUDENT FORMS
- OFFICE OF THE REGISTRAR
- RETENTION OF ELECTRONIC VERSION OF COURSE OUTLINES (SYLLABI)
- ACADEMIC APPEALS
- STUDENT ABSENCE PORTAL

Updated Sept 2, 2025

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