ENV E 324 Biological Processes

Fall 2024 - September 03 to December 09

Class time: Tuesday, Thursday 12:30-13:50 Location: NRE 2-090

Instructor:

Tong Yu, PhD, P.Eng, he/him
(780) 915-3013
tong.yu@ualberta.ca
DICE 7-239
Office Hours: Wednesdays 4:30 - 5:30 pm, plus individual meetings by appointment

Course Description:

*3.8 (fi) (either term, 3-0-3/2) The principles and applications of biological processes in the treatment of contaminated environmental media, with a focus on wastewater treatment. Includes knowledge of environmental microbiology necessary to understand biological processes.

Prerequisites: ENV E 220

Course synchronous and asynchronous content delivery schedule:

In-person course content delivery

Land Acknowledgment:

The University of Alberta respectfully acknowledges that we are situated on Treaty 6 territory, traditional lands of First Nations and Métis people.

TA Information:

Technologist: David Zhao, Email: yupengda@ualberta.ca
TA 1: Calvin Chung, Email: thchung@ualberta.ca , Phone: 587-969-0714
TA 2: Judy Kahkeci, Email: maskoun@ualberta.ca , Phone: 587-985-8800
Please do not pass the phone numbers to anyone else and use them only within working hours.

Lab Sections:

Section	Day	Time	Location
LAB D31	Wednesday	14:00 - 16:50	NRE 2-010, except otherwise noticed
LAB D32	Wednesday	14:00 - 16:50	NRE 2-010, except otherwise noticed

Course Objectives & General Content:

The objective of this course is to introduce to the students the principles and applications of biological processes in environmental engineering, as well as the knowledge of environmental microbiology that is necessary to understand the biological processes. The fundamentals learned in this course will be used in future courses for design of engineered environmental systems.

Learning Outcomes:

By the end of this course, students should be able to:

1. Explain implications of microbial kinetics, thermodynamics, environmental parameters, and biochemical reaction pathways in biological processes.
2. Define engineering systems for biological processes.
3. Describe approaches used in design and operation of biological treatment processes for waste and wastewater.
4. Demonstrate their ability to prepare preliminary design calculations for biological treatment processes.

Marking Scheme:

Activity	(A)Synchronous	Due/Scheduled	Weight
Quizzes		On specified dates	15%
Homework Assignments		On specified dates	15%
Laboratory Reports		On specifoed dates	15%
In-Term-Exam		Nov 19, 2024	15%
Final Exam		Follow the University's final exam schedule	40%
Extra Marks			5%

The Faculty recommended grade point average for a 300 level course is 3.0.Instructors have the leeway to deviate from this average and can assign grades based on their own scheme. All grades are approved by the department chair (or delegate). The office of the Dean has final oversight on all grades.

Term Work

All term work solutions will be posted no later than the last day of classes. All term work will be returned to students by the final day of classes, with the exception of major term work due in the last week of classes. The latter will be returned by the day of the final examination or the last day of the examination period if there is no final examination in the course as per university policy; instructors will make accommodations to return these term work. It is the responsibility of the student to pick up all their term work at the specified time and place. Any unreturned term work, shall be retained and then shredded six months after the deadline for reappraisal and grade appeals. Final examinations will be kept for one year as required by university guidelines and the Government of Alberta's Freedom of Information and Protection of Privacy Act.

Calculator Policy

Only approved non-programmable calculators are permitted in examinations. Any calculator taken into an examination must have a sticker identifying it as an acceptable non-programmable calculator (gold sticker). Students can purchase calculators at the University Bookstore with the stickers already affixed. Calculators purchased elsewhere can be brought to the Student Services where the appropriate sticker will be affixed to the calculator.

Expectations for AI use

In this course, our primary focus is to cultivate an equitable, inclusive, and accessible learning community that emphasizes individual critical thinking and problem-solving skills. To ensure a fair and consistent learning experience for all students, the use of advanced AI tools such as ChatGPT or Dall-E 2 is strictly prohibited for all academic (written/coding/creative/etc.) work, assignments, and assessments in this course. Each student is expected to complete all tasks without substantive assistance from others, including AI tools.

Any use of AI tool in your academic work may result in academic penalties and be considered an act of cheating and a violation as outlined in the relevant sections of University of Alberta (November 2022) Code of Student Behaviour .

Text and References (Mandatory):

Metcalf & Eddy AECOM, 2013. Wastewater Engineering: Treatment and Resource Recovery. Fifth Edition. McGraw-Hill Education. (ISBN 978-0073401188)

This textbook is a classic book in environmental engineering, casually called "the bible of wastewater treatment", and is widely used by environmental engineers worldwide.

Also, course lecture notes and handout materials will be available on eClass.

Website:

eClass

Previous Examples of Evaluative Materials:

Guidelines for In-Term-Exam and Final Exam preparation, with exam preparation questions as representative evaluative course materials, will be provided to all students prior to each exam and a Q&A session will also be offered prior to each exam. No past exam will be made available.

Lab Information:

Lab Topic	Date
Lab 1: EnvE 324 Pre-Lab Extra Lecture (Entire Class)	2024-09-11
Lab 2: EnvE 324 Lab 1 (D31) Microscopic examination of organisms active in biological wastewater treatment	2024-09-18
Lab 3: EnvE 324 Lab 1 (D32) Microscopic examination of organisms active in biological wastewater treatment	2024-09-25
Lab 4: EnvE 324 Lab 2 (D31) Sanitary microbiology	2024-10-02
Lab 5: EnvE 324 Lab 2 (D32) Sanitary microbiology	2024-10-09

Lab 6: EnvE 324 Lab 3 (D31) Biochemical oxygen demand	2024-10-16
Lab 7: EnvE 324 Lab 3 (D32) Biochemical oxygen demand, (D31) BOD Day 7 data collection; Lab 4 (D31) Tour of wastewater treatment plant	2024-10-23
Lab 8: EnvE 324 Lab 3 (D32) BOD Day 7 data collection	2024-10-30
Lab 9: EnvE 324 Lab 4 (D32) Tour of wastewater treatment plant	2024-11-06
Lab 10: EnvE 324 Lab 5 (D31) BioWin software simulation (in CL 1-30)	2024-11-20
Lab 11: EnvE 324 Lab 5 (D32) BioWin software simulation (in CL 1-30)	2024-11-27

Students will undergo WHMIS and lab specific safety training as a part of this course and are expected to follow appropriate lab safety procedures at all times.

Did you know that the University of Alberta has various low-to-no-cost services to help students succeed? Visit http://www.deanofstudents.ualberta.ca/ for information about the academic, wellness, and various other support services available to U of A students. It's never too early or too late to seek help!

EnvE 324 Course Content (2024)

<table>
<tr><th>Time</th><th>Lecture Topics</th><th colspan="2">Laboratories</th><th>Homework, Assignments and Lab Reports</th></tr>
<tr><td>Week 1
(Sep 2-6)</td><td>Topic 1: Introduction
Topic 2: Wastewater characterization</td><td colspan="2"></td><td rowspan="14">Reading assignments (all textbook section numbers):
Topic 1: 7-1.
Topic 2: 2-1, 2-3, 2-4, 2-5, 2-6, 2-7, 8-2.
Topic 3: 2-9, 7-2, 7-3, 7-4.
Topic 4: 7-5.
Topic 5: 8-1, 8-2, 8-3.
Topic 6 (I): 7-6
Topic 6 (II): Example 8-3 in 8-6.
Topic 7: 7-9, 7-10, 7-13.
Topic 8: 7-7, 9-1, 9-2.
Topic 9: 7-14, 10-1, 10-2, 10-3.

Homework assignments: There will be 3-4, associated with Topics 6, 7, 8, 9.

Late submission penalty: <u>20% per day</u> for each homework assignment or lab report, except for special circumstances with instructor’s email approval.</td></tr>
<tr><td>Week 2
(Sep 9-13)</td><td>Topic 2: Wastewater characterization
Topic 3: Wastewater microbiology</td><td colspan="2">Extra Lecture (on <u>Sep 11</u>): Topic 2 & Topic 3</td></tr>
<tr><td>Week 3
(Sep 16-20)</td><td>Topic 3: Wastewater microbiology
Topic 4: Microbial growth kinetics</td><td colspan="2" rowspan="2">Lab 1: Microscopic examination of organisms active in biological wastewater treatment</td></tr>
<tr><td>Week 4
(Sep 23-27)</td><td>Topic 4: Microbial growth kinetics
<u>Quiz 1</u></td></tr>
<tr><td>Week 5
(Sep 30 - Oct 4)</td><td>Topic 5: Activated sludge processes
<u>Quiz 2</u></td><td colspan="2" rowspan="2">Lab 2: Sanitary Microbiology</td></tr>
<tr><td>Week 6
(Oct 7-11)</td><td>Topic 5: Activated sludge processes
Topic 6: Modeling activated sludge process I
<u>Quiz 3</u></td></tr>
<tr><td>Week 7
(Oct 14-18)</td><td>Topic 6: Modeling activated sludge process I
<u>Quiz 4</u></td><td rowspan="4">Lab 3: Biochemical Oxygen Demand</td><td></td></tr>
<tr><td>Week 8
(Oct 21-25)</td><td>Topic 6: Modeling activated sludge process I
Topic 6: Modeling activated sludge process II
<u>Quiz 5</u> (tentative)</td><td rowspan="3">Lab 4: Tour of wastewater treatment plant</td></tr>
<tr><td>Week 9
(Oct 28-Nov 1)</td><td>Topic 6: Modeling activated sludge process II
Topic 7: Biological nutrients removal</td></tr>
<tr><td>Week 10
(Nov 4-8)</td><td>Topic 7: Biological nutrients removal
Topic 8: Biofilm processes</td><td></td></tr>
<tr><td>Nov 11-15</td><td colspan="3">Reading week, no class</td></tr>
<tr><td>Week 11
(Nov 18-22)</td><td><u>In-Term-Exam (Nov 19)</u>
Topic 8: Biofilm processes</td><td colspan="2" rowspan="3">Lab 5: BioWin Software Simulation</td></tr>
<tr><td>Week 12
(Nov 25-29)</td><td>Topic 9: Anaerobic processes</td></tr>
<tr><td>Week 13
(Dec 2-6)</td><td>Topic 10 (optional): Guest lecture (tentative)</td></tr>
<tr><td></td><td colspan="3"><u>Final Exam</u> (follows the University’s final exam schedule)</td></tr>
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Note: Lecture and homework content may vary according to actual lecture progress in class.

UNIVERSITY OF ALBERTA
DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING

EnvE 324 – Biological Processes

Laboratory Report Policies

These lab report policies are applicable to EnvE 324 Lab 1, 2 and 3 in Fall Term 2024. The specific report requirements for Lab 4 and 5 will be communicated with each lab. Group lab reports shall be typed and submitted by the deadline as instructed for each lab. The size and composition of lab groups will be determined prior to each lab, depending on the experimental apparatuses available.

The format of the reports shall be as follows (unless otherwise instructed):

Section	Contents
Cover Page	Course no., lab no., lab title, name and ID
Introduction	A brief (a few sentences) description of what the report addresses, the relevant background and a statement of the objectives of the experiment
Methodology	Provide a brief (a few sentences) description of the methods used. To avoid unnecessary duplication, you can refer to the standard methods or to the laboratory handout for the details. You must make note of any important changes in the written procedure.
Results	Presentation of the *reduced* data (i.e. not raw data) in tables or figures with explanatory text. All figures and tables must be numbered appropriately, provided with a descriptive title and introduced in the text. (i.e. The results of the first column settling test are summarized in Table 1). In this section enough information should be provided so that an informed individual can understand what the information is and what it pertains to.
Discussion	The results presented in the "Results" session should be discussed and interpreted. Explain the significance of the results and any deviations from expected values. Discuss potential sources of error that might explain any deviations you observed. Provide answers to discussion questions here.
Conclusions	Brief statement of main conclusions
References	Listing of the citations referred to in the body of the report
Appendices	Raw data, sample calculations, etc. Appendices should be referred to in the body of the text.

Lab Report Length: There is no minimum or maximum length for the laboratory reports, but a typical report should be about 2 to 4 pages (not including the cover page), depending upon the number of tables or graphs. **Quality should be emphasized over quantity**. A good report is accurate, complete, and concise.

Lab reports due date: One week after the completion of each lab that requires a written report.

EnvE 324 Distribution and Requirements of the Extra Marks (2024)

There are total of 5 points as extra marks, as explained below:

1. **Attendance (1 point)**: Good attendance in lectures and labs (defined as missing no more than 4 lectures or no more than 1 in-person lab).

2. **Student self-introduction card (1 point)**: This self-intro card will allow the instructor, technologist and TAs to better know every student. The aim of this activity is to enhance student's educational experience in this course. The participation of a student in this activity is voluntary.

3. **End-of-term evaluation by the instructor, technologist, and TAs (1 point each from the instructor, technologist, and TAs)**: This subjective evaluation is to reward outstanding students whose qualities are not typically recognized by regular marking scheme. Examples include (1) asking good quality questions in class and outside class, (2) being prepared and well-organized in labs, (3) demonstrated trouble-shooting skills in labs, (4) actively participating in interactions with the instructor/TAs and fellow students on course-related activities outside regular lectures and labs, (5) clear evidence of dedication to environmental engineering and leadership activities that are related to this course. Only outstanding performances will qualify for these marks.

University and faculty policies

Respect and professionalism

The Faculty of Engineering is committed to fostering and protecting an equitable, inclusive, and respectful work and study environment in line with University of Alberta policies and professional engineering industry standards.

The faculty prepares students to uphold industry standards to become a Professional Engineer (P.Eng). Therefore, respect, professionalism, and accountability must be upheld within the Faculty of Engineering and the University of Alberta.

Academic integrity

All students are expected to follow the University of Alberta's Student Code of Behaviour and Student Conduct Policy. The faculty expects an environment free of harassment, discrimination, and bullying. We encourage you to talk to the Office of Safe Disclosure and Human Rights about experiences, questions, or concerns. Additional resources and support for students are attached below.

Engineering students studying in the province of Alberta must also follow the Code of Ethics set by the Association of Professional Engineers and Geoscientists of Alberta (APEGA).

Course outline policies, course requirements, evaluation and grading information can be found in the University Calendar.

Safety during learning activities

In all Faculty of Engineering courses, labs, seminars or other learning activities, safety is of paramount importance. In some cases, laboratory work in a program requires high standards for risk management to keep potential hazards safely under control.

Anyone found to be unable to function safely in the class, lab, seminar or other learning activity may be asked to leave or be removed for their and the safety of other participants and instructors in alignment with the Student Code of Behaviour and Student Conduct Policy. As members, or prospective members, of the engineering profession, it is your responsibility to identify and inform the proper authorities of unsafe work.

Audio and video recording

Audio or video recording, digital or otherwise, of lectures, labs, seminars or any other teaching environment by students is allowed only with the prior written consent of the instructor or as a part of an approved accommodation plan.

Student or instructor content, digital or otherwise, created and/or used within the context of the course is to be used solely for personal study and is not to be used or distributed for any other purpose without prior written consent from the content author(s).

Only those items specifically authorized by the instructor may be brought into the exam facility. Students must not bring any unauthorized electronic device into an examination room, including cell phones or other devices.

Student services and support

Health & Wellness Support

Counselling and Clinical Services

Free, short-term, appointment-based counselling and psychiatric services. Also offers drop-in workshops. Book an initial consultation. Visit uab.ca/CCS to learn more.

Wellness Supports Social Workers

Free one-on-one support for students in the areas of housing, finances, academics, personal wellness, life skill development, family dynamics, system navigation, and any area of life where there is a desire to invite change. Visit uab.ca/wellness to learn more.

Sexual Assault Centre

Free, anonymous, and confidential drop-in counselling. Visit uab.ca/UASAC to learn more.

The Office of Safe Disclosure & Human Rights (OSDHR)

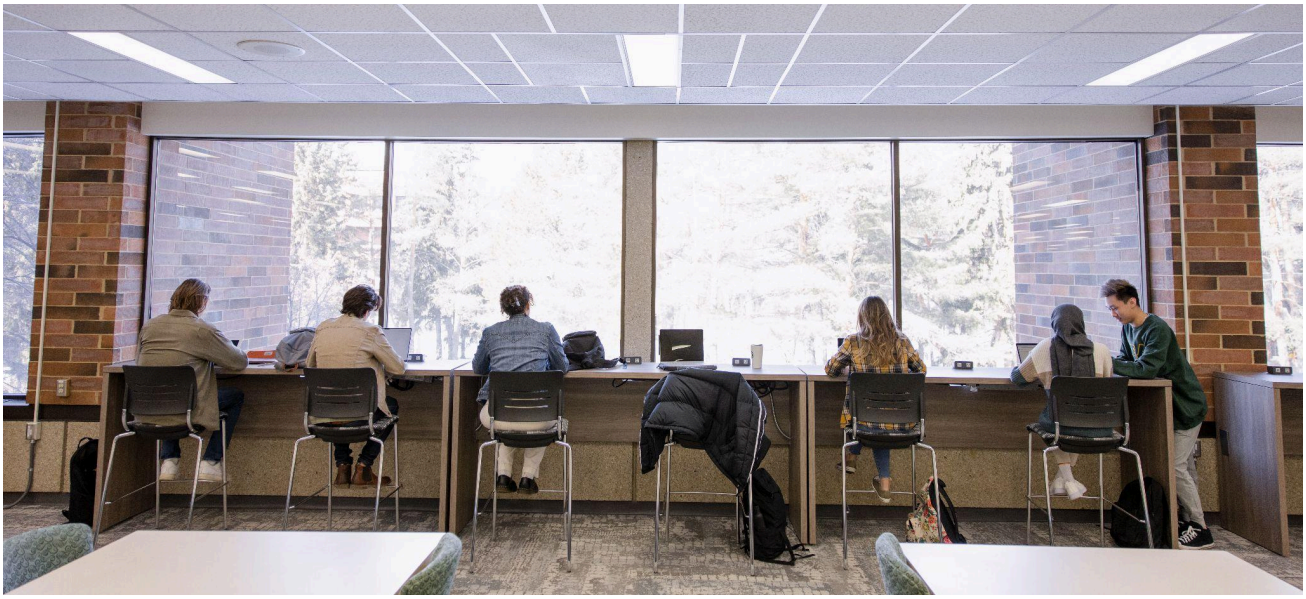
The OSDHR advises confidentially on sensitive issues you may not feel comfortable solving on your own. Contact the OSDHR if you want to get help or to make a report while keeping your privacy. Visit uab.ca/OSDHR to learn more.

HIAR (Helping Individuals at Risk)

If you're worried about someone, contact HIAR, who can help assess risk and connect individuals to support. Learn more at uab.ca/HIAR.

Immediate External Supports

Health Link Alberta: 811
Suicide Crisis Helpline: 988



Academic support

Academic Success Centre
Access to a variety of services to maximize your academic success. Learn more at uab.ca/ASC.

Accessibility Resources
Connects students with disabilities to accommodations. Learn more at uab.ca/Access under accommodations + accessibility.

Decima Robinson Support Centre
Academic support for 100- or 200-level introductory calculus, linear algebra and statistics courses. Visit uab.ca/DSC to learn more.

Engineering Student Success Centre
The Faculty of Engineering provides drop-in tutoring for first-year courses. Visit uab.ca/ESSC to learn more.

Office of the Student Ombuds
Call for complex problems and conflict mediation. Learn more at uab.ca/ombuds.

Financial support

Student Service Centre

For awards and other funding support. Learn more at uab.ca/ask.

Campus Food Bank

The Campus Food Bank Society is an independent charity supporting University of Alberta students, faculty, staff, and alumni for up to five years. For additional information visit their website at campusfoodbank.com.