This course introduces the basic engineering and science framework needed to understand and predict environmental processes and to appreciate the link between human activity and environmental sustainability. The course emphasizes the role of the engineer in protecting human health and the environment. The course discusses pressing environmental issues and innovative solutions including the role of engineers to collaborate for positive change. The course provides an introduction to a career in environmental engineering, but also provides concepts that are relevant to all civil engineering careers. The general objectives are for the student to become able to:

- Identify key components of the physical environment and how they are influenced by human activity.
- Recognize how culture, societal factors and economics frame environmental issues.
- Apply the mathematics of growth to better understand population growth and sustainability at various scales.
- Use the mass balance approach to estimate pollutant concentrations in simple open and closed environmental systems.
- Apply fundamental principles of chemistry and physics to model the fate of pollutants in the environment (air and water).
- Understand the central role of protecting public health and safety in the engineering profession.
- Understand the concepts of sustainable development and design and environmental stewardship.
- Demonstrate knowledge of professional ethics and provide reasoned arguments on ethical issues in environmental engineering.
- Improve communication and teamwork skills through undertaking individual written assignments, working on a group project, and delivering a group presentation.
- Appreciate the need for life-long learning to keep abreast of emerging environmental issues and policies.

Antirequisite(s): Chemistry 2210A/B.

Prerequisite(s): Chemistry 1302A/B or the former Chemistry 1024A/B.

Note: It is the student's responsibility to ensure that all Prerequisite and Corequisite conditions are met or that special permission to waive these requirements has been granted by the Faculty. It is also the student's responsibility to ensure that they have not taken a course listed as an Antirequisite. The student may be dropped from the course or not given credit for the course towards their degree if they violate the Prerequisite, Corequisite or Antirequisite conditions.

Contact Hours:
2 lecture hours/week;
Lectures will be delivered asynchronously through pre-recorded videos posted to the course OWL site. Lectures will be organized into weekly learning modules which students should review in the week they are posted, and be prepared to review and discuss in the group discussion on the following week. Review of lecture material and self-study should take approximately 6 hours per week.

1 Group Discussion /week
A 1-hour discussion session will be delivered in-person each week. Students will be divided into two groups and each group will be assigned one hour that will occur on a regular basis during the scheduled lecture hours for the course. See details below.

2 tutorial hours/week
2-hour tutorial sessions will be in person.

Guest lectures
1-hour guest lectures will occur several times during the term and will be in person.

Instructor:
Dr. Sabina Rakhimbekova, SEB 3041, e-mail: srakhimb@uwo.ca
Office hours: Tuesdays 2:30 pm – 3:30 pm or by appointment.

Administrative Assistant: Sandra McKay (smckay@uwo.ca)

Textbook:
Course notes (with gaps) will be provided. These should be downloaded from the course website in advance of watching the lecture. The gaps will be filled in during the lectures and should be done by the student in their own set of notes while watching the lecture; this will promote active learning. Solutions to some example problems will be provided in the tutorials and these, as well as the gap-filled notes, will NOT be posted on the course website.

Units:
SI unit systems will be adopted in assignments, test, and examination.
Specific Learning Objectives:

I. Growth in Human Systems and Sustainability
At the end of this section, the student should be able to

(a) Understand, differentiate and manipulate equations for linear, exponential, and logistic growth and apply to environmental problems including population growth.

(b) Manipulate the mathematics of growth as a product of factors and apply to environmental problems including growth of greenhouse gas emissions.

(c) Explain in context and calculate (where appropriate) the concepts of IPAT, environmental resistance, total fertility rate, demographic transition, tragedy of the commons, market failure, sustainable development, environmental footprint, human development index, sustainability of human society.

II. Pollutants in the Environment: Water
At the end of this section, the student should be able to:

(a) Identify the basic physical and chemical properties of water.

(b) Recognize the major parts of the hydrologic cycle.

(c) Articulate the social and geopolitical dimensions of water pollution, water shortages and water disparity.

(d) Understand the major classes of pollutants in environmental water systems, such as pathogens, nutrients, heavy metals and pesticides.

(e) Calculate and employ the criteria used to describe water quality.

(f) Describe and differentiate drinking water and wastewater treatment systems.

III. Pollutants in the Environment: Air
At the end of this section, the student should be able to:

(a) Identify the basic physical and chemical properties of air and common primary and secondary air pollutants, including VOCs, ozone, photochemical smog, and particulate matter.

(b) Understand the trends and social and economic factors that influence the management of local, national and global air pollution.

(c) Recognize the basic mechanisms that lead to ozone depletion and smog.

(d) Appreciate the Montreal Protocol as an example of successful global partnership to reduce a targeted environmental threat.

(e) Demonstrate an appreciation for the science of climate change, its drivers and predicted trajectories, as well as the environmental, social, and economic impacts.

(f) Understand the Professional Code of Ethics and be able to apply it to the responsibilities of engineers in an environmental context.

The instructor may expand or revise material presented in the course as appropriate.

General Learning Objectives:

E=Evaluate, T=Teach, I=Introduction; (I) = Introduction, (D) = Developing, (A) = Advanced level

<table>
<thead>
<tr>
<th>Knowledge Base</th>
<th>E (I)</th>
<th>Engineering Tools</th>
<th>I</th>
<th>Impact on Society</th>
<th>E (I)</th>
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<tbody>
<tr>
<td>Problem Analysis</td>
<td>E (I)</td>
<td>Team Work</td>
<td>I</td>
<td>Ethics and Equity</td>
<td>E (I)</td>
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<tr>
<td>Investigation</td>
<td>Communication</td>
<td>E (I)</td>
<td>Economics Project Management and Life-Long Learning</td>
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<td>Design</td>
<td>Professionalism</td>
<td>E (I)</td>
<td>Life-Long Learning</td>
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**Evaluation:**

The final mark will be determined as follows:

- Participation: 10 %
- Assignments: 10 %
- Midterm Test: 25 %
- Project: 15 %
- Final Examination: 40 %

Total: 100 %

1. **Midterm Examination:**

The midterm exam will be 2.0 hours.
Tentative Date: Tuesday Oct 26, 10:30 am - 12:30 pm.
Room: SEB 1200

The midterm will be CLOSED BOOK: no programmable calculators or other external sources of information, including books, notes or crib sheets, are permitted. A list of equations will be provided on the exam (and posted one week prior to the exam). Only non-programmable calculators acceptable to the Department for closed book exams will be permitted; check with the Department of Civil and Environmental Engineering Office. Part marks may not be awarded for some of the problems on the midterm or final exam.

2. **Final Examination:**

The final exam will be 3.0 hours on a date to be determined. Consult the final exam schedule when published.

The final examination will be CLOSED BOOK: no programmable calculators or other external sources of information, including books, notes or crib sheets, are permitted. A list of equations will be provided on the exam (and posted one week prior to the exam). A list of acceptable calculators for closed book exams will be posted on the bulletin board across from the Department of Civil and Environmental Engineering Office: please be sure your calculator is on it! Part marks may not be awarded for some of the problems on the final exam.

3. **Assignments:**

There will be 3 assignments during the term. The purpose of the assignments is to help students in their assimilation and synthesis of the material, to develop their communication skills, and to prepare for the midterm and final. Assignment questions will consist of a mix of short answer, computations, and essay-style responses.

Assignments will be due electronically as a PDF through the course website; if completed by hand, then it must be converted to a very clear and legible PDF for submission (instructions will be
provided). Completion using software (Word, OneNote, XL, etc.) is ideal for easy conversion to PDF. Submission in any format other than a single PDF (unless otherwise indicated in the cover page of the assignment) will be assigned a mark of zero.

All written submissions will be passed through Turnitin to ensure no copying or plagiarism. You may discuss the assignments with colleagues but the work you turn in must be yours alone. Assignments are to be submitted prior to 11:55 pm on the due date. Late assignments will be assessed a penalty of 10% per day, to a maximum of 4 days, after which they will receive a mark of zero. Request for extensions for legitimate reasons (e.g., sickness) must follow appropriate procedures; see “Academic Consideration for Student Absence” section below. The maximum number of missed assignments for each student will be one; if more than one assignment is missed a student may be barred from writing the final exam.

**Assignment Schedule**

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Published</th>
<th>Tutorial</th>
<th>Due</th>
<th>Returned</th>
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<tbody>
<tr>
<td>1</td>
<td>Sept 14</td>
<td>Sept 15</td>
<td>Sept 21</td>
<td>Sept 28</td>
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<td>Oct 5</td>
<td>Oct 6</td>
<td>Oct 12</td>
<td>Oct 19</td>
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<td>3</td>
<td>Nov 09</td>
<td>Nov 10</td>
<td>Nov 16</td>
<td>Nov 23</td>
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**4. Group Discussions:**

Group Discussions will be in-person in a regular slot each week to complement online lectures. You have been assigned to Group A or Group B (you will be notified through OWL and can check this in OWL). Your attendance and participation in Group Discussions is expected (i.e., not optional to get full marks in the course).

The Group Discussions have multiple objectives:
- Provide opportunity to directly interact with the Professor and other students
- Discussion of current environmental issues in the news
- Discuss lectures and course notes
- Answer your questions on course deadlines, course lectures, and related material
- Provide examples to further supplement the course notes
- Participate in “Test-your-learning quizzes” on the course notes released the previous week (uses iClicker, will count towards participation, correct/incorrect will not matter)

Group A: Tuesdays 10:30 am – 11:30 am
Group B: Tuesdays 11:30 am – 12:30 pm

You must attend the session to which you were assigned. If you are unable to attend on a regular basis for a specific reason, please contact the instructor at the beginning of the term to explain and discuss possible alternative arrangements in exceptional circumstances.

**5. Tutorial Slots:**
The tutorial slots will be used in multiple ways:

1) **Assignment/Problem Support**: Scheduled sessions to help with each assignment (see schedule above). During these three tutorials, TAs will be available to help you with any questions you have; however, students **must try the questions** before asking for help. Attendance is **highly recommended**.

2) **Project work**: For all other tutorial slots, students are expected to use the tutorial time to work on their group projects. Attendance is **not expected**.

6. **Project**

A group research project will be assigned. Groups will be randomly assigned. The project runs throughout the course with a succession of written and oral deliverables. A component of peer review is included to ensure equal contribution from all group members. Full details provided in a separate document and lecture.

7. **Participation**

Participation is an important component of this course. It will be assessed in primarily three ways:

- a. Attendance and verbal contribution during group discussions, guest lectures and student presentations
- b. Participation in the “test-your-learning” quizzes using iClicker during group discussions
- c. Posting relevant, original, constructive material to the online discussion forums on the class website (both original posts and replies)

**Information regarding iClicker Cloud Classroom Polling**

We will be using a cloud-based student response software by iClicker in class this semester. This will help me understand what you know, give everyone a chance to participate in class, and provide more interaction on concepts and example questions. We will also be using this software to keep track of attendance. At the start of every class you will JOIN my class; only after you do this will you be able to answer any poll questions posted. It does not matter if you answer right or wrong, there are no marks assigned for correctness. You only get marks for participating. Participating in the polls also, at the same time, registers your attendance. Participating in the majority of questions asked each day shows you were present in class that day.

You will need to create an iClicker Reef Student account to participate in class using your laptop, smart phone, or tablet connected to the university Wi-Fi.

**Creating Your iClicker Reef Student Account**

Go to iclicker.com/students or download the iClicker Reef Student app for your Apple or Android device to sign up for a Reef account. Those using the mobile app must have it updated to version 5.0.4 (Oct 2018) or newer. You should use your university email address and your University ID (e.g., “srakhimb” for student srakhimb@uwo.ca) in the Student ID field. You can edit your email address, password, or student ID from your account profile. Do not create and use more than one Reef account as you will only receive credit from a single account.

You do not need to purchase anything – iClicker Cloud is fully supported by Western and is free to all its students. Make sure you choose **Western University Ontario** when signing up.
Add This Course to Your Reef Account

- Use the + sign to search for my course in iClicker Reef.
- In the “Find Your Institution” field, enter Western University Ontario
- In the “Find Your Course” field, enter CEE 2217 Intro to Environ Eng
- Click “Add This Course” and it will be added to the main screen of your iClicker Reef account

Participating

- Each time our class meets, make sure you have selected my course from the main screen of your iClicker Reef account.
- When I start a session, click the Join button that appears on your screen, then answer each question I ask in iClicker Reef.
- For short answer and numeric questions, make sure you press Send.

Keep Track, Review, Study

- You can review your grades, performance, and participation in iClicker Reef
- You can use the questions I asked during class as flashcards or practice tests in the Study Tools section of iClicker Reef.

Academic Integrity Information

iClicker activities fall under the provisions of our campus academic honesty policy. Students must not engage in academic dishonesty while participating in iClicker activities. This includes but is not limited to:

- Checking in while not physically in class
- Having another student check you into class
- Answering polling questions while not physically in class
- Looking at other students’ devices while answering live questions
- Using more than one iClicker remote or account at a time

Any student found to be in violation of these rules will lose polling points for the entire term and may be reported to the Dean of Engineering.

8. 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 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.

9. Cheating:

University policy states that cheating is a scholastic offence. The commission of a scholastic offence is attended by academic penalties that might include expulsion from the program. If you are caught cheating, there will be no second warning.

For more information on scholastic offenses, please see:
10. **Attendance:**
Any student who, in the opinion of the instructor, has not engaged sufficiently in class, laboratory, or tutorial periods 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 final examination in the course.

11. **Use of laptop computers, tablets or smart mobile phones.**
Use of laptop computers, tablets or smart mobile phones is expected to be for the purpose of participating in the lecture explicitly. They can be used to fill in the gapped notes, participate in class polls, and to register your attendance. Students using the devices for activities not related to this class may be asked to leave.

12. **Accommodation:**
Students with disabilities work with Accessible Education (formerly SSD) which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The accommodation policy can be found here: Academic Accommodation for Students with Disabilities.

13. **Academic Consideration for Student Absence**
Students will have up to two (2) opportunities during the regular academic year to use an online portal to self-report an absence during the term, provided the following conditions are met: the absence is no more than 48 hours in duration, and the assessment for which consideration is being sought is worth 30% or less of the student’s final grade. Students are expected to contact their instructors within 24 hours of the end of the period of the self-reported absence, unless noted on the syllabus. Students are not able to use the self-reporting option in the following circumstances:

- for exams scheduled by the Office of the Registrar (e.g., December and April exams)
- absence of a duration greater than 48 hours,
- assessments worth more than 30% of the student’s final grade,
- if a student has already used the self-reporting portal twice during the academic year

If the conditions for a Self-Reported Absence are *not* met, students will need to provide a Student Medical Certificate if the absence is medical, or provide appropriate documentation if there are compassionate grounds for the absence in question. Students are encouraged to contact their Faculty academic counselling office to obtain more information about the relevant documentation. Students should also note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds, or for other reasons. **All documentation required for absences that are not covered by the Self-Reported Absence Policy must be submitted to the Academic Counselling office of a student's Home Faculty.**

For Western University policy on Consideration for Student Absence, see
14. Religious Accommodation
Students should consult the University's list of recognized religious holidays, and should give reasonable notice in writing, prior to the holiday, to the Instructor and an Academic Counsellor if their course requirements will be affected by a religious observance. Additional information is given in the Western Multicultural Calendar.

15. Use of Recordings:
Participants in this course are not permitted to record online lecture sessions, except where recording is an approved accommodation, or the participant has the prior written permission of the instructor. The lecture notes and online lecture videos are copyrighted to the instructor and legally protected. Do not post these videos and lecture notes on any other website or online forums. The illegal posting and sharing of the copyrighted course content could be subjected to legal actions.

16. 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. Late comers may be asked to wait outside the classroom until being invited in by the Instructor. Please turn off your cell phone audio or motion notifications (calls, texts, alerts, etc) before coming to a class. Students are expected to participate in class discussions. On the premises of the University or at a University-sponsored program, students must abide by the Student Code of Conduct: https://www.uwo.ca/univsec/pdf/board/code.pdf

17. Conduct:
In the event of a COVID-19 resurgence during the course that necessitates the course delivery moving away from face-to-face interaction, all remaining course content will be delivered entirely online, either synchronously (i.e., at the times indicated in the timetable) or asynchronously (e.g., posted on OWL for students to view at their convenience). The grading scheme will not change. Any remaining assessments will also be conducted online at the discretion of the course instructor.