

THE UNIVERSITY OF WESTERN ONTARIO  
FACULTY OF ENGINEERING SCIENCE  
DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING

CEE 2217 Introduction to Environmental Engineering

Course Outline 2009-2010

This course introduces the general themes and engineering approaches related to an understanding of environmental issues associated with human activity. The general objectives are for the student to be able to:

- Understand the physical environment and how it is influenced by human activity.
- Understand how culture, societal issues and economics frame environmental issues.
- Apply the mathematics of growth and develop an appreciation for the global context of population growth and sustainable yield of systems.
- Apply the laws of mass balance and thermodynamics to simple flow and energy systems.
- Understand and use basic principles in chemistry and physics to explain the behaviour of pollutants in the environment (air, land and water).
- Develop an appreciation for the topic of global climate change and the roles and responsibilities of engineers in mitigation and adaptation.
- Learn about the principle of sustainable development and develop an appreciation of its implementation in engineering design and its integration into society.
- Consider the near and long-term future for society and for the engineering profession
- Provide an informed opinion on the opportunities and responsibilities of engineers in their careers over the next 40 years.
- Improve communication and team skills by undertaking individual written assignments and making group presentations.
- Recognize the need for life-long learning in keeping abreast of emerging environmental issues and policies.

**Prerequisite:** Chemistry 024

**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 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 he or she violates the Prerequisite, Corerequisite or Antirequisite conditions.

**Corequisite:** None

**Antirequisite:** Chem 226

**Contact Hours** 3 lecture hours and 2 tutorial hours each week.

**Schedule**

Lectures M,W 10:30 – 11:30, SEB-2200 and T 9:30 – 10:30, SEB-2100  
Tutorials Tue, 10:30 – 12:30, SEB-2100

## **Texts**

*Required:* Hot Flat and Crowded (2008), by Thomas Friedman; Douglas & McIntyre, Farrar Straus & Giroux.

*Recommended:* Gilbert M. Masters (2008). Introduction to Environmental Engineering and Science. 3rd Edition. Prentice Hall. [10 copies on 3-hr reserve in Taylor Library].

## **Instructor**

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## **Administrative Assistant**

Stephanie Lawrence  
CEE Administrative Assistant  
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## **Teaching Assistants**

		<b>Contact about:</b>
Chris Power (CP)	cpower9@uwo.ca	WebCT
Stephanie Drake (SD)	sdrake5@uwo.ca	Assignments
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Amjad Tariq (AT)	atariq@uwo.ca	

To setup a meeting to discuss a particular marked assignment: email the TA who marked it (see initials).

## **Topics and Specific Learning Objectives**

### **I. Analysis and Prediction of Growth**

At the end of this section, the student should be able to

- Manipulate the mathematics of growth and understand the concepts of half-life and exponential decay.
- Understanding the concept of continuous compounding with application to population growth and resource consumption.
- Understand the concept of Sustainable Yield and its role in resource availability.
- Explain the concept of demographic transition in the context of population growth.

### **II. Mass and Energy Transfer**

At the end of this section, the student should be able to:

- Use appropriate units in calculating or measuring environmental quantities for liquids, gases and solids.
- Apply the fundamental principles of conservation of mass to materials balance in steady state systems.
- Understand non-conservative and transient systems and their calculation in mass balance scenarios.
- Understand introductory thermodynamic principles such as temperature, heat and work.
- Apply the laws of thermodynamics to simple energy systems.
- Grasp the principles of chemical kinetics and apply the various reaction rate laws to problems.

### **II (A). Pollutants in the Environment: Water**

At the end of this section, the student should be able to:

- Understand the basic physical and chemical properties of water.

- (b) Understand the major parts of the hydrologic cycle.
- (c) Grasp the behaviour of pollutants in water, such as pathogens, nutrients, heavy metals, pesticides, and volatile organic compounds.
- (d) Understand water quality criteria such as MCL (maximum contaminant levels) for drinking water.
- (e) Understand key surface water characteristics such as biological oxygen demand, chemical oxygen demand, and nitrification.
- (f) Understand key ground water characteristics such as darcy transport, hydraulic conductivity, and contaminant breakthrough at receiving points.
- (g) Understand the key role water shortage, water disparity, and water related disasters will have in the future in the context of national and global sustainability.

### III (B). Pollutants in the Environment: Land

At the end of this section, the student should be able to:

- (h) Develop an understanding of solid waste management problems and opportunities
  - (i) Explain the difference between municipal and hazardous waste
  - (j) Appreciate the components in product life cycle analysis
  - (k) Understand the principles of land conservation and material recoverability
  - (l) Provide insight into Corporate Social Responsibility and the link between economic and environmental problem solving with respect to waste management.

### III (C). Pollutants in the Environment: Air

At the end of this section, the student should be able to:

- (m) Physical and chemical fundamentals related to air pollutants
- (n) Perspective on key air pollution problems including ozone depleting compounds, photochemical smog, and global warming.
- (o) Conduct mass balance calculations for air pollutant concentrations
- (p) Understand the key factors that influence local, national, and global air pollutant concentrations
- (q) Appreciate the Montreal Protocol as an example of successful global partnership to reduce a targeted environmental threat.

### IV. Global Climate Change

Through the material presented throughout the course, the student should be able to:

- (a) Explain the majority scientific opinion surrounding global climate change and understand the importance of the topic in the future of engineering profession.
- (b) Develop an appreciation for the major impacts of global warming and the dominant environmental, social, and economic systems that will be impacted.
- (c) Understand global carbon emissions and carbon footprint.
- (d) Provide some insight into the projected impacts and opportunity for technology development and evolving engineering activities.
- (e) Thoughtfully consider climate change impacts and activities on a local, national, and global scale.

### V. Sustainable Development and Appropriate Engineering for Developing World

Through the material presented throughout the course, the student should be able to:

- (a) Understand the concept of sustainable development and appreciate the relationship between economics, social responsibility and environment.
- (b) Explain the `tragedy of the commons`.
- (c) Appreciate the feedback cycle between poverty, population, environmental degradation, and sustainability.
- (d) Discuss positive examples of engineers and engineering students working towards promoting sustainable communities.
- (e) Identify and discuss appropriate technologies in water resources and sanitation for developing countries.

**Units** S/ unit systems will be adopted in assignments, test, and examination.

**Evaluation**

Assignments:	15%
Midterm	20%
Project Presentation	15%
Final Examination	50%

A student must pass the final examination and submit all assignments to pass the course. A student who fails the final examination will be assigned the aggregate mark as determined above, or 48%, whichever is less.

**Examination and Tests**

One 2-hour midterm. Date: Tues Oct 27, 10:30 – 12:30, SEB-2100

One 3-hour final examination. Date and location: TBA

The Midterm and Final Examinations are Closed Book. Only approved (non-programmable) calculators are allowed (see Appendix for list). No other external sources of information, including books, notes or crib sheets, are permitted.

**Weekly Assignments**

There are 9 assignments in total; one per week (with one exception). Assignments are to be done individually. Each assignment will contain three sections: I. *Core Material*, II. *Hot, Flat, and Crowded*, and III. *Supplementary Material (bonus)*. Sections I and II will be required, while Section III will be for bonus marks. As guidance, numerical answers to numerical questions will be provided on the assignment. Part marks are available for partially correct solutions. Some discussion questions will not have ‘right’ and ‘wrong’ answers but rather will be judged on quality of the written content (i.e., well thought out, properly justified, logically presented, well written).

Each assignment will be posted on the course website on Friday afternoon by 3 pm. The tutorial for questions/discussions associated with that assignment will be on the following Tuesday. You may only ask for assistance on a question you have attempted. Completed assignments are due on Fridays at 3:00 p.m. (i.e., one week from the day it was posted). Completed assignments are to be deposited in Locker #52, 2nd Floor, Spencer Engineering Building. Marked assignments will be handed back 11 days from the due date (i.e., at the following Tuesday tutorial). On this day, solutions will be posted on the website. Students will be able to view their tutorial mark online once the assignments are returned.

Assignment	Date Published	Date Due	Date Returned
1	Sept 18	Sept 25	Oct 6
2	Sept 25	Oct 2	Oct 13
3	Oct 2	Oct 9	Oct 20
4	Oct 9	Oct 16	Oct 26 <sup>a</sup>
5	Oct 16	Oct 23	Nov 3
6	Oct 30 <sup>b</sup>	Nov 6	Nov 17
7	Nov 6	Nov 13	Nov 24
8	Nov 13	Nov 20	Dec 1
9	Nov 20	Nov 27	Dec 8

<sup>a</sup> Return early (Mon in class) in time for Midterm

<sup>b</sup> One week skipped due to Midterm

## Format

Each assignment will be posted on WebCT. You must complete the assignment (very neatly in pen OR using word processing software) and then PRINT OUT and hand-in the completed assignment. Pages will be separated, so your name and student number must be on the top of every page.

## Late Assignments

Late assignments will be accepted for 5 days following their due date. 10% per day will be deducted for late assignments. From 3:00 Friday until 3:00 Monday is considered 1 day late. Each 24 hours after is considered as a further day late (e.g., 3:00 pm Monday to 3:00 pm Tuesday). An assignment will not be accepted after Friday at 3:00 p.m. one week from when the assignment was due. For extenuating circumstances, see details in the Faculty of Engineering Policy (attached). If no assignment is received for a student, the mark assigned is zero for that week. The maximum number of missed assignments for each student will be three; if more than three assignments are missed than a student may be barred from writing the final exam.

## Plagiarism on Assignments

Each person must hand in an assignment that contains only their own work. Where material is taken from a published or online source, that source must be fully documented so references can be checked. If an assignment is deemed to be similar to another from this year or a previous year (in the opinion of the TAs and the Prof.) this will be taken as a case of plagiarism. In such circumstances, both individuals (e.g., the person providing the answer and the person copying it) will both receive a mark of zero on the entire assignment. For a first offense, both individuals will receive a personal warning and the infraction will be recorded. For a second offense, further action will be taken.

## Project

Group project and oral presentation based on sustainability issue of interest to the group. Groups will be randomly assigned. Project runs throughout the course with succession of deliverables. Full details provided in separate document.

## Attendance

Attendance at the lectures and tutorials is highly recommended. The lectures will present the key material upon which the midterm and examination are based and will provide the opportunity to fill in the gapped notes provided online (‘filled in’ notes will not be provided online at any time). Tutorials will provide one-on-one assistance with tutorial problems that have been already attempted and may provide more detail that supplement the lecture notes. Attendance will not be recorded, with one exception: **Attendance for guest lectures is mandatory.** A number of distinguished guest lecturers are being brought in to present on key topics throughout the course. Attendance will be kept at these lectures and individuals that miss a guest lecture will receive a 2% deduction off their final grade. If a legitimate timetable conflict exists then an email permission is required **in advance** from the Prof.; send an email at least one week in advance to request permission to miss a guest lecture.

## WebCT

The course WebCT will be the main communication hub and information repository for the course. The calendar will be updated with due dates. Notices will be posted on key reminders, dates, rooms, etc. All course notes will be published by the Friday in advance of the week in which that material will be taught. All notes will be provided electronically only. The notes contain gaps – the gapped information will be provided in class only. All information on the project will be available on the course website. Assignments and assignment solutions will be posted. Practice problems will be available. Supplementary material related to each assignment will be posted as will be suggested links to further material. Chat and feedback forums are there for exchange of ideas and discussion.

## **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 final examinations 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.

## **Consultation Hours**

Students are encouraged to discuss problems with the teaching assistant and/or instructor during tutorial sessions. Other individual consultation may be arranged by appointment requested via email.

## **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 or other Problems<sup>1</sup>**

Students should immediately consult with WE Undergraduate Affairs, SEB2097 and the course instructor 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 WE Undergraduate Affairs and the course instructor how best to deal with the problem. Failure to immediately notify WE Undergraduate Affairs and the course instructor (or as soon as possible thereafter) will have a negative effect on any appeal.

## **Cheating**

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

## **Repeating Course**

The Senate (SCAPA) approved the following policy in Engineering with regard to students who are repeating a failed course:

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.

## **Notices**

Students are responsible for regularly checking their e-mail, the course WebCT site, and notices posted outside the Student Liaison Office SEB2097.

## **CEAB Course Breakdown**

Engineering Science = 40% : 21.6 AUs  
Basic Science = 35%: 18.9 AUs  
Complementary Studies = 25%: 13.5 AUs  
Total = 54 AUs

**Note:** The document "*Instruction for students unable to write tests or examinations or submit assignments as scheduled*" IS ATTACHED AND IS PART OF THIS COURSE OUTLINE.

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**Acceptable Calculators for Closed Book Exams:**

**Texas Instruments:** TI-30X(a), TI-34

**Hewlett Packard:** HP-32S

**Canon:** F-500

**Casio:** FX-82s, FX-115s, FX-260, FX-300w, FX-500(A), FX-991(s)or(w)

**Sharp:** EL-509g, EL-510(RB), EL-520L, EL-531g, EL-540g, EL-545

**Cora:** TK-315

**Micronta:** 65-820



The University of Western Ontario  
Faculty of Engineering  
2009-2010

**INSTRUCTIONS FOR STUDENTS UNABLE TO WRITE TESTS  
OR EXAMINATIONS OR SUBMIT ASSIGNMENTS AS SCHEDULED**

IF, ON MEDICAL OR COMPASSIONATE GROUNDS, YOU ARE UNABLE TO WRITE TERM TESTS OR FINAL EXAMINATIONS OR COMPLETE COURSE WORK BY THE DUE DATE, YOU SHOULD FOLLOW THE INSTRUCTIONS LISTED BELOW. YOU SHOULD UNDERSTAND THAT ACADEMIC ACCOMMODATION WILL NOT BE GRANTED AUTOMATICALLY ON REQUEST. YOU MUST DEMONSTRATE TO YOUR DEPARTMENT (OR THE UNDERGRADUATE SERVICES OFFICE IF YOU ARE IN FIRST YEAR) THAT THERE ARE COMPELLING MEDICAL OR COMPASSIONATE GROUNDS THAT CAN BE DOCUMENTED BEFORE ACADEMIC ACCOMMODATION WILL BE CONSIDERED. DIFFERENT REGULATIONS APPLY TO TERM TESTS, FINAL EXAMINATIONS AND LATE ASSIGNMENTS. READ THE INSTRUCTIONS CAREFULLY. (SEE THE 2009 UWO ACADEMIC CALENDAR).

**A. GENERAL REGULATIONS & PROCEDURES**

1. CHECK THE COURSE OUTLINE TO SEE IF THE INSTRUCTOR HAS A POLICY FOR MISSED TESTS, EXAMINATIONS, LATE ASSIGNMENTS OR ATTENDANCE.
2. BRING YOUR REQUEST FOR ACADEMIC ACCOMMODATION TO THE ATTENTION OF THE CHAIR OF YOUR DEPARTMENT (OR THE UNDERGRADUATE SERVICES OFFICE IF YOU ARE IN FIRST YEAR) PRIOR TO THE SCHEDULED TIME OF THE TEST OR FINAL EXAMINATION OR DUE DATE OF THE ASSIGNMENT. IF YOU ARE UNABLE TO CONTACT THE RELEVANT PERSON, LEAVE A MESSAGE WITH THE APPROPRIATE DEPARTMENT (OR WITH THE UNDERGRADUATE SERVICES OFFICE, IF YOU ARE IN FIRST YEAR). THE ADDRESSES, TELEPHONE AND FAX NUMBERS ARE GIVEN AT THE END OF THESE INSTRUCTIONS. DOCUMENTATION MUST BE PROVIDED AS SOON AS POSSIBLE.
3. IF YOU DECIDE TO WRITE A TEST OR AN EXAMINATION YOU SHOULD BE PREPARED TO ACCEPT THE MARK YOU EARN. REWRITING TESTS OR EXAMINATIONS OR HAVING THE VALUE OF A TEST OR EXAMINATION REWEIGHTED ON A RETROACTIVE BASIS IS NOT PERMITTED.

**B. TERM TESTS**

1. If you are unable to write a term test, inform your instructor and the Chair of your Department (or the Undergraduate Services Office if you are in first year) prior to the scheduled date of the test. If the instructor is not available, leave a message for him/her at the department office and inform the Chair of the Department (or the Undergraduate Services Office if you are in first year).
2. Be prepared to provide supporting documentation to the Chair and the Undergraduate Services Office (see next page for information on documentation).
3. Discuss with the instructor if and when the test can be rescheduled. **N.B.** The approval of the Chair (or the Undergraduate Services Office if you are in first year) is required when rescheduling term tests.

**C. FINAL EXAMINATIONS**

1. If you are unable to write a final examination, contact the Undergraduate Services Office **PRIOR TO THE SCHEDULED EXAMINATION TIME** to request permission to write a Special Final Examination. If no one is available in the Undergraduate Services Office, leave a message clearly stating your name & student number (please spell your full name).
2. Be prepared to provide the Undergraduate Services Office with supporting documentation (see next page for information on documentation) the next day, or as soon as possible (in cases where students are hospitalized). The following circumstances are not considered grounds for missing a final examination or requesting special examinations: common cold, sleeping in, misreading timetable and travel arrangements.
3. In order to receive permission to write a special examination, you must obtain the approval of the Chair of the Department **and** the Associate Dean and in order to apply you must sign a "Recommendation for a Special Examination Form" available in the Undergraduate Services Office. The Undergraduate Services Office will then notify the course instructor(s) and reschedule the examination on your behalf.

**N.B. It is the student's responsibility to check the date, time and location of the special examination.**

**D. LATE ASSIGNMENTS**

1. Advise the instructor if you are having problems completing the assignment on time (**prior** to the due date of the assignment).
2. Be prepared to provide documentation if requested by the instructor (see reverse side for information on documentation).
3. If you are granted an extension, establish a due date. The approval of the Chair of your Department (or the Associate Dean if you are in first year) is not required if assignments will be completed prior to the last day of classes.
4. i) Extensions beyond the end of classes must have the consent of the instructor, the department Chair and the Associate Dean. Documentation is mandatory.

- ii) A Recommendation of Incomplete Form must be filled out indicating the work to be completed and the date by which it is due. This form must be signed by the student, the instructor, the department Chair and the Associate Dean.

### SHORT ABSENCES

If you miss a class due to a minor illness or other problems, check your course outlines for information regarding attendance requirements and make sure you are not missing a test or assignment. Cover any readings and arrange to borrow notes from a classmate.

### EXTENDED ABSENCES

If you are absent more than one week or if you get too far behind to catch up, you should consider reducing your workload by dropping one or more courses. (Note drop deadlines listed below). You may want to seek advice from the academic counsellor in your Department or the counsellors in the Undergraduate Services Office if you are in first year.

### DOCUMENTATION

If you consulted Student Health Services regarding your illness or personal problem, you should complete a Records Release Form in your Departmental Office (or in the Undergraduate Services Office if you are in first year). This form will be forwarded to Student Health Services who in turn will provide confirmation of the problem to the Department or Associate Dean as requested. At your request the Department (or Undergraduate Services Office if you are in first year) will send confirmation to your instructor(s).

If you were seen by an off-campus doctor, you must provide the doctor with a Student Medical Certificate to complete and then bring it to the Department (or the Undergraduate Services Office if you are in first year). **This note must contain the following information: severity of illness, effect on academic studies, duration of absence.**

**In Case of Serious Illness of a Family Member:** Provide a Student Medical Certificate to your family member's physician to complete and bring it to the Department (or the Undergraduate Services Office if you are in first year).

**In Case of a Death:** Obtain a copy of the death certificate or the notice provided by the funeral director's office. You must include your relationship to the deceased and bring it to the Department (or the Undergraduate Services Office if you are in first year).

**For Other Extenuating Circumstances:** If you are not sure what documentation to provide, ask the Departmental Office (or the Undergraduate Services Office if you are in first year) for direction.

**Note:** Forged notes and certificates will be dealt with severely. To submit a forged document is a scholastic offence (see below).

### ACADEMIC CONCERNS

You need to know if your instructors have a policy on late penalties, missed tests, etc. This information may be included on the course outlines. If not, ask your instructor(s).

**You should also be aware of attendance requirements in some courses. You can be debarred from writing the final examination if your attendance is not satisfactory.**

If you are in academic difficulty, check out the minimum requirements for progression in the calendar. If in doubt, see your academic counsellor.

**Calendar References:** Check these regulations in your 2009 Western Academic Calendar:

Absences Due to Illness - page 25
Academic Accommodations for Disabled Students - page 26
Academic Accommodations for Religious or Holy Days - page 28
Course Withdrawals - pages 45-46
Debarred from Writing Examinations - page 38
Incomplete Standing - page 18
Scheduling of Term Assignments - page 39
Scholastic Offences - page 21-25
Special Examinations - page 37

**Note:** These instructions apply to all students registered in the Faculty of Engineering regardless of whether the courses are offered by the Faculty of Engineering or other faculties in the University.

<b><u>Drop Deadlines:</u></b>	First term half course (i.e. "A" or "F"):	October 15, 2009
	Full courses and full-year half courses (i.e. "E", "Y" or no suffix):	November 30, 2009
	Second term half or second term full course (i.e. "B" or "G"):	February 12, 2010

Undergraduate Services Office:	SEB 2097	telephone: (519) 661-2130	fax: (519) 661-3757
Dept. of Chemical and Biochemical Engineering:	TEB 477	telephone: (519) 661-2131	fax: (519) 661-3498
Dept. of Civil and Environmental Engineering:	SEB 3005	telephone: (519) 661-2139	fax: (519) 661-3779
Dept. of Electrical and Computer Engineering:	TEB 279	telephone: (519) 661-3758	fax: (519) 850-2436
Dept. of Mechanical and Materials Engineering:	SEB 3002	telephone: (519) 661-2136	fax: (519) 661-3020