# ENGG*2560 Environmental Engineering Systems

01

Winter 2022
Section(s): C01

School of Engineering
Credit Weight: 0.50
Version 1.00 - January 14, 2022

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# 1 Course Details

## 1.1 Calendar Description

Analysis techniques for natural and engineered systems including chemical, physical and biological processes. Mass balance analysis for steady state and unsteady state situations. Analysis under both equilibrium and non-equilibrium conditions. Reactor types including batch, plug-flow, CSTR. Noise pollution, control and prevention.

**Pre-Requisites:** CHEM*1050, MATH*2270

## 1.2 Course Description

This course aims to establish fundamental chemical engineering skills necessary to address environmental engineering systems. The course also aims to introduce basic noise modelling and control approaches.

## 1.3 Timetable

**Lectures**:

| | | |
|---|---|---|
| Tuesday and Thursday | 8:30 - 9:50 | Virtual or in MCLN 107 |

**Tutorials & Labs**

| | | | |
|---|---|---|---|
| Friday | Sec 01 | 12:30- 14:20 | THRN 1116 |

| | | | |
|---|---|---|---|
| Friday | Sec 02 | 8:30- 10:20 | THRN 1116 |
| Wednesday | Sec 03 | 11:30- 13:20 | THRN 1116 |

* If you cannot attend in person labs, we will provide recordings and you will still be able to complete your assessment, as this is a hybrid course. You will be notified when tutorials will happen (they do not occur every week).

### 1.4 Final Exam

There is no final exam.

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# 2 Instructional Support

## 2.1 Instructional Support Team

**Instructor:** Erica Pensini
**Email:** epensini@uoguelph.ca
**Telephone:** +1-519-824-4120 x56746
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**Lab Technician:** Joanne Ryks
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**Telephone:** +1-519-824-4120 x54087
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**Lab Technician:** Ryan Smith
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**Telephone:** +1-519-824-4120 x53278
**Office:** THRN 1114

## 2.2 Teaching Assistants

**Teaching Assistant (GTA):** Hiral Jariwala
**Email:** hjariwal@uoguelph.ca

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# 3 Learning Resources

## 3.1 Required Resources

**Course Website (Website)**
ENGG*2560 Courselink site will provide copies of lecture slides, laboratory descriptions and assignments.

## 3.2 Additional Resources

**Lecture and Lab Information, and Assignments (Other)**
Posted on Courselink.

## 3.3 Course Contact Hours (Lectures, Labs, & Tutorials)

The lectures, labs and tutorials are the primary means used to support your learning in this course. Lectures will be the primary means for course news and announcements in addition to provision of course materials.

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# 4 Learning Outcomes

## 4.1 Course Learning Outcomes

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

1. Apply chemical mass balances to a range of environmental engineering components.
2. Develop mathematical models of a range of environmental engineering systems.
3. Explain basic noise control approaches.
4. Apply basic noise modelling equations.
5. Demonstrate safe laboratory practices based on guidance provided.
6. Produce experimental results in an interpretable form (effective tables and figures).
7. Formulate a credible set of conclusions and recommendations based on experimental objectives.
8. Prepare a well-structured laboratory report.

## 4.2 Engineers Canada - Graduate Attributes (2018)

Successfully completing this course will contribute to the following:

| # | Outcome | Learning Outcome |
|---|---|---|
| 1 | Knowledge Base | 1, 2, 3, 4, 7 |
| 1.1 | Recall, describe and apply fundamental mathematical principles and concepts | 1, 2, 3, 4, 7 |
| 1.3 | Recall, describe and apply fundamental engineering principles and concepts | 1, 2, 3, 4, 7 |
| 1.4 | Recall, describe and apply program-specific engineering principles and concepts | 7 |
| 2 | Problem Analysis | 1, 2, 3, 4, 7 |

| # | Outcome | Learning Outcome |
|---|---|---|
| 2.1 | Formulate a problem statement in engineering and non-engineering terminology | 1, 2, 3, 4, 7 |
| 2.2 | Identify, organize and justify appropriate information, including assumptions | 1, 2, 3, 7 |
| 2.3 | Construct a conceptual framework and select an appropriate solution approach | 1, 2, 3, 4, 7 |
| 2.4 | Execute an engineering solution | 1, 3, 4, 7 |
| 2.5 | Critique and appraise solution approach and results | 1, 2, 3, 7 |
| 3 | Investigation | 2, 3, 4, 7 |
| 3.1 | Propose a working hypothesis | 2, 3, 7 |
| 3.2 | Design and apply an experimental plan/investigative approach (for example, to characterize, test or troubleshoot a system) | 3, 7 |
| 3.3 | Analyze and interpret experimental data | 2, 3, 7 |
| 3.4 | Assess validity of conclusions within limitations of data and methodologies | 2, 3, 4, 7 |
| 4 | Design | 1, 2 |
| 4.1 | Describe design process used to develop design solution | 1, 2 |
| 4.2 | Construct design-specific problem statements including the definition of criteria and constraints | 1, 2 |
| 4.5 | Develop and refine an engineering design solution, through techniques such as iteration, simulation and/or prototyping | 2 |
| 5 | Use of Engineering Tools | 1, 2, 3, 4, 7 |
| 5.1 | Select appropriate engineering tools from various alternatives | 1, 2, 7 |
| 5.2 | Demonstrate proficiency in the application of selected engineering tools | 1, 2, 3, 4, 7 |
| 5.3 | Recognize limitations of selected engineering tools | 1, 2, 3, 4, 7 |
| 6 | Individual & Teamwork | 2, 3, 7 |
| 6.1 | Describe principles of team dynamics and leadership | 2, 3, 7 |
| 6.2 | Understand all members’ roles and responsibilities within a team | 2, 3, 7 |
| 6.3 | Execute and adapt individual role to promote team success through, for | 2, 3, 7 |

| # | Outcome | Learning Outcome |
|---|---|---|
| | example, timeliness, respect, positive attitude | |
| 6.4 | Apply strategies to mitigate and/or resolve conflicts | 2, 3, 7 |
| 6.5 | Demonstrate leadership through, for example, influencing team vision and process, promoting a positive team culture, and inspiring team members to excel | 2, 3, 7 |
| 7 | Communication Skills | 1, 2, 3, 6, 7, 8 |
| 7.1 | Identify key message(s) and intended audience in verbal or written communication as both sender and receiver | 2, 3, 6, 7, 8 |
| 7.2 | Interpret technical documentation such as device specification sheets, drawings, diagrams, flowcharts, and pseudocode | 1, 2, 3, 6, 7, 8 |
| 7.3 | Construct the finished elements using accepted norms in English, graphical standards, and engineering conventions, as appropriate for the message and audience | 1, 2, 3, 6, 7, 8 |
| 7.4 | Substantiate claims by building evidence-based arguments and integrating effective figures, tables, equations, and/or references | 2, 3, 6, 7, 8 |
| 7.5 | Demonstrate ability to process oral and written communication by following instructions, actively listening, incorporating feedback, and formulating meaningful questions | 2, 3, 6, 7, 8 |
| 8 | Professionalism | 2, 3, 4, 5, 6, 7, 8 |
| 8.1 | Demonstrate an understanding of what it means to be a professional engineer and distinguish between legislated and non-legislated professions | 5 |
| 8.2 | Effectively describe engineering law and its impact on professional engineering practice | 5 |
| 8.3 | Demonstrate professional behaviour | 2, 3, 4, 5, 6, 7, 8 |
| 12 | Life Long Learning | 3 |
| 12.3 | Demonstrate capability for continuous knowledge and skill development in a changing world | 3 |

# 5 Teaching and Learning Activities

## 5.1 Lecture

| | |
|---|---|
| **Topics:** | Introduction |
| **Topics:** | Mass & Energy Balance Principles |
| **Topics:** | Reactors & Chemical Kinetics |
| **Topics:** | Biochemical Kinetics & Reactors |
| **Topics:** | Noise |
| **Topics:** | Equilibrium |
| **Topics:** | Growth |
| **Topics:** | Wrap-up, Course Evaluation |

## 5.2 Lab

| | |
|---|---|
| **Topics:** | Problem Sets |
| **Topics:** | Batch Reactors |
| **Topics:** | Problem Sets |
| **Topics:** | Reactor Systems |
| **Topics:** | Simulink |
| **Topics:** | Problem Sets |
| **Topics:** | Programming |
| **Topics:** | Problem Sets |

## 5.3 Other Important Dates

Other Important Dates

**January 10**: Classes commence

**February 21 – February 27**: WINTER BREAK

**February 28**: classes resume

**April 8**: Last day of classes.

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# 6 Assessments

## 6.1 Marking Schemes & Distributions

| Name | Scheme A (%) |
|---|---|
| Batch Reactor Lab | 15 |
| Reactor Systems Lab | 25 |
| Quizzes | 60 |
| Total | 100 |

## 6.2 Assessment Details

**Batch Reactor Lab (15%)**

**Date:** Due three weeks after your lab, at 11:59 pm
**Learning Outcome:** 1, 2, 3, 4, 5, 5, 6, 7, 8
The lab will take place during the first week of February. It will involve a hands on session regarding rectors and a final report, in which reactors are modeled and the hands-on experience is critically evaluated. Recordings will be provided if you will not attend in person. The report will be used to assess the knowledge acquired by the students. The students will also have to answer theoretical questions and include them in their report.

Please note that we will be providing recordings of the labs for those students who are not able to attend in person. This will allow all students to complete this assessment.

The assessment is linked to the following graduate attributes: A knowledge base for engineering (1), Problem analysis (2), Investigation (3), Use of engineering tools (3), (Team) Individual and teamwork (6), (Comm.) Communication skills (7).

**Reactor Systems Lab (25%)**

**Date:** Due three weeks after your lab, at 11:59 pm
**Learning Outcome:** 1, 2, 3, 3, 4, 5, 5, 6, 7, 8
The lab will take place the first week of March. It will involve a hands on session regarding rectors and a final report, in which reactors are modeled and the hands-on experience is critically evaluated. Recordings will be provided if you will not attend in person. The report will be used to assess the knowledge acquired by the students. The students will have to answer theoretical questions as part of their report.

Please note that we will be providing recordings of the labs for those students who are not able to attend in person. This will allow all students to complete this assessment.

The assessment is linked to the following graduate attributes: A knowledge base for engineering (1), Problem analysis (2), Investigation (3), Use of engineering tools (3), (Team) Individual and teamwork (6), (Comm.) Communication skills (7).

**Quizzes (60%)**
**Date:** Tue, Jan 26, 11:30 AM - Tue, Apr 6, 11:30 AM, Virtual
**Learning Outcome:** 1, 2, 3, 3, 4, 5, 5, 6, 7, 8
There will be a a total of 6 quizzes , each worth 10%. Quizzes will be conducted using Courselink.

During quizzes, the students will be asked to solve numerical problems and answer theory questions.

The assessment is linked to the following graduate attributes: A knowledge base for engineering (1), Problem analysis (2), Use of engineering tools (3), (Comm.) Communication skills (7).

Quizzes dates:

January 27, February 11, February 20, March 8, March 22, April 7

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# 7 Course Statements

## 7.1 Communication & Email Policy

Communication associated with course material is delivered by a combination of the lectures, lab/tutorials and the Courselink site. It is your responsibility to receive communication from ALL of these sources – there will be some mutual reinforcement between these sources but they are not completely redundant. As per university regulations, all students are required to check their <uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its students.

## 7.2 Course Grading Policies

**Missed Assessments**: If you are unable to meet an in-course requirement due to medical, psychological, or compassionate reasons, please email the course instructor. See the undergraduate calendar for information on regulations and procedures for Academic Consideration:
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

**Accommodation of Religious Obligations**: If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor **within two weeks of the start** of the semester to make alternate arrangements. See the undergraduate calendar for information on regulations and procedures for Academic Accommodation of Religious Obligations:
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml

**Passing grade**: To pass the course students must obtain a grade of 50% or higher.

**Missed quizzes**: If you miss a quiz due to grounds for granting academic consideration or religious accommodation, the weight of the missed test will be redistributed among the other assessment. If you do not have a valid reason for a missed quiz, you will be given zero marks on that quiz.

**Lab Work**: You must pass the laboratory safety quiz to be permitted to complete the hands on laboratories. If you cannot attend the in person labs, we will provide videos so that you can complete the reports.

**Late Lab Reports**: Late submissions (without instructor permission based on suitable grounds and documentation) will be penalized. The penalty will depend on how late: 10% for 1-12 hours; 25% for 12-48 hours; 50% for 48-96 hours and 100% after 96 hours.

## 7.3 Relationships with other Courses & Labs

### Previous Courses:

**CHEM*1040/1050**: Chemicals are generally pollutants. Chemical properties are key to pollutant impacts and pollutant treatment and prevention and resource recovery.

**CIS*1500**: Programming logic.

**ENGG*1500**: Manipulating variables and equations is an essential skill.

**MATH*2270**: Applied Differential Equations: Mathematics employed to solve mass transfer problems.

### Follow-on Required Courses:

**ENGG*3180**: Air Quality (required for EE's only). Chemical behaviour in the atmosphere relies on ENGG*2560, Fluid Mechanics and Thermodynamics.

**ENGG*3590**: Water Quality. Chemical behaviour in water relies on ENGG*2560.

**ENGG*3470**: Mass transfer operations (required for EE's only). An extension of the principles of ENGG*2560 to systems with mass transfer limitations between phases (i.e. non-equilibrium).

**ENGG*4340**: Solid & Hazardous Waste Management (required for EE's only).

**Follow-on Elective Courses:**

**ENGG*4070:** Life Cycle Assessment for Sustainable Design

**ENGG*4240:** Site Remediation

**ENGG*4760**: Biological Wastewater Treatment Design

**ENGG*4770**: Physical & Chemical Wastewater Treatment Design

**ENGG*4810**: Control of Atmospheric Particulates

**ENGG*4820**: Atmospheric Emission Control – Combustion Systems

# 8 School of Engineering Statements

## 8.1 Instructor's Role and Responsibility to Students

The instructor's role is to develop and deliver course material in ways that facilitate learning for a variety of students. Selected lecture notes will be made available to students on Courselink but these are not intended to be stand-alone course notes. Some written lecture notes will be presented only in class. During lectures, the instructor will expand and explain the content of notes and provide example problems that supplement posted notes. Scheduled classes will be the principal venue to provide information and feedback for tests and labs.

## 8.2 Students' Learning Responsibilities

Students are expected to take advantage of the learning opportunities provided during lectures and lab sessions. Students, especially those having difficulty with the course content, should also make use of other resources recommended by the instructor. Students who do (or may) fall behind due to illness, work, or extra-curricular activities are advised to keep the instructor informed. This will allow the instructor to recommend extra resources in a timely manner and/or provide consideration if appropriate.

## 8.3 Lab Safety

Safety is critically important to the School and is the responsibility of all members of the School: faculty, staff and students. As a student in a lab course you are responsible for taking all reasonable safety precautions and following the lab safety rules specific to the lab you are working in. In addition, you are responsible for reporting all safety issues to the laboratory supervisor, GTA or faculty responsible.

# 9 University Statements

## 9.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

## 9.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Graduate Calendar - Grounds for Academic Consideration
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions
https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml

## 9.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml

Graduate Calendar - Registration Changes
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml

Associate Diploma Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml

## 9.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

## 9.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to make a booking at least 14 days in advance, and no later than November 1 (fall), March 1 (winter) or July 1 (summer). Similarly, new or changed accommodations for online quizzes, tests and exams must be approved at least a week ahead of time.

For Guelph students, information can be found on the SAS website
https://www.uoguelph.ca/sas

For Ridgetown students, information can be found on the Ridgetown SAS website
https://www.ridgetownc.com/services/accessibilityservices.cfm

## 9.6 Academic Integrity

The University of Guelph is committed to upholding the highest standards of academic integrity, and it is the responsibility of all members of the University community-faculty, staff, and students-to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff, and students have the responsibility of supporting an environment that encourages academic integrity. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

Undergraduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

Graduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

## 9.7 Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

## 9.8 Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies, and regulations that apply to undergraduate, graduate, and diploma programs.

Academic Calendars
https://www.uoguelph.ca/academics/calendars

## 9.9 Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings, changes in classroom protocols, and academic schedules. Any such changes will be announced via CourseLink and/or class email.

This includes on-campus scheduling during the semester, mid-terms and final examination schedules. All University-wide decisions will be posted on the COVID-19 website (https://news.uoguelph.ca/2019-novel-coronavirus-information/) and circulated by email.

## 9.10 Illness

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g.. final exam or major assignment).

## 9.11 Covid-19 Safety Protocols

For information on current safety protocols, follow these links:

- https://news.uoguelph.ca/return-to-campuses/how-u-of-g-is-preparing-for-your-safe-return/
- https://news.uoguelph.ca/return-to-campuses/spaces/#ClassroomSpaces

Please note, these guidelines may be updated as required in response to evolving University, Public Health or government directives.

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