



ENGG*4340 Solid and Hazardous Waste Management

01

Fall 2021

Section(s): C01

School of Engineering

Credit Weight: 0.50

Version 1.00 - September 08, 2021

1 Course Details

1.1 Calendar Description

Solid waste generation rates and waste composition. Integrated waste management: collection, recovery, reuse, recycling, energy-from-waste, and landfilling. Biological treatment of the organic waste fraction - direct land application, composting, anaerobic digestion. Environmental impact of waste management and sustainable development. Cross media issues related to solid waste disposal. An introduction to hazardous waste management and treatment methods.

Pre-Requisites:

ENGG*2560 or ENGG*2660

Restrictions:

This is a Priority Access Course. Enrolment may be restricted to the ENVE specialization in the BENG and BENG:C programs. See department for more information.

1.2 Course Description

Solid waste generation rates and waste composition. Integrated waste management: collection, recovery, reuse, recycling, energy-from-waste, and landfilling. Biological treatment of the organic waste fraction - direct land application, composting, anaerobic digestion. Environmental impact of waste management and sustainable development. Cross media issues related to solid waste disposal. An introduction to hazardous waste management and treatment methods.

1.3 Timetable

Lectures: Mainly "Asynchronous Delivery"

Scheduled synchronous meetings will be announced to discuss issues related to course

material and term projects These meetings will be preannounced and will take place during the time slot: Tues and Thur 10:00 AM - 11:20 AM

Tutorials: "Synchronous Delivery"

Section 01 Fri 11:30AM - 01:20PM, AD-S, Room Virtual

Section 02 Wed 03:30PM - 05:20PM, AD-S, Room Virtual

1.4 Final Exam

Date: December 10, 2020

Time: 8:30 AM - 10:30 am

Location: Online

2 Instructional Support

2.1 Instructional Support Team

Instructor:	Miln Harvey Ph.D., P.Eng.
Email:	miln@uoguelph.ca
Telephone:	+1-226-821-0498
Office:	On-line
Office Hours:	Virtual meeting by appointment using Zoom.

Links will be provided.

2.2 Teaching Assistants

Teaching Assistant (GTA):	Alex Nauta
Email:	anauta@uoguelph.ca
Office Hours:	TBA on Courselink

3 Learning Resources

3.1 Required Resources

Course Website (Website)

Course material, news, announcements, and grades will be regularly posted to the ENGG*4340 Courselink site. You are responsible for checking the site regularly.

Handbook of Solid Waste Management (Textbook)

Required resources will be distributed via Courselink. Part of the course will be using the

“Handbook of Solid Waste Management”. George Tchobanoglous and Frank Kreith. McGraw-Hill, (ISBN: 0-07-150034-0). **A pdf copy of the book will be posted in the CourseLink for the students to download.**

3.2 Recommended Resources

Integrated Solid Waste Management, Engineering Principles and Management Issues (Textbook)

George Tchobanoglous, Hilary Theisen, Samuel Vigil. McGraw-Hill, (ISBN: 0-07-063237-5)

Hazardous Wastes: Sources, Pathways, Receptors. (Textbook)

Richard J Watts. John Wiley & Sons.

3.3 Additional Resources

Lecture Information (Notes)

Lecture notes will be posted on CourseLink. Students are expected to self-study all posted material.

Tutorial Information (Notes)

The handouts for all the tutorial sessions will be posted within the tutorial section. All types of resources regarding tutorials, links to web pages can be found in this section.

Project Information (Other)

Requirements will be posted on CourseLink

Miscellaneous Information (Other)

Other information will be posted on CourseLink.

3.4 Communication & Email Policy

Please use lectures and tutorial sessions as your main opportunity to ask questions about the course. Major announcements will be posted to the course website. **It is your responsibility to check the course website regularly.** As per university regulations, all students are required to check their <mail.uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its students.

4 Learning Outcomes

Completion of this course will provide students with an understanding of (i) waste generation and composition of solid waste; (ii) physical and chemical properties of solid waste; (iii) solid waste treatment and disposal alternatives; (iv) positive and negative impacts associated with treatment and disposal alternatives and (v) cross-media issues related to solid and hazardous waste treatment and disposal. Students will also become familiar with the technical literature dealing with solid and hazardous waste management.

4.1 Course Learning Outcomes

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

1. Understand the concept of integrated waste management and the regulatory framework

2. Able to characterize the waste components and use the characteristics to make suitable decision on waste management options
3. Able to identify and classify hazardous wastes and explain the techniques of hazardous waste management
4. Design the refuse collection system, transfer station basics, economics of using transfer station in waste collection and transfer systems
5. Evaluate different methods of processing of municipal solid waste for its beneficial reuse, recycling, materials separation, treatment, and disposal
6. Perform preliminary design calculations for combustion and energy recovery systems and biochemical processes.
7. Design landfill systems: siting issues, leachate collection system, gas collection system.

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, 5, 6, 7
1.3	Recall, describe and apply fundamental engineering principles and concepts	2, 3, 5, 6, 7
1.4	Recall, describe and apply program-specific engineering principles and concepts	1, 5, 7
2	Problem Analysis	2, 4, 5, 7
2.5	Critique and appraise solution approach and results	2, 4, 5, 7
4	Design	4, 5, 6, 7
4.4	Evaluate alternative design solutions based on problem definition	4, 5, 6, 7
5	Use of Engineering Tools	2, 5, 7
5.1	Select appropriate engineering tools from various alternatives	5
5.2	Demonstrate proficiency in the application of selected engineering tools	2, 7
7	Communication Skills	5
7.1	Identify key message(s) and intended audience in verbal or written communication as both sender and receiver	5
7.5	Demonstrate ability to process oral and written communication by following instructions, actively listening, incorporating feedback, and formulating meaningful questions	5

#	Outcome	Learning Outcome
9	Impact of Engineering on Society and the Environment	1, 3, 4, 7
9.1	Analyze the safety, social, environmental, and legal aspects of engineering activity	1, 3, 4, 7
11	Economics and Project Management	2, 4, 5, 6
11.3	Estimate economic impact and feasibility of an engineering project or design using techniques such as cost benefit analysis over the life of the project or design	2, 4, 5, 6

4.3 Relationships with other Courses & Labs

Previous Courses:

- **ENGG*2560:** Environmental Engineering Systems: The fundamental concepts of engineered systems including chemical, physical and biological processes taught in this course will be used a lot in the present course. Or,
- **ENGG*2660:** Biological Engineering Systems: The fundamental concepts of engineered systems including chemical, physical and biological processes taught in this course will be used a lot in the present course.

Follow-on Courses:

- **ENGG*41X:** Environmental Engineering Design
- **ENGG*4260:** Water and Wastewater Design
- **ENGG*4070:** Life Cycle Technique for Sustainable Design

5 Teaching and Learning Activities

5.1 Lecture

Topics: Introduction to solid waste management

References:	Chapter 1/Book A
Learning Outcome:	1
Topics:	Legislative framework
References:	Chapter 1, 2, 3/Book A
Learning Outcome:	1
Topics:	Waste Generation
References:	Chapter 4/Book A
Learning Outcome:	2
Topics:	Physical, chemical, and biological properties of MSW
References:	Chapter 3,4/Book A
Learning Outcome:	2
Topics:	Issues in Waste Generation and Collection
References:	Chapter 4/Book A
Learning Outcome:	2, 4
Topics:	Collection of Solid Waste
References:	Chapter 4/Book A
Learning Outcome:	4
Topics:	Separation and processing of solid waste
References:	Chapter 5/Book A
Learning Outcome:	5

Topics:	Landfills
References:	Chapter 5/Book A
Learning Outcome:	5, 6, 7
Topics:	Case Study of Landfill Design
Learning Outcome:	4
Topics:	Composting and Digestion
References:	Chapter 7/Book A
Learning Outcome:	7
Topics:	Thermal Treatment
References:	Chapter 10/Book A
Learning Outcome:	7
Topics:	Hazardous waste and Environmental Risk
References:	Handouts/Book B
Learning Outcome:	3

5.2 Other Important Dates

Thursday, September 9, 2021: First day of class

Friday, October 8, 2021: Fall Break begins at end of classes this day

Monday, October 11, 2021: Thanksgiving holiday

Tuesday, October 12, 2021: Fall Study Break Day - classes rescheduled to Thursday, December 2

Wednesday, December 1, 2021: Last day for regularly scheduled classes

Thursday, December 2, 2021: Classes rescheduled from Tuesday, October 12, Tuesday schedule in effect

6 Assessments

6.1 Marking Schemes & Distributions

Name	Scheme A (%)
Assignments	25
Group Project #1	15
Group Project #2	35
Final Exam	25
Total	100

6.2 Assessment Details

Assignment (25%)

Date: Throughout the semester, All assignments are to be submitted in the designated Dropbox in CourseLink

Learning Outcome: 1, 2, 3, 5, 6, 7

Ass. # 1. Due on September 24

Ass. # 2. Due on October 8

Ass. # 3. Due on October 29

Ass. # 4. Due on November 12

Ass. # 5. Due on November 26

All assignments are to be submitted in the designated Dropbox in CourseLink

Team Project #1 (15%)

Learning Outcome: 1, 2, 3, 4, 5, 6, 7

Analysis of Solid Waste Management Practices

Due: Friday October 15, 2021

Team Project #2 (35%)

Learning Outcome: 1, 2, 3, 4, 5, 6, 7
Problem-based Learning Design Project

Due: Thursday December 2, 2021

Final Exam (25%)

Date: Thu, Dec 10, 8:30 AM - 10:30 AM, online

Learning Outcome: 1, 2, 3, 4, 5, 6, 7

6.3 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. Please see below for specific details and consult 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: In order to pass the course, you must obtain a grade of 50% or higher on aggregate from all the assessments.

Missed tests: If you miss a test due to grounds for granting academic consideration or religious accommodation, the weight of the missed test will be added to the final exam. There will be no makeup midterm tests or quizzes.

Team Work: Team work is required for the project assignment. If there is some observation or evidence that you have not been an approximately equal contributor to the work then you will be asked to provide evidence of your individual efforts, contributions and results. Keeping a log book may be one effective means to help demonstrate your contributions.

7 School of Engineering Statements

7.1 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.

7.2 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.

7.3 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.

8 University Statements

8.1 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.

8.2 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>

8.3 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>

8.4 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.

8.5 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 book their exams at least 7 days in advance and not later than the 40th Class Day.

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>

8.6 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>

8.7 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.

8.8 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>

8.9 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.

8.10 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).

8.11 Covid-19 Safety Protocols

For information on current safety protocols, follow these links:

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

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