# ENGG*4340 Solid and Hazardous Waste Management - DRAFT

Fall 2017

Sections(s): C01

School of Engineering

Credit Weight: 0.50

Version 1.00 - August 30, 2017

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# 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-Requisite(s):** ENGG*2560 or ENGG*2660

## 1.2 Timetable

**Lectures:**
Tues and Thur 10:00 AM – 11:20 AM MCKN, Room 029

**Tutorials:**
Section 01 Fri 08:30 AM - 10:20 AM ROZH, Room 108
Section 02 Wed 03:30 PM - 05:20 PM MCKN, Room 310
Section 03 Mon 02:30 PM - 04:20 PM MCKN, Room 313

## 1.3 Final Exam

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# 2 Instructional Support

## 2.1 Instructor(s)

**Bassim Abbassi Ph.D.**
Email: babbassi@uoguelph.ca

| | |
|---|---|
| Telephone: | +1-519-824-4120 x52040 |
| Office: | THRN 2333 |
| Office Hours: | Tue. & Thur. (1:00 PM to 3:00 PM) & Wednesdays (1:30 PM to 2:30 PM) or by appointment |

## 2.2 Teaching Assistant(s)

| Name | Details |
|---|---|
| Kayla Schmidt | kschmi01@uoguelph.ca<br>TBA on Courselink |
| Juanita Arevalo Camargo | arevaloj@uoguelph.ca<br>TBA on Courselink |

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# 3 Learning Resources

## 3.1 Required Resources(s)

**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(s)

**Integrated Solid Waste Management, Engineering Principals 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(s)

**Lecture Information (Notes)**

Some lecture notes will be posted on Courselink, generally before the specific lecture. Note that posted notes might be incomplete, prepared with the intention that students will take additional notes during lectures.

**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.

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# 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 for different components and properties 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

| # | Outcome Set Name | Course Learning Outcome |
|---|---|---|
| 1 | Knowledge base | 1, 2, 3, 5 |

| # | Outcome Set Name | Course Learning Outcome |
|---|---|---|
| 1.1 | Recall, describe and apply fundamental mathematical principles and concepts | 1, 2, 3, 5 |
| 1.2 | Recall, describe and apply fundamental concepts and principles in natural sciences | 1, 2, 3, 5 |
| 1.3 | Comprehend and apply fundamental engineering concepts | 1, 2, 3, 5 |
| 1.4 | Comprehend and apply program-specific engineering concepts | 1, 2, 3, 5 |
| 3 | Investigation | 2, 3, 5 |
| 3.1 | Propose and test working hypotheses | 2, 3, 5 |
| 3.2 | Design and apply an investigation plan | 2, 3, 5 |
| 3.3 | Analyze and interpret experimental data | 2, 3, 5 |
| 3.4 | Assess validity of conclusions within limitations of data and methodologies | 2, 3, 5 |
| 4 | Design | 4, 6, 7 |
| 4.1 | Describe the design process | 4, 6, 7 |
| 4.2 | Construct design-specific problem statements | 4, 6, 7 |
| 4.3 | Create engineering design solutions | 4, 6, 7 |
| 4.4 | Develop engineering design solutions | 4, 6, 7 |
| 4.5 | Assess engineering design solutions | 4, 6, 7 |
| 4.6 | Implement engineering design solutions | 4, 6, 7 |
| 5 | Use of engineering tools | 3, 4, 5, 6 |
| 5.1 | Select appropriate engineering tools from various alternatives | 3, 4, 5, 6 |
| 5.2 | Apply selected engineering tools | 3, 4, 5, 6 |
| 5.3 | Recognize limitations of selected engineering tools | 3, 4, 5, 6 |
| 7 | Communication skills | 2, 5 |
| 7.1 | Develop and deliver clear, key concepts using methods appropriate for the intended audience | 2, 5 |
| 7.2 | Critically evaluate received information | 2, 5 |
| 7.3 | Demonstrate active listening and follow instructions | 2, 5 |
| 9 | Impact of engineering on society and environment | 1, 3 |
| 9.1 | Analyze the social, environmental and legal aspects of engineering activity | 1, 3 |

| # | Outcome Set Name | Course Learning Outcome |
|---|---|---|
| 9.2 | Summarize the common sources of uncertainty and risk in their engineering field | 1, 3 |
| 9.3 | Identify the impact of introducing innovative technologies to solve engineering problems | 1, 3 |
| 11 | Economics and project management | 1, 7 |
| 11.1 | Apply project management techniques and manage resources within identified constraints | 1, 7 |
| 11.2 | Estimate the life cycle engineering benefits and costs associated with engineering design | 1, 7 |
| 12 | Life-long learning | 1 |
| 12.1 | Identify personal career goals and opportunities for professional development | 1 |
| 12.2 | Analyze a self-assessment of skills relative to SOE defined learning outcomes | 1 |
| 12.3 | Identify and critique limits of their field | 1 |

## 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

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# 5 Teaching and Learning Activities

## 5.1 Lecture Schedule

| Week | Schedule |
|---|---|
| Lectures 1-2 | Introduction to solid waste management |
| Lectures 3 | Legislative trends and impacts |
| Lectures 4-5 | Sources, types and composition of MSW |
| Lectures 6-7 | Physical, chemical, and biological properties of MSW |
| Lectures 8-10 | Hazardous waste |
| Lecture 11 | Guest lecturer, David Gordon |
| Lectures 12-13 | Solid waste generation and collection rates |
| Lecture 14-15 | Waste handling and separation, storage, and processing at source |
| Lectures 16-17 | Collection of solid waste |
| Lectures 18-20 | Separation and processing of solid waste |
| Lecture 21 | Transfer and transport |
| Lectures 22-24 | Disposal of solid wastes |

## 5.2 Other Important Dates

Thursday, September 7, 2017: First day of class

Monday, October 9, 2017: Thanksgiving holiday

Tuesday, October 10, 2017: Fall Study Break Day, Class rescheduled to Thursday, November 30

Friday, November 3, 2017: 40$^{th}$ class day – last day to drop classes

Wednesday, November 29, 2017: Regular classes conclude

Thursday, November 30, 2017: last day of class

## 5.3 Site Visit

***Possible site visit to Guelph Solid Waste Innovation Centre. Date will be agreed upon with students***

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# 6 Assessments

## 6.1 Marking Schemes & Distribution

| Name | Scheme A (%) |
|---|---|
| Assignments | 20 |
| Project | 20 |
| Midterm Exam | 20 |
| Final Exam | 40 |
| Total | 100 |

## 6.2 Assessment Details

**Assignment**

**Date:**

Ass. # 1. Due on September 29

Ass. # 2. Due on October 20

Ass. # 3. Due on November 3

Ass. # 4. Due on November 24

***All assignments are to be submitted in hardcopies***

**Project**

**Date:**

***Submission 1:*** Friday September 29, email

Ono-on-one meeting with each group will be scheduled in the second half of October (date: TBA)

***Final Submission:*** Friday December 1

Presentations: During the tutorial hours (Nov. 10, 13, 17, & 20)

***Electronic copies of both manuscript (MS-word) and presentation (PPT) are to be submitted via CourseLink Dropbox***

**Midterm Exam**

**Date:** Tuesday, October 24, in class

Tuesday, Oct. 24, in class

**Final Exam**

**Date:** Thursday, December 7, Room TBA on Web advisor

02:30 PM - 04:30 PM

## 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.

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# 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 regulations and procedures for Academic Consideration are detailed in the Undergraduate Calendar.

## 8.3 Drop Date

Courses that are one semester long must be dropped by the end of the fortieth class day; two-semester courses must be dropped by the last day of the add period in the second semester. The regulations and procedures for Dropping Courses are available in the Undergraduate Calendar.

## 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.

More information: www.uoguelph.ca/sas

## 8.6 Academic Misconduct

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 discourages misconduct. 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.

The Academic Misconduct Policy is detailed in the Undergraduate Calendar.

## 8.7 Recording of Materials

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a classmate 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 which apply to undergraduate, graduate and diploma programs.