



CIEG436: Processing, Recycling, and Management of Solid Wastes

Credits: 3 Semester: Spring 2023
Section 010 M/W 8:40-9:55 am Sharp Lab 120

1. Instructor Information

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[LinkedIn](#) | [Instagram @ProfSaxe](#)

Student hours:

Scheduled in-person: Tuesday, 9-10am; Wednesday 11am-12pm

Scheduled virtual via Zoom (LINK): Mondays 12-1pm (*day/time may change based on student need; periodic, additional virtual days/times may be added*)

Drop-in: anytime I'm in my office

By appointment: I encourage you to send me an email to schedule an in-person or virtual appointment if the times above do not work for you. We will find a time that works!

Welcome to solid waste class! This may be the only solid waste course you take as an undergraduate, so there's a lot of ground to cover. We'll cover the topic of solid waste in breadth, as the name of the course implies, but we'll also dive deeper in a few areas. In addition to the technical aspects of solid waste management, we'll touch on regulatory and policy issues as well as the importance of public engagement in this topic. A successful class depends on the engagement of everyone in our class meetings, small group discussions, and online discussion forums. I look forward to leading you through this topic!

As we go through the course, I expect you to have questions! Please ask those questions in class, on Canvas discussion boards, or in my office hours. I am here to support your success. Please use opportunities like my student office hours to clarify course topics, seek guidance on homework or project assignments, or ask professional development questions.

2. Course Description and Learning Objectives

Examines the problem of solid waste management in a throw-away society: landfills, incineration, composting, recycle and reuse options are described from regulatory, economic, and engineering perspectives. Includes design and operational aspects of common waste management processes, including landfilling, recycling, and biological treatment, as well as application of life cycle analysis to waste management.

Course learning objectives:

By the end of this course, students will be able to:

1. Recognize the elements of solid waste management systems, including waste generation, storage, collection, and landfilling
2. Describe the purpose of landfill components and design protective elements of a landfill
3. Analyze solid waste management systems to determine appropriate use of incineration, composting and recycling.
4. Derive an approach to comparing solid waste management options using life cycle analysis and engineering economics

Statement on the FE Exam

All students are encouraged to take the Fundamentals of Engineering (FE) Exam before graduating. Find out more about the exam, including how to register, [here](#). Additional FAQs about the exam can be found [here](#).

Course Delivery

This course will be delivered primarily in person; however, I will present some material through recordings, readings, and discussions on Canvas. Our in-person classes will be used for a combination of lectures and small group learning activities. I specifically designed the class to use both Canvas and in-person class meetings to achieve learning objectives.

3. ABET Student Outcomes

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. An ability to communicate effectively with a range of audiences
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

4. Learning Resources

Learning Materials

The textbooks for this course are available online through the [UD Library](#) website. I will post any reading assignments beyond those listed below on Canvas.

- Christensen, T.H. (ed). 2011. [Solid Waste Technology & Management](http://delcat.worldcat.org/oclc/695549651). Wiley, UK. Available online at <http://delcat.worldcat.org/oclc/695549651>. (ISBN 9780470666883) **Students may download individual chapters in pdf format or read online.**
- Pichtel, J. 2005. [Waste Management Practices: Municipal Hazardous and Industrial](http://site.ebrary.com/lib/udel/detail.action?docID=10834370). Taylor and Francis, Boca Raton, FL. (ISBN 9781466585195) Available online at <http://site.ebrary.com/lib/udel/detail.action?docID=10834370>. **This is available online with unlimited access; however, there is a 102-page limit on downloads for each user.**

Technology

Canvas: In this class, I will use Canvas, UD's online learning management system, for course activities and communication. I will post all assignments through the Canvas course site unless otherwise directed. Information on how to use Canvas is available through the [Canvas Student Guide](#). You can also access Canvas via [MyUD](#).

Zoom: In this class, I will use Zoom for office hours and other video conferencing. The link for office hours is on the first page of the syllabus. Zoom is a web-based application that can be used from a computer, tablet, or phone. From a computer, click the class web link and be sure to install the small program that will download to your computer. You only need to install the program once. From a mobile device, download the free Zoom app and type in the class meeting ID number. A microphone and camera are recommended for online meetings. Information on how to test your computer's audio and video can be found on [Zoom's website](#). Learn more info about [Zoom at UD](#).

Poll Everywhere: We will use this online polling platform to collect real-time responses from everyone attending class. Access to Poll Everywhere is possible by using any computer or mobile device with internet access. Poll Everywhere is a UD licensed tool and there is no cost to you to use this tool. Please read over the [UD student guide](#) that will demonstrate how to log in and how to respond to polls. As a reminder, the [UD academic honesty policy](#) applies to the use of educational technology tools such as Poll Everywhere.

5. Learning Assessment

Course Component	Percent of Course Grade
Homework assignments (approx. 5 assignments)	35%
Exams (2 exams at 15% each)	30%
Group Project (submitted in 3 phases)	25%
Engagement	10%

Homework

You may work in groups of 2 to 4 on homework assignments. Each student must turn in one assignment; *if you worked with other students, please indicate who you worked with*. Due dates are posted on Canvas. I will deduct points for assignments submitted after the due date (**see LATE POLICY, below**), unless you submit (and I approve) a special request ***in advance***.

Exams

I will give exams in person. Exam 1 will cover modules 1-3 and will occur during regularly-schedule class time; exam 2 will cover modules 4-6 and will be held during finals week.

Semester project

I will provide details on the semester project in a separate document. The project is worth 100 points, total, and accounts for 25% of your course grade. Five (5) points in each phase are based on peer feedback. Your project must be completed by our final class meeting. The project is divided into 3 phases with these corresponding due dates and weights:

Phase 1 (due 3/22): 25 points | Phase 2 (due 5/1): 25 points | Phase 3 (due 5/16): 50 points

Engagement

Engagement consists of Canvas activities, including surveys, discussions, and lost & found assignments. *Points associated with engagement activities will be indicated on Canvas. Each activity will be worth 1 to 2 points. Your engagement score will correspond to the percent of available engagement points you earn.*

Grading Scale

I will assign the following letter grades, based on the calculation coming from the course assessment section:

Grade	Interval	Grade	Interval	Grade	Interval
A	94.50 and over	B-	79.50 to 82.49	D+	66.50 to 69.49
A-	89.50 to 94.49	C+	76.50 to 79.49	D	62.50 to 66.49
B+	86.50 to 89.49	C	72.50 to 76.49	D-	59.50 to 62.49
B	82.50 to 86.49	C-	69.50 to 72.49	F	Below 59.49

Questions about grading

If you have a question about grading of a homework assignment, exam, or other activity, **contact me within one week of receiving the graded assignment**. After one week, I will not entertain grade changes.

Late Policy

I will provide you with adequate time to complete assignments. However, please communicate with me early if you think you may have difficulty meeting a deadline so that we may discuss. Late assignments will lose 20% per day. 5 days from the due date, a late assignment will be considered missing and will not be accepted or graded (i.e., 20% x 5 days = 100% deducted). I will not accept homework assignments after solutions are posted on Canvas.

6. Course Topics and Schedule

We will cover topics in this order, on approximately this schedule; we may run a bit ahead of or behind this schedule. **Associated reading and video assignments are posted on Canvas and should be completed before class.**

Week	Class dates	Lecture topic(s)
1	Feb 6 Feb 8	Course introduction 1.1 What is waste? 1.2 Overview of solid waste management systems; zero waste planning
2	Feb 13 Feb 15	1.3 Waste generation 1.4 Waste characterization
3	Feb 20 Feb 22	1.5 Waste storage and collection 1.6 Routing 1.7 Transfer stations
4	Feb 27 Mar 1	2.1, 2.2, 2.3: Engineering Economics
5	Mar 6 Mar 8	3.1 Material recovery facilities 3.2 Recycling
6	Mar 13 Mar 15	3.3 Composting 3.4 Anaerobic digestion
7	Mar 20 Mar 22	3.5 Incineration/waste-to-energy
SPRING BREAK (Mar 27-31)		
8	Apr 3 Apr 5	4.1 Overview of life cycle assessment 4.2 Life cycle assessment in waste management 4.3 Evaluation of solid waste LCAs
9	Apr 10 Apr 12 APR 14	5.1 Intro to landfills 5.2 Landfill design basics EXAM 1 (MODULES 1-3) FRIDAY MORNING – HOLD FOR FIELD TRIP!
10	Apr 17 Apr 19	5.3 Landfill liners 5.4 Landfill water balance and contaminant movement
11	Apr 24 Apr 26	5.4 Landfill water balance and contaminant movement
12	May 1 May 3	5.5 Landfill gas 5.6 Other landfill types 5.7 Landfill closure
13	May 8 May 10	6.1 Solid waste planning 6.2 Public engagement in solid waste planning
14	May 15	In-class semester project activity
TBD	Finals week	EXAM 2 (MODULES 4-6)

My lectures and course materials (syllabi, PowerPoint presentations, exams, homework assignments, video recordings, and similar materials) are protected by U.S. copyright law. You may take notes and make copies of course materials for your own personal use or for another student who is registered and enrolled in this course. You may not reproduce, distribute, or display via posting or uploading lecture notes/recordings/other course materials in any other way without my express written consent, nor may you allow others to do so. Doing so may be in violation of the University of Delaware student code of conduct. (Language adapted from UC Santa Cruz.)

7. Course Policy Document

Instructor Policies

I have a goal of maintaining an inclusive and engaging classroom environment. I encourage dialogue and questions, as well as respect for students and the instructor, in both in-person and online discussions. **Cell phone use is permitted for answering poll questions. For non-polling portions of class meetings, please do not use cell phones or earbuds out of respect for your instructor and classmates.** The use of laptops for notetaking or class activities is permitted.

I will make every effort to avoid changing the course schedule but the possibility exists that unforeseen events will make changes necessary. I will reserve the right to make changes to the syllabus as necessary. I will notify you in a timely manner of any syllabus changes via announcements on the course Canvas site. Please make sure your settings on Canvas are set to send you emails of posted announcements.

To foster peer connections, we will have several class sessions/activities together with CIEG133. Please use these opportunities to share experiences with first-year students just beginning their engineering education.

Communication

When in doubt, communicate. I will typically send messages to the class as Announcements through Canvas; please check your Canvas settings to ensure you receive these messages. In addition, I welcome communication via email and phone, or in person during office hours or during a scheduled appointment. I will respond to all emails in a timely manner, however, please do not expect that email will be returned immediately.

Use of Advanced Automated Tools

Students are expected to complete assignments **without** the use of advanced automated tools (artificial intelligence or machine learning tools such as ChatGPT or Dall-E 2).

Attendance

I have specially designed in-class activities to help you achieve learning objectives. Attendance is critical to achieve the course learning objectives. However, absence and tardiness are not acceptable reasons for late or missing assignments. **Communication is critical in regard to attendance.** Let me know in advance if you anticipate missing a class. **If you feel ill, please stay home.**

Absences on religious holidays listed in university calendars are recognized as an excused absence. Nevertheless, I urge you to remind me of your intention to be absent on a particular upcoming holiday. Absences on religious holidays not listed in university calendars, as well as absences due to athletic participation or other extracurricular activities in which students are official representatives of the university, shall be recognized as excused absences when you inform me (in writing) during the first two weeks of the semester of these planned absences.

Student Mental Health & Wellbeing

In addition to impacting your overall well-being, diminished mental health can interfere with optimal academic performance. If this course is causing or contributing significant mental or emotional stress, then please reach out to me directly. However, problems with other parts of your life can also contribute to decreased academic performance. UD's Center for Counseling & Student Development (CCSD) provides cost-free and confidential mental health services to help you manage personal challenges that threaten your emotional or academic well-being. Remember, getting help is a smart and courageous thing to do -- for yourself and for those who care about you.

- **Contact me:** If you are struggling with this class, please check in during student hours or contact me by email
- **Check in with your academic advisor:** If you are struggling in multiple classes, unsure whether you are making the most of your time at UD, or unsure what academic resources are available at UD.
- **UD's Center for Counseling & Student Development and UD Helpline:** CCSD is open and available remotely, and 24/7 mental health support remains available on the UD Helpline at 302-831-1001 for any student in need of someone to talk to. Visit [CCSD's website](#) for additional information and resources.
- **UD's Crisis Text Line:** Text "UDTEXT" or "STEVE" at 741741 for students of color to connect with confidential text message support.
- **Division of Student Life:** Explore the Student Life's [Wellbeing webpage](#) for a comprehensive listing of well-being resources, activities and services available to all students.

UD Academic Policies

The Safety of Our Learning Environment

Student learning can only occur when students and their instructors feel safe, respected, and supported by each other. To ensure that our learning environment is as safe as possible, you are expected to abide by the most up-to-date [University of Delaware's COVID-19 Guidelines](#),

Academic Integrity

Please familiarize yourself with UD policies regarding academic dishonesty. To falsify the results of one's research, to steal the words or ideas of another, to cheat on an assignment, to re-submit the same assignment for different classes, or to allow or assist another to commit these acts corrupts the educational process. Students are expected to do their own work and neither give nor receive unauthorized assistance. View the [university's academic integrity policies and procedures](#). Office of Student Conduct, 218 Hulliher Hall, (302) 831-2117. E-mail: student-conduct@udel.edu
Harassment, Discrimination, and Sexual Misconduct

The University of Delaware works to promote an academic and work environment that is free from all forms of discrimination, including harassment and sexual misconduct. As a member of the community, your rights, resource and responsibilities are reflected in the Non-Discrimination, Sexual Misconduct, and Title IX policy. Please familiarize yourself with this policy at the [University's Office of Equity & Inclusion's website](#). You can report any concerns to the University's Office of Equity & Inclusion, at 305 Hulliher Hall, (302) 831-8063 or you can report anonymously through UD Police (302) 831-2222 or the [EthicsPoint Compliance Hotline](#).

- Read the [full policy](#)
- [File a report](#)

Faculty Statement on Disclosures of Instances of Sexual Misconduct

If, at any time during this course, I happen to be made aware that a student may have been the victim of sexual misconduct (including sexual harassment, sexual violence, domestic/dating violence, or stalking), I am obligated by federal law to inform the university's Title IX Coordinator. The university needs to know information about such incidents to, not only offer resources, but to ensure a safe campus environment. The Title IX Coordinator will decide if the incident should be examined further. If such a situation is disclosed to me in class, in a paper assignment, or in office hours, I promise to protect your privacy--I will not disclose the incident to anyone but the Title IX Coordinator. For more information on Sexual Misconduct policies, where to get help, and reporting information, please refer to www.udel.edu/sexualmisconduct. At UD, we provide 24/7/365 crisis assistance and victim advocacy and counseling. Contact 302-831-1001 to get in touch with a sexual offense support advocate, as well as confidential and anonymous counseling services for other concerns.

Accommodations for Students with Disabilities

Any student who may need an accommodation based on a disability should contact the Office of Disability Support Services (DSS) office as soon as possible. For more information, please visit [Getting Registered at DSS](#). Contact DSS by phone: 302-831-4643; fax: 302-831-3261; website: www.udel.edu/dss; email: dssoffice@udel.edu; or visit 240 Academy Street, Alison Hall Suite 130 during business hours (8-5 M-F).

Non-Discrimination

The University of Delaware does not discriminate against any person on the basis of race, color, national origin, sex, gender identity or expression, sexual orientation, genetic information, marital status, disability, religion, age, veteran status or any other characteristic protected by applicable law in its employment, educational programs and activities, admissions policies, and scholarship and loan programs as required by Title IX of the Educational Amendments of 1972, the Americans with Disabilities Act of 1990, Section 504 of the Rehabilitation Act of 1973, Title VII of the Civil Rights Act of 1964, and other applicable statutes and University policies. The University of Delaware also prohibits unlawful harassment including sexual harassment and sexual violence.

For inquiries or complaints related to non-discrimination policies, please contact: Office of Equity & Inclusion-oei@udel.edu, 305 Hulliher Hall Newark, DE 19716 (302) 831-8063

For complaints related to Section 504 of the Rehabilitation Act of 1973 and/or the Americans with Disabilities Act, please contact: Office of Disability Support Services, dssoffice@udel.edu, Alison Hall, Suite 130, Newark, DE 19716 (302) 831-4643 OR contact the [U.S. Department of Education - Office for Civil Rights](#)