

Carleton University

Department of Civil and Environmental Engineering (CEE)

ENVE 5206: ENERGY AND RESOURCE RECOVERY FROM WASTE

WINTER 2024

Teaching Team

Instructor: Dr. Abid Hussain (Assistant Professor, CEE)

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Office Hours: TBD

Course Description and requirements

1) Course schedule:

Lectures: Monday, 18:05 – 20:55

2) Course description and learning outcomes:

Introduction to the principles, design and application of biochemical and thermal processes for recovery of energy and value-added materials from different solid wastes and wastewater. Biochemical processes; biotransformation pathways, reactor analysis and chemical kinetics. Thermal treatment

3) Textbook(s)/References

No prescribed textbook. Lecture notes and additional materials will be provided through the course website.

4) Topics and tentative plan

Teaching Modules:

| | |
|----------|---|
| Module 1 | Course introduction |
| Module 2 | Waste generation, characteristics, circular economy, overview of processes for energy and resource recovery |
| Module 3 | Biochemical processes: <ul style="list-style-type: none">▪ anaerobic digestion▪ fermentation▪ microbial electrochemical systems |
| Module 4 | Thermal processes: <ul style="list-style-type: none">▪ incineration▪ gasification▪ pyrolysis |
| Module 5 | Integrated biochemical – thermal systems |
| Module 6 | Term project |

5) Evaluation and marking scheme:

Evaluation:

| | |
|------------------------|-----|
| In-Class Participation | 20% |
| Term Project | 25% |
| *Final Exam | 55% |

*Student needs to get at least 45% in the final exam to pass the course.

* Final exams are for evaluation purposes and will not be returned to students. The exam will be open book, implying that students will be allowed access to the lecture slides/notes.

* Deferred Final Examinations: Students who are unable to write the final examination because of a serious illness/emergency or other circumstance beyond their control may apply for accommodation by contacting the instructor.

* Proctored final exam will be conducted on campus.

In-Class Participation:

Each student will give two 15-minute presentation on a current topic in the media related to energy and resource recovery. This presentation should include an explanation of why this news story was chosen by the student and the connection to the course modules. The student is also required to prepare a question to be directed to the class to promote a brief (2-3 minute) discussion at the end of the presentation. A schedule of presentation times (starting the week of January 29th, 2024) will be posted on Brightspace. Student should get their presentation topic approved by the instructor at least 3 days prior to her/his presentation date.

Term Project:

To conduct a critical review of a topic in energy and resource recovery from waste. In preparing a critical review, the student must bring his/her own knowledge to critically analyze literature from a scientific and engineering perspective. The student must synthesize a coherent and integral view of the subject; a critical review does not merely summarize the published results of prior studies. Specifically, the term project should include:

- An overview of the topic
- A critical review that includes recent knowledge (engineering principles, technology, biotechnology, etc.) and policy or regulation, if appropriate
- Current scientific references (minimum of 10, published in the past 10 years)

Alternatively, the students can propose and analyze options for energy and resource recovery, for a specific industry, community, or region (for instance, conducting a case study).

Term Project Deliverables

The project will be completed in groups of no more than three (3) students and will include the following:

1. Group Members and Topic
 - Format: list of group members' names and the desired topic.
 - Submission to the instructor by email or in class by **January 29th, 2024**.
2. Initial Literature Search
 - Format: maximum 2-page document
 - i. List of preliminary key words
 - ii. Brief summary of the preliminary references (i.e. 2 to 3 sentences from Books, Review Journals, etc.).

- Submission to the instructor by **February 5th, 2024**.
3. Project Overview and Description
- Format: maximum 3-page document
 - i. Description of critical component of the project
 - ii. Preliminary literature review (list of references and brief description of their content)
 - Submission to the instructor by **February 26th, 2024**.
4. Written Report
- Format; document body to be a maximum of 25 pages (including references), double-spaced with page numbers
 - i. Cover page (names and project title)
 - ii. Table of Contents
 - iii. Introduction, analysis, results and Conclusion
 - iv. References, must be referenced in the text
 - v. Properly labelled figures and tables, must be referenced in the text
 - vi. May include appendices, must be referenced in the text
 - Submission: paper and electronic copies due by **April 1st, 2024**.
 - Evaluation:
 - 30% - format (presentation, organization)
 - 70% - content (information presented, critical analysis)
- Note: The written report has to be submitted for the oral presentation to proceed.
5. Presentation
- 12 minutes presentation with 3 minutes for questions
 - Presentation will occur during the lecture **April 8th, 2024**
 - Evaluation:
 - 50% - content (introduction, presentation & analysis of information, conclusion)
 - 25% - delivery (visual aids, contact with audience, level of preparation)
 - 25% - questions (Q&A, professionalism)

Additional Notes:

- You are expected to attend the presentations of your classmates and ask questions. This will be counted towards your project presentation.
- Plagiarism detection software will be used to screen project submissions in this course. This is being done to verify that use of all materials and sources are properly documented.

6) Academic dates:

Students should be aware of the academic dates (e.g., last day for academic withdrawal) posted on the Registrar's office web site <https://carleton.ca/registrar/registration/dates/academic-dates/>

Academic Integrity and Plagiarism

- a) Please consult the Faculty of Engineering and Design information page about the Academic Integrity policy and our procedures: <https://carleton.ca/engineering-design/current-students/fed-academic-integrity> Violations of the Academic Integrity Policy will result in the assignment of a penalty such as reduced grades, the assignment of an F in a course, a suspension or, expulsion.
- b) One of the main objectives of the Academic Integrity Policy is to ensure that **the work you submit is your own**. As a result, it is important to write your own solutions when studying and

preparing with other students and to avoid plagiarism in your submissions. The University Academic Integrity Policy defines plagiarism as “presenting, whether intentionally or not, the ideas, expression of ideas or work of others as one’s own.” This includes reproducing or paraphrasing portions of someone else’s published or unpublished material, regardless of the source, and presenting these as one’s own without proper citation or reference to the original source.

Examples of violations of the policy include, but are not limited to:

- any submission prepared in whole or in part, by someone else;
- using another’s data or research findings without appropriate acknowledgement;
- submitting a computer program developed in whole or in part by someone else, with or without modifications, as one’s own; and
- failing to acknowledge sources of information through the use of proper citations when using another’s work and/or failing to use quotations marks.

Copyright

The materials (including the course outline and any slides, posted notes, videos, labs, project, assignments, quizzes, exams and solutions) created for this course and posted on this web site are intended for personal use and may not be reproduced or redistributed or posted on any web site without prior written permission from the author(s).

Learning and Working Environment

The University and all members of the University community share responsibility for ensuring that the University’s educational, work and living environments are free from discrimination and harassment. Should you have concerns about harassment or discrimination relating to your age, ancestry, citizenship, colour, creed (religion), disability, ethnic origin, family status, gender expression, gender identity, marital status, place of origin, race, sex (including pregnancy), or sexual orientation, please contact the [Department of Equity and Inclusive Communities](#) at equity@carleton.ca. We will strive to create an environment of mutual respect for all through equity, diversity, and inclusion within this course. The space which we work in will be safe for everyone. Please be considerate of everyone’s personal beliefs, choices, and opinions.

Academic Accommodations

You may need special arrangements to meet your academic obligations during the term. For an accommodation request the processes are as follows:

Academic Accommodations for Students with Disabilities: The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at **613-520-6608** or pmc@carleton.ca.

You should request your academic accommodations in the [Ventus Student Portal](#), for each course at the beginning of every term. For in-term tests or midterms, please request accommodations at least two (2) weeks before the first test or midterm. Please consult the [PMC website](#) for the deadline to request accommodations for the formally-scheduled exam (if applicable).

Accommodation for Student Activities: Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, see the [Senate Policy on Accommodation for Student Activities \(PDF\)](#).

Pregnancy Obligation: Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, please review the [Student Guide to Academic Accommodation \(PDF\)](#).

Religious Obligation: Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, please review the [Student Guide to Academic Accommodation \(PDF\)](#).

Survivors of Sexual Violence: As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and where survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit the [Sexual Violence Prevention & Survivor Support](#).

Student Mental Health and Wellness

As a university student you may experience a range of mental health challenges that can significantly impact your academic success and overall well-being. Carleton's [Wellness Services Navigator](#) is designed to help students connect with mental health and wellness resources.

If you need to talk to someone from the department for more information and support with connecting to resources, you can contact the following faculty members, depending on your program. Or contact the department at orCEEUGChair@cunet.carleton.ca.

ACSE: Prof. [Scott Bucking](#)

Email: scott.bucking@carleton.ca, Office: 5209 Canal Building

CIVE: Prof. [Heng Khoo](#)

Email: heng.khoo@carleton.ca, Office: 3364 Mackenzie

ENVE: Prof. [Shoeleh Shams](#)

Email: shoeleh.shams@Carleton.ca, Office: 4242 Mackenzie

Here is a list of on-campus and off-campus recourses:

1. **Carleton's Health and Counselling Services:** To book an appointment contact the main clinic by calling (613) 520-6674. If urgent, let the Patient Care Coordinator know or go in person to the main clinic (2500 Carleton Technology and Training Centre Building) and indicate that they are in crisis and need to speak to someone right away. For more information, please see <https://carleton.ca/health/>
2. [Emergencies and Crisis](#) and [Emergency Numbers](#)

3. **Good2Talk (1-866-925-5454):** Good2Talk is a free, confidential helpline providing professional counselling and information and referrals for mental health, addictions and well-being to post-secondary students in Ontario, 24/7/36 <https://good2talk.ca/>
4. **Empower Me:** Undergraduate students have access to free counselling services in the community through Empower Me, either in person, by telephone, video-counselling or e-counselling. **This free service is accessible 24/7, 365 days per year.** Call **1-844-741-6389 (toll free)** to make an appointment with a counsellor in the community. More information is available <https://students.carleton.ca/services/empower-me-counselling-services/>
5. **The Walk-In Counselling Clinic (off-campus community resource):** The walk-in Counselling Clinic have offices in various locations across Ottawa and the greater Champlain region that are open 7 days a week. Individuals will be assisted, with no appointment, on a first-come, first-serve basis during the Walk-in Counselling Clinic hours. The Walk-in Counselling Clinic **offers services in many languages** and is free and confidential. More information can be found at: <https://walkincounselling.com/>
6. **Distress Centre of Ottawa and Region:** Available 10am-11pm, 7 days/week, 365 days/year. **Distress Line:** 613-238-3311, **Crisis Line:** 613-722-6914 or 1-866-996-0991, **Text:** 343-306-5550. <https://www.dcottawa.on.ca/>
7. **Distress and Crisis Ontario,** Available for chat 2 pm – 2 am EST. <https://www.dcontario.org/>
8. **BounceBack Ontario (Toll-Free: 1-866-345-0224)** is a free skill-building program managed by the Canadian Mental Health Association (CMHA). It is designed to help adults and youth 15+ manage low mood, mild to moderate depression and anxiety, stress or worry. Delivered over the phone with a coach and through online videos, you will get access to tools that will support you on your path to mental wellness. <https://bouncebackontario.ca/>.