Fall 2023
Wastewater Treatment Principles and Design
Department of Civil and Environmental Engineering
Carleton University
ENVE 4005

Teaching Team

Instructor:

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Jordansmyth@cunet.carleton.ca or jordan.smyth@jacobs.com

Office Hours: Please contact me directly via e-mail if you have any questions and we will set up a meeting

TA(s): Information will be posted on Brightspace

Course Description and requirements

1) Course schedule

Lectures: Tuesday, 6:05pm – 8:55pm
Labs: Monday, 11:35am – 2:25pm
Tutorials: Tuesday, 11:35am – 12:25pm

2) Course description

Theoretical aspects of unit operations and processes for wastewater treatment with design applications. Topics include wastewater characteristics, flow rates, primary treatment, chemical unit processes, biological treatment processes, advanced wastewater treatment, disinfection, biosolids treatment and disposal. Laboratory procedures: wastewater characterization, sludge dewatering, anaerobic growth, chemical precipitation, disinfection.

Course Outline

<table>
<thead>
<tr>
<th>Week</th>
<th>Subject</th>
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<tbody>
<tr>
<td>Week 1</td>
<td>Introduction to wastewater treatment</td>
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<tr>
<td>Week 2</td>
<td>Wastewater characteristics and flow rates, Lab (Even)</td>
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<tr>
<td>Week 3</td>
<td>Preliminary treatment, Lab (Odd)</td>
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</tbody>
</table>
Week 4 Primary treatment, Lab (Even)
Week 5 Chemical unit processes
Week 6 Aerobic biological treatment processes, Lab (Odd)
Week 7 Anaerobic biological treatment processes, Midterm, Lab (Odd)
Week 8 Advanced wastewater treatment, Lab (Even)
Week 9 Disinfection processes, Lab (Odd)
Week 10 Biosolids treatment and disposal, Lab (Even)
Week 11 Decentralized and on-site wastewater treatment, Lab (Odd)
Week 12 Presentation of the design projects, Lab (Even)

3) Precluded Courses
ENVE 3001 – Water Treatment Principles and Design
ENVE 3002 – Systems Modelling

4) Learning Outcomes
Learning outcomes for this course are as follows:

1. Learn fundamentals and science of wastewater treatment
2. Learn and design physical treatment processes
3. Learn and design chemical treatment processes
4. Learn and design biological treatment processes
5. Learn and design advanced treatment processes
6. Learn and design biosolids treatment processes
7. Learn and design on-site treatment processes
8. Assess water reuse options
9. Understand and integrate technical, environmental, financial, political, and ethical criteria in decision making
10. Learn and compare wastewater regulations in Canada and other countries
11. Collaborate with team members on a design project
12. Write engineering reports to a client

5) Graduate Attributes
The Canadian Engineering Accreditation Board (CEAB) requires graduates of undergraduate engineering programs to possess 12 attributes. Courses in all four years of our programs evaluate students' progress towards acquiring these attributes. Aggregate data (typically, the data collected in all sections of a
course during an academic year) is used for accreditation purposes and to guide improvements to our
programs. Some of the assessments used to measure GAs may also contribute to final grades; however,
the GA measurements for individual students are not used to determine the student's year-to-year
progression through the program or eligibility to graduate. This following list provides the GAs that will
be measured in this course, along with the Learning Outcomes that are intended to develop abilities
related to these attributes.

<table>
<thead>
<tr>
<th>GA - Indicator</th>
<th>Assessment Tool</th>
</tr>
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<tbody>
<tr>
<td>1.8C – Discipline-specific concept CEE-8 Water/Wastewater Engineering</td>
<td>Midterm/final exam</td>
</tr>
<tr>
<td>3.1 – Complex problem assessment</td>
<td>Midterm/final exam</td>
</tr>
<tr>
<td>3.3 – Experimental procedure</td>
<td>Labs</td>
</tr>
<tr>
<td>3.4 – Data reduction methods and results</td>
<td>Labs</td>
</tr>
<tr>
<td>3.5 – Interpretation of data (synthesis) and discussion</td>
<td>Labs</td>
</tr>
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</table>

For information on GAs and continual curriculum improvement, visit the Accreditation section of
Engineers Canada website.

6) Accreditation Units

<table>
<thead>
<tr>
<th>Math</th>
<th>Natural Science</th>
<th>Complementary Studies</th>
<th>Engineering Science</th>
<th>Engineering Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>-</td>
<td>-</td>
<td>25%</td>
<td>75%</td>
</tr>
</tbody>
</table>

7) Textbook(s)/References

These books are available in the library, and you are not expected to purchase them:

1. Wastewater Engineering: Treatment and Reuse.
   Metcalf & Eddy, Inc. Revised by George Tchobanoglous, Franklin L. Burton, and H. David Stensel.
   Publisher: McGraw-Hill.

2. Wastewater Treatment Plant Design.
   Edited by P. Aarne Vesilind. Publisher: Water Environment Federation and IWA Publishing.


8) Topics and tentative plan

Labs

Labs will start the week of September 18th. There will be five (5) total labs:

1. Wastewater characterization
2. Phosphorus precipitation
3. Sludge dewatering
4. Disinfection
5. Anaerobic digestion

Lab reports will have the following sections: Introduction, Materials and Methods, Results, Discussion, and Conclusions. Experimental data will be shared within a group and each group will submit one report. Sharing data, graphs, reports with other groups is not allowed.

Lab reports will be due two weeks after the completion of the lab.

Tutorials

Tutorials will start on September 19th.

Design Project

Consulting firms (teams of three to four students) will work on the design project together throughout the term. Each group will submit one report (maximum 5 pages of text, single space, font size 12 – excluding supporting graphs and figures). Sample calculations should be included in the Appendix. You will evaluate your team members based on effort and contribution at the end of the term.

Midterm

Midterm will take place in mid-late October.

Exam

Final examination will be set by Examination Services.

9) Evaluation and marking scheme

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midterm</td>
<td>20%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>50%</td>
</tr>
<tr>
<td>Laboratory Reports</td>
<td>15%</td>
</tr>
<tr>
<td>Design Project</td>
<td>15%</td>
</tr>
</tbody>
</table>

a) Final Examination

i) Final exams are for evaluation purpose and will not be returned to students.

ii) Exam Conditions
Exam will be closed-book. In order to pass the course, students must achieve a grade of 50% on the final exam.

iii) Final Exam Weight
Final Exam will have 50% weight on cumulative grade earned.

ii) 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 Registrar’s office. Consult the Section 4.3 of the University Calendar.
b) Exam format and e-proctoring statement
   The final exam will be proctored and on campus.

c) Additional requirements
   N/A

d) Term work late submission policy
   For each late laboratory report, 5% of the grade will be deducted for every day late. Weekends are included.

e) Deferred term work
   Students who claim illness, injury or other extraordinary circumstances beyond their control as a reason for missed term work are held responsible for immediately informing the instructor concerned and for making alternate arrangements with the instructor and in all cases. This must occur no later than three (3) days after the term work was due. The alternate arrangement must be made before the last day of classes in the term as published in the academic schedule. Consult Section 4.4 of the University Calendar.

10) Academic dates
   Students should be aware of the academic dates (eg. 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.
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.

Engineering Academic Advising

The Engineering Academic Support Service assists undergraduate engineering students with course selection, registration, and learning support from first-year through to graduation. Academic Advisors Contact can be found here: https://carleton.ca/engineering-design/current-students/undergrad-academic-support/undergraduate-advisors/.

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 or CEEUGChair@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, 24/7/365 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/


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/](https://bouncebackontario.ca/).