

Carleton University
The Department of Civil and Environmental Engineering
ENVE 3001 Water Treatment Principles and Design

Course Objectives: To present theoretical and practical aspects of unit operations for water treatment with design applications. Topics include water characteristics and contaminants, coagulation, flocculation, sedimentation, filtration, adsorption, ion exchange, disinfection and disinfection by-products, and speciality topics. Laboratory procedures: water characteristics, and specific unit processes covered in the lectures.

Course Professor: Dr. Onita Basu (ME 2366)

Email contact: onita.basu@carleton.ca

Note: do not use *cmail* it will not reach me

Note: please email to arrange to meet with me, as I am rarely in my office but I am happy to arrange to meet online (zoom) or in person by appointment. For zoom meetings please ensure to have your camera on for our chat.

Course Lectures: Monday & Wednesday, 1:00 pm to 2:25 pm - Mackenzie (ME) 4332

Course Labs: Fridays 2:35 pm to 5:25 pm - Minto Case 1040

Labs are in-person

Course PA(Tutorial): Fridays 1:00 to 2:25 pm - Nideyinàn (NN), formerly Uni Center 282

Teaching Assistants

1. TBD
2. TBD

Text:

Course Notes – BrightSpace

Topics to be covered in this course:

- **Intro to Water Treatment**
- **Water Quality Characteristics**
- **Coagulation and Flocculation**
- **Sedimentation**
- **Filtration**
- **Adsorption**
- **Ion Exchange/Softening**
- **Water Disinfection**
- **Water Residuals (time permitting)**
- **Special Topics (time permitting)**

Reference Books: (Suggested but not limited to)

The library database has several Water Treatment Textbooks – key words “Water Treatment”, “Water Treatment Plant Design” into the search will assist with finding textbooks

The library has access to the following online textbook:

Water Treatment – Pizzi, Nicholas G; American Water Works Association

If you are looking for journal articles on specific topics – the following journals are recommended (the list is not exhaustive but is a good starting point if you are new to the field):

- Journal of Chemical Technology and Biotechnology
- Chemosphere
- Journal of Water Process Engineering
- Journal of Separation and Purification
- Science of the Total Environment
- IWA H2Open

Learning Objectives:

- (1) Be able to describe the basic steps for a Water Treatment Plant
- (2) Utilize mass balance calculations in reactive and non-reactive systems
- (3) Become familiar with various terms and definitions associated with Water Quality and Water Treatment
- (4) Improve understanding of coagulation chemistry, complete coagulation and flocculation design calculations related to G-value, chemical consumption, basin sizing, energy requirements, impeller sizing
- (5) Understand and complete calculations related to Type 1 and Type 2 removal processes in sedimentation theory.
- (6) Complete preliminary design calculations for plain sedimentation basins and high-rate clarification units
- (7) Graph and determine Freundlich and Langmuir Isotherms for Adsorption Processes
- (8) Complete headloss and backwash calculations for rapid filter design, understand operating parameters a filter column.
- (9) Understand and calculate selectivity coefficients and equivalents for single and multicomponent ion exchange removal
- (10) Complete disinfection calculations as per CT-theory, learn disinfection chemical reactions, rates, and apply basic design values.

Grading:

Lab Reports =	20%
Assignments =	20%
Midterm =	15%
Final Exam =	45%

Additional Notes:

Information (lecture material, lab notes, etc) for the course will be posted on BrightSpace.

What happens if an assignment/lab is late? You will receive a 10% deduction from the overall mark for the first 24 hours. You will receive a mark of zero after that. All lab reports and assignments will be uploaded to the Brightspace portal. The pre-lab is submitted in person.

What happens if I miss the Midterm or Final Exam? If you are ill, complete the self declaration document within 72 hours of the exam. <https://carleton.ca/registrar/wp-content/uploads/self-declaration.pdf> The weight of the missed midterm will be applied to the final exam.

Lab Reports (20%)

- Individual Prelabs - are due in person at the start of the lab, there are no extensions for the prelab. You will need to print out a copy of the Prelab to Submit. (You will often need to reference the prelab to help you with in-lab calculations or preparation).
- Group Lab Reports – lab reports are submitted by groups of 2-3 people. The group lab reports are expected to include the following sections: Introduction/Background Section, Results, Discussion, and Conclusion. For some labs, data between groups will be pooled for analysis. Note: in the event of a 4 person group – two lab reports will be submitted.
- Poorly constructed labs will be rejected. Labs must include at least two references from a text book or journal article related to the introduction and background writeup (this is in addition to the course notes).
- You may change your lab group after Lab 2 if you wish, please discuss with Dr. Basu.

Assignments (20%)

Assignments may be completed individually or in groups up to 3 people. There will be 4 assignments in the course. Assignments will be uploaded to Brightspace. Only one person in the group will upload the assignment, all members however must upload a statement of contribution to the assignment and list the assignment partners. If you do not upload your statement of contribution, you will not receive marks for the assignment.

Midterm (15%)

The midterm is worth 20% of your total mark, if you miss the midterm, the weight of the midterm exam will be moved to the final exam. You must complete the self-declaration form and send to me asap and no later than 72 hours after the midterm.

Final Exam (45%)

Following faculty practice, the final examination papers will not be returned after marking. *A minimum mark of 44% on the final exam is required to pass the course.*

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.

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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. For final exams, the deadlines to request accommodations are published in the [University academic calendars](#) for both undergraduate and graduate students.

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.

Pregnancy Accommodation: Please contact myself (Dr. Basu) 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.

Religious Obligation: Please contact myself (Dr. Basu) 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.

Additional Details on Accommodations can be found here: [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.

ENVE: Prof. [Shoeleh Shams](#)

Email: shoeleh.shams@Carleton.ca

Here is a list of some resources that may be of use:

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/>

Wishing you the best of luck for the term, and I hope you enjoy the course! – Dr. Onita Basu