



Faculty of Engineering and Applied Science

# CHEE 371 – IMMIGRATION OF INDUSTRIAL POLLUTION

## Course Syllabus – Winter 2022

This is your course syllabus. Please download the file and keep it for future reference.

### LAND ACKNOWLEDGEMENT

Queen's University is situated on traditional Anishinaabe and Haudenosaunee Territory.  
See: <http://www.queensu.ca/encyclopedia/t/traditional-territories>

### INCLUSIVITY STATEMENT

Queen's students, faculty, and staff come from every imaginable background – small towns and suburbs, urban high rises, Indigenous communities, and from more than 100 countries around the world. You belong here: <https://www.queensu.ca/inclusive/>.

## TEACHING TEAM

### COURSE INSTRUCTOR

#### Cao Thang Dinh, PhD

Department of Chemical Engineering  
Queen's University

E-mail: [caothang.dinh@queensu.ca](mailto:caothang.dinh@queensu.ca)

Office hours: By appointment



Please check the course website for an up-to-date of Tas and other course personnel.

# CHEE 371 (W 3-0-0.5 3.5)

## COURSE DESCRIPTION

Sources and characteristics of waste streams emanating from chemical and related industries are reviewed as the basis for developing appropriate abatement and treatment strategies. Treatment processes utilizing individual operations as well as integrated systems of physical, chemical and biological treatment are covered. Treatment process designs and sensitivity analyses of alternatives are undertaken for case studies involving industrial solid, liquid and gaseous wastes. Canadian guidelines and regulations are included within the context of environmental and human health.

PREREQUISITES: CHEE 221 or MINE 221, or permission of the department.

(0/0/0/17/25) (Mathematics/Natural Sciences/Complementary Studies/Engineering Science/Engineering Design)

## PRE-REQUISITE KNOWLEDGE

The course assumes knowledge of 2<sup>nd</sup> year thermodynamic properties of fluids, and chemical processes and systems.

## COURSE LEARNING OUTCOMES (CLO)

The principal objective of the course is to provide students in chemical engineering and engineering chemistry with the necessary tools to understand and evaluate physical, chemical and biological waste treatment processes. The students will learn how to apply engineering principles to the estimation and evaluation of unit operations associated with waste treatment processes, and ultimately to analyze the efficiency of applicable treatment solutions.

Specific course learning outcomes (CLO) include:

| CLO   | DESCRIPTION  | INDICATOR   |
|-------|--|---|
| CLO 1 | Identify environmental and human health issues related to waste treatment processes.   | KB-ES (Biochemical)                                 |
| CLO 2 | Determine the parameters necessary to characterize waste streams and processes associated with their physical, biological and chemical treatment.      | KB-ES (Biochemical)                                 |
| CLO 3 | Analyze waste streams design appropriate process flow diagrams and estimate appropriate size of unit operations required to meet applicable standards. | KB-ES (Biochemical)<br>PA-Formulate<br>DE-Solutions |
| CLO 4 | Apply sound engineering principles to evaluate and select appropriate abatement strategies and treatment methods to specific case studies.             | KB-ES (Biochemical)<br>PA-Evaluate<br>DE-Solutions  |
| CLO 5 | Justify selected waste treatment strategies and analyze their strengths and limitations with respect to current guidelines, standards and regulations. | IM-Environment<br>PR-Regulations<br>PR-Standards    |

This course develops the following attributes:

- **Knowledge base for engineering:** application of the foundations of science, materials science, and engineering in biological, physiological, pharmaceutical and/or environmental problems; specifically, knowledge of fluid mechanics, mass, momentum and energy balances, and chemical engineering processes (CLO 1, 2, 3 and 4).
- **Problem analysis:** application of models and solutions to related problems using appropriate methods, in order to reach substantiated conclusions (CLO 3, 4 and 5)
- **Design:** based on knowledge developed in this course as well as engineering concepts introduced in previous courses, conception of appropriate systems to achieve efficient waste stream treatment (CLO 1 through 5)
- **Impact of Engineering:** assessment of reliability, risk, regulatory compliance and safety and takes appropriate action to mitigate social and/or environmental impacts (CLO 1,4)
- **Professionalism:** integration of appropriate standards, codes, legal and regulatory factors into decision making, taking into consideration the protection of the public and public interest in decision making and recommendations; development of an understanding of the roles, responsibilities and ethics of professional engineers; practice of efficient team work and communications (CLO1 through 5)

## COURSE EVALUATION

### ASSESSMENT WEIGHTING

| Assessment Tool | Due Date<br>(before 23:59 ET) | Weight      | Alignment with<br>CLOs |
|-----------------|-------------------------------|-------------|------------------------|
| Quiz 1          | Week 5                        | 15%         | 1,2,3,4                |
| Quiz 2          | Week 10                       | 15%         | 1,2,3,5                |
| Assignment 1    | Week 4                        | 10%         | 1,2,3,4,5              |
| Assignment 2    | Week 8                        | 10%         | 1,2,3,4,5              |
| Assignment 3    | Week 12                       | 10%         | 1,2,3,4,5              |
| Final Exam      | Exam period                   | 40%         | 1,2,3,4,5              |
|                 |                               | <b>100%</b> |                        |

### ASSESSMENT DESCRIPTIONS

#### Quizzes

There are two quizzes in this course. Students must pass the individual examination component (combined mark on quizzes + final) to pass the course, as stated in Departmental Policy. Attendance at mid-term (2 quizzes) and final exam is mandatory. Marks assigned to the mid-term may be transferred

to the final exam for a medical reason supported with proper documentation following the stipulations of the [departmental policy](#).

## Assignments

There are three assignments in this course. Assignments will be completed during the term. The aim of these projects is to apply the theory presented on the various aspects of industrial pollution. Submissions can be made online (via onQ). Only one submission per group, with the name of each group member clearly indicated. Assignment solutions and reports may be hand-written (pen or pencil), or typed, but must be complete and fully support the answers.

## Final Exam

Students must write their exam on the day and time scheduled by the University. You should not schedule vacations, travel, etc. during the exam period. The [Term and Session Dates](#) will indicate the final exam period session dates in each term.

## Remote Proctoring - Proctortrack

The final exam and some tests/quizzes in this course will use remote proctoring provided by a third-party, cloud-based service that enables the completion of a proctored exam or test from an off-campus location, through onQ. This online proctoring solution was chosen as part of the approach to maintaining academic integrity in online assessment. Precise details about how remote proctoring will be used in this course can be found in the “Getting Started with Remote Proctoring” content module in onQ or will be provided by the instructor.

When writing tests/exams using remote proctoring, you are connecting to the third-party service. Queen’s has conducted a privacy and security review of the service in accordance with Ontario’s privacy legislation.

You should also take measures yourself to protect your information by keeping your NetID password and challenge questions private, closing all applications prior to starting an exam/test, and ensuring your device is updated and safeguarded against malware.

For more information about remote proctoring, see the Student FAQs on the OUR Exams resource page for [remote proctoring](#).

## GRADING

All assessments in this course will receive numerical percentage marks. The final grade you receive for the course will be derived by converting your numerical course average to a letter grade according to the established [Grade Point Index](#).

## Feedback on Assessments

The teaching team will provide feedback on graded activities. You can expect feedback on your assessments within seven days of the due date.

## Accessing Your Final Grade

Your final grades will show on SOLUS. Official transcripts showing final grades will be available on the Official Grade Release Date. Please note that in official transcripts, a mark of IN (incomplete) is considered a grade, and your transcript is released with this grade.

## COURSE MATERIALS

### Recommended Textbook

- *Principles of Environmental Engineering and Science* by Davis and Masten, 4<sup>rd</sup> Ed. McGraw Hill (2020); (referred to as **M&D**) (This is International Student Edition. It is available at campus bookstore).

### Additional Textbooks (Optional)

- *Environmental Chemistry* 4<sup>th</sup> Ed., by Baird and Cann (or previous editions) Freeman (2008); (referred to as **B&C**)
- *Wastewater Engineering – Treatment and Resource Recovery*, 5<sup>th</sup> Ed., by Metcalf & Eddy / AECOM (or previous editions) McGraw Hill (2014); (referred to as **M&E**)
- *Water and Wastewater Engineering – Design Principle and Practice*, 2<sup>nd</sup> Ed., by Mackenzie L. Davis, McGraw Hill (2020); (referred to as **Davis**).

### Other Material

All course lecture slides, videos, assignments and tutorials will be posted online. If you are registered for the course, you can access this information by logging in to the LMS.

### Suggested Time Commitment

This course represents a study period of one semester spanning 12 weeks. Learners can expect to invest on average 6-8 hours per week in this course. Learners who adhere to a pre-determined study schedule are more likely to successfully complete the course.

## WEEKLY COURSE CONTENT

| Week        | Content   | Assessment   |
|-------------|---|--|
| <b>1</b>    | <b>Module 1: Risk and Regulation</b>  |  |
| 1           | Introduction<br>Risk assessment <ul style="list-style-type: none"> <li>- Toxicity assessment</li> <li>- Exposure assessment</li> <li>- Risk characterization</li> </ul> Guidelines and regulations              | CLO 1,2  |
| <b>2-3</b>  | <b>Module 2: Air Pollution</b>  |  |
| 2           | Air pollutants<br>Global warming and Ozone layer<br>Air movement  | All CLO  |
| 3           | Air pollution mitigation<br>CO <sub>2</sub> capture and utilization   |  |
| <b>4-8</b>  | <b>Module 3: Liquid Waste</b>   |  |
| 4           | Water pollution sources and constituents<br>Wastewater characterization   | All CLO<br>Assignment 1 (week 4)<br>Quiz 1 (week 5)<br>Assignment 2 (week 8) |
| 5           | Unit operation of liquid waste treatment  |  |
| 6           | Primary/Physical mitigation <ul style="list-style-type: none"> <li>- Screening</li> <li>- Sedimentation</li> </ul> Secondary/Biological mitigation <ul style="list-style-type: none"> <li>- Overview</li> </ul> |  |
| 7           | Secondary/Biological mitigation <ul style="list-style-type: none"> <li>- CSTR without recycle</li> <li>- Activated sludge process</li> </ul>  |  |
| 8           | Tertiary/Chemical mitigation <ul style="list-style-type: none"> <li>- Nutrient removal</li> <li>- Disinfection</li> </ul>   |  |
| <b>9-11</b> | <b>Module 4: Solid waste</b>  |  |
| 9           | Treatment technologies <ul style="list-style-type: none"> <li>- Overview</li> <li>- Sludge thickening</li> </ul>  | All CLO<br>Quiz 2 (week 10)  |
| 10          | Treatment technologies <ul style="list-style-type: none"> <li>- Anaerobic digestion</li> </ul>  |  |
| 11          | Treatment technologies <ul style="list-style-type: none"> <li>- Waste management</li> </ul>   |  |
| <b>12</b>   | <b>Module 5: Industrial ecology</b>   |  |
| 12          | Integrated operations<br>Life cycle analysis  | CLO 1,2,5<br>Assignment 3  |

# COURSE COMMUNICATION

## NETIQUETTE

In this course, you may be expected to communicate with your peers and the teaching team through electronic communication. You are expected to use the utmost respect in your dealings with your colleagues or when participating in activities, discussions, and online communication.

Following is a list of netiquette guidelines. Please read them carefully and use them to guide your online communication in this course and beyond.

1. Make a personal commitment to learn about, understand, and support your peers.
2. Assume the best of others and expect the best of them.
3. Acknowledge the impact of oppression on the lives of other people and make sure your writing is respectful and inclusive.
4. Recognize and value the experiences, abilities, and knowledge each person brings.
5. Pay close attention to what your peers write before you respond. Think through and re-read your writings before you post or send them to others.
6. It's alright to disagree with ideas, but do not make personal attacks.
7. Be open to be challenged or confronted on your ideas and challenge others with the intent of facilitating growth. Do not demean or embarrass others.
8. Encourage others to develop and share their ideas.

## QUESTIONS ABOUT COURSE MATERIAL

Questions or comments regarding the course material that can be of benefit to other students should be posted in the Q&A forum on the class website. The instructor, TAs, and students are encouraged to answer these questions directly in the discussion forum for the benefit of everyone in the course.

## COURSE ANNOUNCEMENTS

The instructor will routinely post course news in the Announcements section on the main course homepage on OnQ. Please sign up to be automatically notified by email when the instructor posts new information in the Announcements section. Instructions on how to modify your notifications are found in the **Begin Here** section of the onQ course site.

## OFFICE HOURS

In addition to interaction in the Q&A discussion forums, you will have the opportunity to interact with either a TA or the instructor through office hours. The instructor will provide a schedule of availability at the beginning of the term.

## CONFIDENTIAL MATTERS

If you have a confidential matter you would like to discuss with your instructor, their contact details are on the first page of this document. Expect email replies within 48 hours.

## RECORDING SYNCHRONOUS (LIVE) CLASSES

Synchronous (live) classes will be delivered in this course through a video conferencing platform supported by the University [MS Teams, Zoom]. Steps have been taken by the University to configure these platforms in a secure manner, and to maintain student privacy while delivering courses remotely. Please note the following:

- Lectures will be recorded with video and audio (and in some cases transcription) and will be made available to students in the course for the duration of the term. You will be able to turn off your camera and microphone if you would like.
- Tutorials **will not** have mandatory participation and **will** be recorded with video and audio.

The recordings may capture your name, image or voice through the video and audio recordings. By attending these live classes, you are consenting to the collection of this information for the purposes of administering the class and associated coursework. If you are concerned about the collection of your name and other personal information in the class, please contact the course instructor to identify possible alternatives.

To learn more about how your personal information is collected, used and disclosed by Queen's University, please see the general [Notice of Collection, Use and Disclosure of Personal Information](#).

## STANDARD FEAS INFORMATION

### COURSE POLICIES

Please review the following policies concerning copyright, academic integrity, absences and academic accommodations:

#### COPYRIGHT

Course materials created by the course instructor, including all slides, presentations, synchronous and asynchronous course recordings, handouts, tests, exams, and other similar course materials, are the intellectual property of the instructor. It is a departure from academic integrity to distribute, publicly post, sell or otherwise disseminate an instructor's course materials or to provide an instructor's course materials to anyone else for distribution, posting, sale or other means of dissemination, without the instructor's **express consent**. A student who engages in such conduct may be subject to penalty for a departure from academic integrity and may also face adverse legal consequences for infringement of intellectual property rights and, with respect to recordings, potentially privacy violations of other students.

#### ACADEMIC INTEGRITY

As an engineering student, you have made a decision to join us in the profession of engineering, a long-respected profession with high standards of behaviour. As future engineers, we expect you to behave with integrity at all times. Please note that Engineers have a duty to:

- Act at all times with devotion to the high ideals of personal honour and professional integrity.



- Give proper credit for engineering work

The standard of behaviour expected of professional engineers is explained in the [Professional Engineers Ontario Code of Ethics](#). Information on policies concerning academic integrity is available in the [Queen's University Code of Conduct](#), in the [Senate Academic Integrity Policy Statement](#), on the [Faculty of Engineering and Applied Science website](#), and from your instructor.

Departures from academic integrity include plagiarism, use of unauthorized materials or services, facilitation, forgery, falsification, unauthorized use of intellectual property, and collaboration, and are antithetical to the development of an academic community at Queen's. Given the seriousness of these matters, actions which contravene the regulation on academic integrity carry sanctions that can range from a warning or the loss of grades on an assignment to the failure of a course to a requirement to withdraw from the University.

In the case of online or remotely proctored exams, impersonating another student, copying from another student, making information available to another student about the exam questions or possible answers, posting materials to online services, communicating with another person during an exam or about an exam during the exam window, or accessing unauthorized materials, including internet sources and using unauthorized materials, including smart devices, are actions in contravention of academic integrity.

## **LATE POLICY**

Any applicable late penalties are described in the details for each assessment. In the event of extenuating circumstances, you must follow the policies for requesting an academic consideration (please see below). Note that unacceptable reasons include extra-curricular activities, travel plans, being generally behind on schoolwork, etc. In the absence of an approved consideration request, the normal late penalty will apply as described in the assignment or any course/departmental policies.

## **INVALID EXAMS**

An exam may be declared invalid in case of an interruption in an in-person examination; if the instructions in a remote or online exam were not followed; if the student uploads wrong materials; or if a situation arises where the integrity of the exam cannot be verified. If an exam is declared invalid, the student may be granted a re-write.

## **ABSENCES (ACADEMIC CONSIDERATIONS) AND ACADEMIC ACCOMMODATIONS**

For absences and academic accommodations please review the information on the [FEAS website](#).

# **ACADEMIC AND STUDENT SUPPORT**

Queen's has a robust set of supports available to you including the [Library](#), [Student Academic Success Services \(Learning Strategies and Writing Centre\)](#), and [Career Services](#). Learners are encouraged to visit the Faculty of Engineering and Applied Science [Current Students](#) web portal for information about various other policies such as academic advisors, registration, student exchanges, awards and scholarships, etc.

## INDIVIDUAL NEEDS AND SUPPORT

If you have a disability or health-related condition that may require academic accommodations, please approach the [Queen's Accessibility Services](#). The staff at Accessibility Services are available by appointment to develop individualized accommodation plans, provide referrals, and assist with advocacy. The sooner you let us know your needs, the better we can assist you in achieving your learning goals. For questions or assistance with requesting Academic Consideration or Accommodation, contact the FEAS Academic Accommodation Coordinator at [engineering.aac@queensu.ca](mailto:engineering.aac@queensu.ca)

Every effort has been made to provide course materials that are accessible. For further information on accessibility compliance of the educational technologies used in this course, please consult the links below.

| <b>EDUCATIONAL TECHNOLOGY</b><br><b>(MODIFY THIS TABLE TO INCLUDE TOOLS USED IN YOUR COURSE)</b> | <b>ACCESSIBILITY COMPLIANCE INFORMATION</b>   |
|--|---|
| onQ<br>(Brightspace Learning Management System by D2L)   | <a href="https://www.d2l.com/accessibility/standards/">https://www.d2l.com/accessibility/standards/</a>   |
| MS-Teams   | <a href="https://support.microsoft.com/en-us/office/accessibility-support-for-microsoft-teams-d12ee53f-d15f-445e-be8d-f0ba2c5ee68f">https://support.microsoft.com/en-us/office/accessibility-support-for-microsoft-teams-d12ee53f-d15f-445e-be8d-f0ba2c5ee68f</a> |
| Zoom   | <a href="https://zoom.us/accessibility">https://zoom.us/accessibility</a>   |

If you find any element of this course difficult to access, please contact [engineering.aac@queensu.ca](mailto:engineering.aac@queensu.ca)

## ACCOMMODATIONS RELATED TO REMOTE ASSESSMENT

To have your accommodations applied to a remote-proctored exam please follow the instructions for submitting your information, as outlined on the QSAS website. Your accommodations will be incorporated into your exam session by the Queen's University exam coordinators, on behalf of your course instructor. This information is uploaded automatically to [Proctortrack / Examity](#).

If you are already registered with QSAS and you require additional accommodations related to remote-proctored exams, please consult with your QSAS advisor to update your Letter of Accommodation as appropriate.

## RELIGIOUS OBSERVANCE

Students in need of accommodation for religious observance are asked to speak to their professor within a week of receiving their syllabus. Note also that alternative assignments are considered a "reasonable accommodation" under the Ontario Human Rights Code. Students with questions about their rights and responsibilities regarding religious accommodation should contact the Chaplain via [Chaplain@queensu.ca](mailto:Chaplain@queensu.ca).

## **TECHNICAL SUPPORT**

Some basic comfort level with basic hardware and software skills are required for this course. If you require technical assistance, please contact [Technical Support](#).

## **SUPPORTIVE PERSONAL COUNSELLING**

If at any time you find yourself feeling overwhelmed, anxious, sad, lonely, or distressed, consider confidential supportive counselling offered by the [embedded counselors](#) and by Student Wellness Services <https://www.queensu.ca/studentwellness/>