ENGG*4770 Physical & Chemical Water and Wastewater Treatment Design

Fall 2018
Section(s): C01

School of Engineering
Credit Weight: 0.50
Version 1.00 - September 06, 2018

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1 Course Details

1.1 Calendar Description

This course focuses on the theory, application, and design principles of physical and chemical operations and processes for the treatment of water and wastewater. This involves the design of physical and chemical unit operations, and evaluating the optimum combination to satisfy the given design constraints and criteria. The optimum designs integrate engineering science, basic science, economics, and health and safety for workers and the public.

Pre-Requisite(s): ENGG*3590
Restriction(s): ENGG*4260

1.2 Timetable

Lectures:

Tuesday	Sec 101&102	2:30 – 3:50 pm	MINS 106
Thursday	Sec 101&102	2:30 – 3:50 pm	MINS 106

Laboratory:

Wednesday	Sec 101	12:30 – 2:20 pm	THRN 1116
Wednesday	Sec 102	9:30 – 11:20 am	THRN 1116

1.3 Final Exam

There is no final exam for this course.

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2 Instructional Support

2.1 Instructor(s)

Shelir Ebrahimi
Email: shelir@uoguelph.ca
Telephone: +1-519-824-4120 x54469
Office: RICHS 1511
Office Hours: Thursdays: 10:30 - 11:30 am or by appointment

2.2 Instructional Support Team

Lab Technician: Joanne Ryks
Email: jryks@uoguelph.ca
Telephone: +1-519-824-4120 x54087
Office: THRN 1114

2.3 Teaching Assistant(s)

Teaching Assistant: Jinghan Zhao
Email: jzhao11@uoguelph.ca
Office Hours: TBD

Teaching Assistant: Aneela Hayder
Email: ahayder@uoguelph.ca
Office: TBA

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3 Learning Resources

3.1 Required Resource(s)

Course Website (Website)
http://courselink.uoguelph.ca
Course material, news, announcements, and grades will be regularly posted to the ENGG*4770 Courselink site. You are responsible for checking the site regularly.

3.2 Recommended Resource(s)

Metcalf & Eddy, Inc. (2014). Wastewater Engineering: Treatment and Resource Recovery, 5th edition, McGraw Hill, Inc., New York, NY, 2018p. (Textbook)

Crittenden, J. et al. (2012). Water Treatment Processes, Principle & Designe. MWH, 3rd Edition. (Textbook)

Davis, M.L. (2010). Water and Wastewater Engineering: Design Principles and Practice. McGraw Hill, Inc., New York, NY. (Textbook)

Droste, R.L. (1997). Theory and Practice of Water and Wastewater Treatment. John Wiley & Sons, New York, NY, 800p. (Textbook)

Recommended Standards for Wastewater Facilities. 1997 Edition, The Great Lakes – Upper Mississippi River Board of State and Provincial Public health and Environmental Managers, Albany, NY. (Textbook)

Reynolds, T.D. and Richards, P.A. (1996). Unit Operations and Processes in Environmental Engineering, 2nd Edition, PWS Publishing Co. Boston, MA, 798p. (Textbook)

3.3 Additional Resource(s)

Lecture, lab, and project information (Notes)

All the lecture notes as well as assignments and lab notes are posted on the Courselink throughout the semester. Also, the information for all the design projects and report draft and evaluation rubrics will be posted on the Courselink. Download them according to the schedule given in this handout.

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4 Learning Outcomes

The goal of this course is to provide the students with the theories and practices for the planning, design and operation of commonly used physical and chemical treatment processes. Emphasis will be placed on integrating individual unit operations and processes to achieve multiple treatment objectives while satisfying the economic, environmental and societal constraints.

4.1 Course Learning Outcomes

By the end of this course, you should be able to:

1. Fully understand the theory behind different physical-chemical methods, that can be used as water & wastewater treatment processes, and their design parameters.
2. Properly identify the critical issues and challenges in planning, design and operation of water and wastewater treatment facilities to meet regulatory requirements
3. Develop reasonable working knowledge and hands-on experiences that can be used to design an efficient, cost-effective treatment systems.
4. Perform lab experiments and interpret the technical data to analyze and explain the performance of specific water/wastewater treatment processes.
5. Improve communication skills in both verbal and written format.

4.2 Engineers Canada - Graduate Attributes (2018)

Successfully completing this course will contribute to the following:

#	Outcome Set Name	Course Learning Outcome
1	Knowledge Base	1
1.4	Recall, describe and apply program-specific engineering principles and concepts	1
2	Problem Analysis	2
2.1	Formulate a problem statement in engineering and non-engineering terminology	2
2.2	Identify, organize and justify appropriate information, including assumptions	2

#	Outcome Set Name	Course Learning Outcome
3	Investigation	4
3.3	Analyze and interpret experimental data	4
3.4	Assess validity of conclusions within limitations of data and methodologies	4
4	Design	3
4.1	Describe design process used to develop design solution	3
4.2	Construct design-specific problem statements including the definition of criteria and constraints	3
4.3	Create a variety of engineering design solutions	3
4.4	Evaluate alternative design solutions based on problem definition	3
4.5	Develop and refine an engineering design solution, through techniques such as iteration, simulation and/or prototyping	3
7	Communication Skills	4, 5
7.1	Identify key message(s) and intended audience in verbal or written communication as both sender and receiver	5
7.2	Interpret technical documentation such as device specification sheets, drawings, diagrams, flowcharts, and pseudocode	5
7.3	Construct the finished elements using accepted norms in English, graphical standards, and engineering conventions, as appropriate for the message and audience	4, 5
7.4	Substantiate claims by building evidence-based arguments and integrating effective figures, tables, equations, and/or references	4
9	Impact of Engineering on Society and the Environment	3
9.3	Anticipate the positive and negative impacts of introducing innovative technologies to solve engineering problems	3

4.3 Graduate Attributes

Successfully completing the course will contribute to the following CEAB Graduate Attributes.

Graduate Attribute	Assessment
1.4 Recall, describe and apply program-specific engineering principles and concepts	Tutorials1-4
2.1 Formulate a problem statement in engineering and non-engineering terminology	Design project report-executive summary & introduction

	Graduate Attribute	Assessment
5	2.2 Identify, organize and justify appropriate information, including assumptions	Design project report-introduction
	3.3 Analyze and interpret experimental data	Assignment 3-Results & discussion
	3.4 Assess validity of conclusions within limitations of data and methodologies	Assignment 3-Conclusion
	4.1 Describe design process used to develop design solution	Design project report
	4.2 Construct design-specific problem statements including the definition of criteria and constraints	Design project report
	4.3 Create a variety of engineering design solutions	Design project report
	4.4 Evaluate alternative design solutions based on problem definition	Design project report
	4.5 Develop and refine an engineering design solution, through techniques such as iteration, simulation and/or prototyping	Design project report
	7.1 Identify key message(s) and intended audience in verbal or written communication as both sender and receiver	Design project report & presentation
	7.2 Interpret technical documentation such as device specification sheets, drawings, diagrams, flowcharts, and pseudocode	Design project report & presentation
	7.3 Construct the finished elements using accepted norms in English, graphical standards, and engineering conventions, as appropriate for the message and audience	Design project report & presentation
	7.4 Substantiate claims by building evidence-based arguments and integrating effective figures, tables, equations, and/or references	Assignment 3
	9.3 Anticipate the positive and negative impacts of introducing innovative technologies to solve engineering problems	Design project report

Teaching and Learning Activities

5.1 Lecture Schedule (Tentative)

Time	Lecture Topics
Week 1 Sep 3-7	Sep 6: First lecture Introduction and treatment processes overview
Week 2 Sep 10-14	Fundamentals of treatment and reuse
Week 3 Sep 17-21	Hydraulic Engineering
Week 4	Hydraulic Engineering

Sep 24-28	Preliminary Treatment (Screening, chlorine addition, pH adjustment, etc.)
Week 5 Oct 1-5	Preliminary Treatment (Coagulation, Flocculation, sedimentation)
Week 6 Oct 8-12	Common physical-chemical processes (Adsorption)
Week 7 Oct 15-19	Common physical-chemical processes (Adsorption)
Week 8 Oct 22-26	Common physical-chemical processes (Filtration)
Week 9 Oct 29-Nov 2	Common physical-chemical processes (Filtration)
Week 10 Nov 5-9	Disinfection, taste & odor control
Week 11 Nov 12-16	Disinfection By-products (DBPs)
Week 12 Nov 19-23	Other physical-chemical treatment processes
Week 13 Nov 26-30	Other industrial treatment processes Project presentations

5.2 Lab Schedule

LAB NUMBER	DATE, WED	ACTIVITY

1	SEP 12	Intro, Safety, and Selection of Design Groups
2	SEP 19	Tutorial 1
3	SEP 26	Tutorial 2
4	OCT 3	Tutorial 3
5	OCT 10	Experiment 1-1
6	OCT 17	Experiment 1-2
7	OCT 24	Experiment 1-3
8	OCT 31	Tutorial 4
9	NOV 7	Design Project
10	NOV 14	Design Project
11	NOV 21	Design Project
12	NOV 28	Design Project Presentation

5.3 Other Important Dates (Related to this Course)

Thursday, September 6th, 2018: First day of class

Monday October 8th, 2018: Thanksgiving Holiday, No classes or labs

Tuesday, October 9th, 2018: Fall Study Break Day, No class

Friday, November 2nd, 2018: Drop date – 40th class day

Thursday, November 29th, 2018: Last day of class

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6 Assessments

6.1 Marking Schemes & Distributions

Name	Scheme A (%)
Individual Tutorials 1-4	20
Individual Assignments 1-3	30
Group Design Presentation	15
Group Design Report	35
Total	100

6.2 Assessment Details

Tutorials (20%)
Date: , In lab, check the lab schedule for more details
20%, equally distributed among 4 tutorials.

Overall there are 4 tutorials which are due at the end of each lab period. Please check the lab schedule for more info. These tutorial questions are done individually.

Assignments (30%)
Date: , In Class, MINS 106
30%, equally distributed among 3 assignments. Assignments should be submitted individually.

Assignments' due date (tentative):

- Assignment 1: Thu, Sep 27, in class
- Assignment 2: Thu, Oct 25, in class
- Assignment 3: Thu, Nov 15, in class

Group Design Project (50%)
Date: , in class and lab
Students will work on a design project in group of 3 or 4 (depending on the size of class). At the end of the semester, each group delivers one design project presentation and one design

project report.

- **Design project presentation (15%):** Wed, Nov 28 in lab, and Thu, Nov 29, in class. The exact schedule for individual groups will be posted on Courselink.
- **Design project report (35%):** The final report is due on Thu, Dec 13, by 12 pm (noon) in my office (RICHS 1511). **Note**: Both paper and electronic copies should be submitted.

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7 Course Statements

7.1 Course Grading Policies

Passing grade: In order to pass the course, you must:

- Pass tutorials (average mark of tutorials 1-4 should be equal or higher than 50%), **AND**
- Pass assignments (average mark on assignments 1-3 should be equal or higher than 50%).

Note: Students must obtain a grade of 50% or higher on the tutorials AND assignments portions of the course in order for the group project portion of the course to count towards the final grade. If you do not pass tutorials OR assignments, you will fail the course and the final mark of the course will be overall mark obtained on tutorials and assignments (design project mark won't count).

Missed Assessments: If you are unable to meet an in-course requirement due to medical, psychological, or compassionate reasons, please email the course instructor. Please see below for specific details and consult the undergraduate calendar for information on regulations and procedures for Academic Consideration:
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Accommodation of Religious Obligations: If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor within two weeks of the start of the semester to make alternate arrangements. See the undergraduate calendar for information on regulations and procedures for Academic Accommodation of Religious Obligations:
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml

Missed submissions: Missed submissions will not be accepted, and there will be no makeup.

Lab Work: You must attend and complete lab experiments (experiments 1-1, 1-2, and 1-3. Please see the lab schedule). If you miss a lab experiment due to grounds for granting academic consideration or religious accommodation, arrangements must be made with the teaching assistant to complete a makeup lab.

Late submissions: Late submissions will not be accepted.

7.2 Communication & Email Policy

Please use lectures and lab help sessions as your main opportunity to ask questions about the course. Major announcements will be posted to the course website. **It is your responsibility to**

check the course website regularly. As per university regulations, all students are required to check their <mail.uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its students.

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8 School of Engineering Statements

8.1 Instructor's Role and Responsibility to Students

The instructor's role is to develop and deliver course material in ways that facilitate learning for a variety of students. Selected lecture notes will be made available to students on Courselink but these are not intended to be stand-alone course notes. Some written lecture notes will be presented only in class. During lectures, the instructor will expand and explain the content of notes and provide example problems that supplement posted notes. Scheduled classes will be the principal venue to provide information and feedback for tests and labs.

8.2 Students' Learning Responsibilities

Students are expected to take advantage of the learning opportunities provided during lectures and lab sessions. Students, especially those having difficulty with the course content, should also make use of other resources recommended by the instructor. Students who do (or may) fall behind due to illness, work, or extra-curricular activities are advised to keep the instructor informed. This will allow the instructor to recommend extra resources in a timely manner and/or provide consideration if appropriate.

8.3 Lab Safety

Safety is critically important to the School and is the responsibility of all members of the School: faculty, staff and students. As a student in a lab course you are responsible for taking all reasonable safety precautions and following the lab safety rules specific to the lab you are working in. In addition, you are responsible for reporting all safety issues to the laboratory supervisor, GTA or faculty responsible.

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9 University Statements

9.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

9.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The regulations and procedures for Academic Consideration are detailed in the Undergraduate Calendar.

9.3 Drop Date

Courses that are one semester long must be dropped by the end of the fortieth class day; two-semester courses must be dropped by the last day of the add period in the second semester. The regulations and procedures for Dropping Courses are available in the Undergraduate Calendar.

9.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

9.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required, however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to book their exams at least 7 days in advance, and not later than the 40th Class Day.

More information: www.uoguelph.ca/sas

9.6 Academic Misconduct

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community – faculty, staff, and students – to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

The Academic Misconduct Policy is detailed in the Undergraduate Calendar.

9.7 Recording of Materials

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

9.8 Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs.