ENGG*4760 Biological Wastewater Treatment Design

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Winter 2021
Section(s): C01

School of Engineering
Credit Weight: 0.50
Version 1.00 - January 11, 2021

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1 Course Details

1.1 Calendar Description

The course applies design principles for a variety of biological treatment systems for both municipal and industrial wastewater. This involves the design of suspended growth and attached growth processes, anaerobic digestion, sludge processing and utilization, water reuse and resource recovery facilities.

Pre-Requisites: ENGG*3590
Restrictions: ENGG*4260

1.2 Course Description

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

1.3 Timetable

Lectures:

All sections: Tuesday and Thursday, 10:00am - 11:20pm

Tutorials - Quizzes -Labs

Labs: Friday 03:30pm - 05:20pm

Midterm: March 5, 03:30pm - 05:20pm

1.4 Final Exam

Saturday, April 24, 11:30 am - 01:30 pm

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2 Instructional Support

2.1 Instructional Support Team

Instructor: Hongde Zhou Ph.D., P.Eng
Email: hzhou@uoguelph.ca
Telephone: +1-519-824-4120 x56990
Office: RICH 3511
Office Hours: Mondays 02:00pm - 3:00pm or by appointment

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

2.2 Teaching Assistants

Teaching Assistant: Na Qin
Email: nqin@uoguelph.ca
Office: THRN 3118
Office Hours: Wednesday 11:30 am - 12:20 pm

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3 Learning Resources

3.1 Required Resources

2.1 Course Website (Website)
https://courselink.uoguelph.ca
Course material, announcements, and grades will be regularly posted to the ENGG*4760 Courselink site. You are responsible for checking the site regularly.

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

3.2 Recommended Resources

WEF and ASCE/EWRI, (2018). Design of Water Resource Recovery Facilities, 6th Edition, WEF Press, Alexandria, VA, 2240p. (Textbook)

Recommended Standards for Wastewater Facilities. (2014). The Great Lakes – Upper Mississippi River Board of State and Provincial Public health and Environmental Managers, Albany, NY. (Textbook)

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

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

Biological Wastewater Treatment (Textbook)
Grady, C.P.L., Jr., Gaigger, G.T. G.T., Love, N.L. and Filipe, C.D.M. (2011). 3rd edition, CRC Press, Boca Raron, FL, 991p.

WastewaterTtreatment Plants: Planning, Design, and Operation (Textbook)
Qasim, S.R. (1999). Technomic Pub. Co, Lancaster, PA, 1107p.

Metcalf & Eddy, Inc. (2006). Water Reuse: Issues, Technologies and Applications, McGraw Hill, Inc., New York, NY, 1570p. (Textbook)

3.3 Additional Resources

Lecture Information (Notes)
All the lecture notes are posted on the Courselink throughout the semester

Design Project and Assignments (Notes)
The information for all design project and assignments will be posted on the Courselink. Download them according to the schedule given in this handout.

Miscellaneous Information (Notes)
Other information related to the course is also posted on the Courselink.

3.4 REFEREED JOURNALS

Water Research

Water Science &Technology

Water Environment Research

Journal of Environmental Engineering, ASCE

Environmental Science & Technology

4 Learning Outcomes

4.1 Course Learning Outcomes

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

1. Understand the theory and design of different biological 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 devise and design an efficient, cost-effective treatment systems.
4. 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	Learning Outcome
1	Knowledge Base	1
1.4	Recall, describe and apply program-specific engineering principles and concepts	1
4	Design	2, 3
4.3	Create a variety of engineering design solutions	2, 3
4.4	Evaluate alternative design solutions based on problem definition	2, 3
6	Individual & Teamwork	4
6.3	Execute and adapt individual role to promote team success through, for example, timeliness, respect, positive attitude	4
7	Communication Skills	4
7.5	Demonstrate ability to process oral and written communication by following instructions, actively listening, incorporating feedback, and formulating meaningful questions	4

4.3 Relationships with other Courses & Labs

Previous Courses:

ENGG*2560: Mass balance analysis for steady state and unsteady state situations, reactor types and analysis, reaction equilibrium and kinetics
ENGG*31X: Some design tools, writing and public speaking techniques, codes, safety issues, environmental assessment and professional management
ENGG*3590: Water quality, basic theories of physical, chemical and biological treatment processes

Follow-on Courses:

None

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5 Teaching and Learning Activities

5.1 Lecture

Tue, Jan 12, 10:00 AM - Mon, Apr 12, 10:00 AM

Topics:

Weeks	Topics
0.5	0 – Introduction ▫ Course outline ▫ Overview of wastewater treatment
1.5	I - Wastewater Generation, Characteristics and Treatment Objectives ▫ Physical, chemical and biological characteristics ▫ Wastewater sources and flow rates ▫ Treatment objectives ▫ Introduction to wastewater treatment process selection

2.0	II – Wastewater Microbiology ▫ Role and classification of microorganisms ▫ Microbial growth kinetics ▫ Types of biological treatment processes	
2.5	III – Suspended Growth Biological Treatment Processes ▫ Lawrence-McCarty Model ▫ Activated sludge design consideration and control ▫ Aeration selection and design ▫ Secondary settling	8 5
1.0	IV –Biological Nutrient Removal Processes ▫ Nitrogen removal ▫ Phosphorous removal ▫ Combined BNR processes	7
Midterm	March 12, 3:30 PM to 5:30PM	
1.5	V – Attached Growth Biological Treatment ▫ Attached growth kinetics and mass transfer limitation ▫ Tricking Filter ▫ Rotating biological contactors ▫ Hybrid processes	
1.5	VI – Anaerobic Processes ▫ Process fundamentals and analysis ▫ Types and design of AD processes	1

1.5	VII – Sludge Processing, Utilization and Disposal ▫ Sources, quantities and characteristics ▫ Regulations for the utilization and disposal ▫ Sludge processing ▫ Land application	1 1 14
Final	April 24, 11:30 AM to 01:30PM	

5.2 Tutorial - Quizzes - Labs

Tutorials and Labs

Sec 101: Wed 11:30am - 1:20pm, MACN 202/THRN 1116

Sec 102: Thur 9:30am - 11:20am, ANNU 204/THRN 1116

Midterms

Mon 7:00pm - 9:00pm, TBA

Please check the class activity schedule so you know when you should be ready for midterms and project report.

5.3 Other Important Dates

Monday, 12th January, 2021: Winter 2021 Semester Starts
Monday, 12th January, 2021: First lecture of class

Monday, 15th February, 2021 to Friday, 19st February, 2021: Winter Break - No classes scheduled this week

Friday, 12th March, 2021: Midterm, 03:30 pm -05:20 pm

Friday, March 12, 2021: Fortieth drop date

Friday, 12th April, 2021: Classes conclude
Monday, 15th April, 2021: Examinations commence

Wednesday, 24th April, 2021: Final Exam, 11:30 AM - 01:20 PM

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6 Assessments

6.1 Marking Schemes & Distributions

Assessment	Weight (%)
Group Project Report	30
Assignments	20
Midterm	20
Final exam	30
Total	100

6.2 Assessment Details

Project (30%)

Due: Fri, Mar 19, 12:59 PM, Report evaluation
Learning Outcome: 2, 3, 4
The details of the project will be posted on Course link. Students will work on a project in group of 2 or 3 (depending on the size of class). You may choose the group members by yourselves.

The final report can be submitted electronically into Courselink Dropbox. The project report must meet the requirements and format specified in the project handout in order to achieve the perceived course objectives. The report should be technically sound, CLEARLY readable, and concise.

Assignments (5) (20%)

All the assignments must be submitted prior to the lectures on the dates specified

Midterm (20%)

Date: Fri, Mar 5, 12:59 PM - , 9:00 PM, TBA
Learning Outcome: 1
Both midterm and final will be open-text exams. Any non-communication calculator is permitted.

Final Exam (40%)

Date: Mon, Apr 20, 7:00 PM - , 9:00 PM, TBA
Learning Outcome: 1, 2, 3

7 Course Statements

7.1 Course Grading Policies

Missed Assessments: If you are unable to meet an in-course requirement due to medical, psychological, or compassionate reasons, please email the course instructor. See 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 Assignments/Midterm Exams: If you miss the midterm exams due to grounds for granting academic consideration or religious accommodation, the weight of the missed assignments/midterm will be added to the final exam. **There will be no makeup assignments/midterm Exam.**

Late submission of project report: Late submission of the project report will be devalued by 25% per every day.

Passing grade: You must achieve a passing grade or greater on combined assignments and project design report together in order to pass the course. If you fail to do so, your final grade will be equal to that failing percentage.

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.

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 grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Graduate Calendar - Grounds for Academic Consideration
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions
https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml

9.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml

Graduate Calendar - Registration Changes

https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml

Associate Diploma Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml

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.

For Guelph students, information can be found on the SAS website
https://www.uoguelph.ca/sas

For Ridgetown students, information can be found on the Ridgetown SAS website
https://www.ridgetownc.com/services/accessibilityservices.cfm

9.6 Academic Integrity

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 encourages academic integrity. 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.

Undergraduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

Graduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

9.7 Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, 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 that apply to undergraduate, graduate, and diploma programs.

Academic Calendars
https://www.uoguelph.ca/academics/calendars

9.9 Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings and academic schedules. Any such changes will be announced via CourseLink and/or class email. All University-wide decisions will be posted on the COVID-19 website (https://news.uoguelph.ca/2019-novel-coronavirus-information/) and circulated by email.

9.10 Illness

The University will not normally require verification of illness (doctor's notes) for fall 2020 or winter 2021 semester courses. However, requests for Academic Consideration may still require medical documentation as appropriate.
