ENGG*4250 Watershed Systems Design

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Winter 2021
Section(s): C01

School of Engineering
Credit Weight: 0.75
Version 1.00 - January 05, 2021

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1 Course Details

1.1 Calendar Description

This course is a hydrological analysis of watershed systems including stream flow for design of structures and channels, flood warning, flood plain mapping and low-flow characteristics. Hydraulic analysis is applied to the design of dams, reservoirs, control structures, energy dissipation structures, bridges and culverts. An analysis of steady flow profiles, flood waves, and sediment transport is applied in the design of natural and constructed channels and protective works for rivers to achieve environmentally sustainable land use in watershed systems.

Pre-Requisites:	ENGG*2230, ENGG*3650
Restrictions:	This is a Priority Access Course. Enrolment may be restricted to the WRE specialization in the BENG and BENG:C programs. See department for more information.

1.2 Course Description

This is a senior level design course in water resources that integrates across many of the foundational courses in water resources (water management, fluid mechanics, hydrology) and the design core of engineering. This major aim is to apply these at the watershed scale to develop design solutions for typical watershed problems.

1.3 Timetable

Lectures:

Tuesday	11:30AM - 12:50PM	AD-S, Room Virtual
Thursday	11:30AM - 12:50PM	AD-S, Room Virtual

Labs:

Wednesday	9:30 AM – 11:20 AM	AD-S, Room Virtual

1.4 Final Exam

Friday April 23, 2021 - Start Time: 11:30 am, AD-S, Room Virtual.

Exam time and location is subject to change. Please see WebAdvisor for the latest information.

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2 Instructional Support

2.1 Instructional Support Team

Instructor: Bahram Gharabaghi , Ph.D., P.Eng.
Email: bgharaba@uoguelph.ca
Telephone: +1-519-824-4120 x58451
Office: THRN 2417

Office Hours: TBA on CourseLink and by appointment

2.2 Teaching Assistants

Teaching Assistant: Cody Kupferschmidt
Email: kupfersc@uoguelph.ca
Office Hours: Cody will schedule 30-min, one on one weekly meetings with each group to discuss the design project progress in the previous week and the work plan for the upcoming week. Design challenges and potential solutions that each member of the group is experiencing will be discussed. Time management skills will be put to test and best practices will be discussed to ensure successful team dynamics and that internal quality control practices are in place.

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3 Learning Resources

3.1 Required Resources

Course Website (Website)
Course material, news, announcements, and grades will be regularly posted to the ENGG*4250 CourseLink site. You are responsible for checking the site regularly.

Open Channel Hydraulics (Textbook)
Terry W. Sturm.

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4 Learning Outcomes

4.1 Course Learning Outcomes

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

1. Apply hydrological techniques to obtain flow rates for the design of conveyance and storage systems.
2. Apply the laws of conservation of mass, energy and momentum to the analysis of hydraulic conditions in conveyance structures and storage facilities.
3. Translate water-related needs into system performance criteria for design purposes.
4. Design open channel networks for water conveyance and storage.
5. Employ standard software in the solution of flow problems and in design calculations.

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4.2 Engineers Canada - Graduate Attributes (2018)

Successfully completing this course will contribute to the following:

#	Outcome	Learning Outcome
1	Knowledge Base	1, 2, 4
1.1	Recall, describe and apply fundamental mathematical principles and concepts	1, 2, 4
1.2	Recall, describe and apply fundamental principles and concepts in natural science	1, 2, 4
1.3	Recall, describe and apply fundamental engineering principles and concepts	1, 2, 4
1.4	Recall, describe and apply program-specific engineering principles and concepts	1, 2, 4
2	Problem Analysis	4
2.1	Formulate a problem statement in engineering and non-engineering	4

#	Outcome	Learning Outcome
	terminology	
2.2	Identify, organize and justify appropriate information, including assumptions	4
2.3	Construct a conceptual framework and select an appropriate solution approach	4
2.4	Execute an engineering solution	4
2.5	Critique and appraise solution approach and results	4
3	Investigation	3, 4
3.1	Propose a working hypothesis	3, 4
3.2	Design and apply an experimental plan/investigative approach (for example, to characterize, test or troubleshoot a system)	3, 4
3.3	Analyze and interpret experimental data	3, 4
3.4	Assess validity of conclusions within limitations of data and methodologies	3, 4
4	Design	4, 5
4.1	Describe design process used to develop design solution	4, 5
4.2	Construct design-specific problem statements including the definition of criteria and constraints	4, 5
4.3	Create a variety of engineering design solutions	4, 5
4.4	Evaluate alternative design solutions based on problem definition	4, 5
4.5	Develop and refine an engineering design solution, through techniques such as iteration, simulation and/or prototyping	4, 5
5	Use of Engineering Tools	4, 5
5.1	Select appropriate engineering tools from various alternatives	4, 5
5.2	Demonstrate proficiency in the application of selected engineering tools	4, 5
5.3	Recognize limitations of selected engineering tools	4, 5
7	Communication Skills	4, 5
7.1	Identify key message(s) and intended audience in verbal or written communication as both sender and receiver	4, 5

#	Outcome	Learning Outcome
7.2	Interpret technical documentation such as device specification sheets, drawings, diagrams, flowcharts, and pseudocode	4, 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, 5
7.5	Demonstrate ability to process oral and written communication by following instructions, actively listening, incorporating feedback, and formulating meaningful questions	4, 5
9	Impact of Engineering on Society and the Environment	3, 4
9.1	Analyze the safety, social, environmental, and legal aspects of engineering activity	3, 4
9.2	Evaluate the uncertainties and risks associated with engineering activities	3, 4
9.3	Anticipate the positive and negative impacts of introducing innovative technologies to solve engineering problems	3, 4
12	Life Long Learning	4
12.1	Identify personal career goals and opportunities for professional development	4
12.2	Self-assess skills relative to career goals and SOE defined learning outcomes	4
12.3	Demonstrate capability for continuous knowledge and skill development in a changing world	4

5 Teaching and Learning Activities

5.1 Lecture and Lab Topics

Both Lectures and Labs will be conducted synchronously (during the scheduled times) online via WebEx, which you can access through Courselink. Make sure you have WebEx installed

before the beginning of the class and have a WebEx account. I strongly encourage everyone to join during regular class time (if they are able to) in order to have as much interactivity as the platform permits. Here is all the information you need to know about the lectures:

- I will be hosting the WebEx meeting and sharing my screen with the slides.
- Your microphone should be muted during the lecture and only unmute if you would like to ask a question.

Week	Tuesday Lecture Topic	Wednesday Lab Topic	Thursday Lecture Topic
1	Course Outline	Flow Duration Curve	Uniform Flow Computation
2	Flood Routing	Reservoir & Channel Routing	Quiz #1
3	Gradually Varied Flows	Water Surface Profiles	Gradually Varied Flows
4	Flow Measurement Devices	HEC RAS Tutorial Part 1	Quiz #2
5	Design Proposal Presentations	HEC RAS Tutorial Part 2	Design Proposal Presentations
6	Channel Transitions	Fish Ladder Design	Quiz #3
7	Design of Erodible Channels	Design of Erodible Channels	Design of Erodible Channels
8	Spillways and Stilling Basins	Hydro Power Generation	Quiz #4
9	Design of Culverts	Culvert Design Examples	Design of Culverts
10	Hydraulic Jumps & River Surges	Spillway & Stilling Basin	Quiz #5
11	Design Project Presentations	Report Writing Tutorial	Design Project Presentations
12	Industry Guest Lecture	Tutorials for the Final Exam	Review of Old Final Exams

5.2 Other Important Dates

- ***Monday*, January 11,** Classes commence
- ***Monday*, February 15,** Winter Break -- NO CLASSES SCHEDULED THIS WEEK
- ***Friday*, April 2,** Holiday – NO CLASSES SCHEDULED – classes rescheduled to Monday, April 12
- ***Monday*, April 12,** Classes rescheduled from Friday, April 2, Classes conclude.

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6 Assessments

6.1 Assessment Details

Bi-Weekly Lecture Quizzes – Top 4 quiz marks will count (worth 5% each) (20%)
Date: Weeks 2, 4, 6, 8, and 10 on CourseLink.
Learning Outcome: 1, 2

- **WEEK 2:** Lecture Quiz #1, Thursday, January 21, 2021, during your lecture;
- **WEEK 4**: Lecture Quiz #2, Thursday, February 4, 2021, during your lecture;
- **WEEK 6**: Lecture Quiz #3, Thursday, February 25, 2021, during your lecture;
- **WEEK 8**: Lecture Quiz #4, Thursday, March 11, 2021, during your lecture;
- **WEEK 10**: Lecture Quiz #5, Thursday, March 25, 2021, during your lecture.

Each lecture quiz will include five arithmetic type questions, one mark each, and are available on CourseLink. The solutions must be within the error tolerance limit of +/- 5% of the correct answer to get the one mark (no part marks). The parameters in each question are randomly selected by CourseLink within acceptable ranges such that each student will get a unique question. The order of the questions are randomly shuffled and moving backward through questions is not allowed. *A camera* is required *for your* exam so the *proctor* is able to monitor *your testing* environment. Your camera must be on during the quizzes to allow the instructors to proctor the test.

Design Proposal Presentations (Week 5, Tues & Thur), 11:30AM - 12:50PM, AD-S, Room Virtual (10%)
Learning Outcome: 3
Four randomly selected groups will present on Tuesday, February 9th and the remaining four groups will present on Thursday February 11, 2021. However, all groups must submit a copy of their presentation on CourseLink dropbox by Monday February 8th, before midnight. Late submissions will get 2% per hour penalty.

Four 3-Minute Reflection Videos (worth 5% each) (20%)
Date: Weeks 3, 6, and 9, submit on CourseLink dropbox.
Learning Outcome: 2
You are required to submit four video assignments, each with a maximum length of 3 minutes. **Anything beyond 3 minutes will not be listened to and will not be counted toward your grade**. For each video assignment, you are asked to identify three themes you have noted from the course contents during the preceding weeks, and explain how you understand these fundamental concepts using the course materials. Please state your name and student ID at the very beginning of your recording. Each 3-minute video is worth 5% for a total of 20% for this activity. **You will be graded based on the following criteria**:

1. the clarity of your presentation of the three themes you have noted
2. the ways in which you are able to connect these themes to the course materials (make sure you cite the course materials)

3. the completeness of your response based on what you could/should have learned through the course materials

The extent to which your recording demonstrates a degree of thoughtfulness and fluency in what you are saying – your recording should not be read (please don't write out your recording and then read it). You should be speaking freely although you can have notes in front of you to make sure you maintain a clear and meaningful structure. The due dates are as follows:

- **WEEK 3**: 3-min video #1, Sunday, Jan. 31, any time before midnight;
- **WEEK 6**: 3-min video #2, Sunday, Feb. 28, any time before midnight;
- **WEEK 9**: 3-min video #3, Sunday, Mar. 21, any time before midnight;
- **WEEK 12**: 3-min video #4, Sunday, Apr. 11, any time before midnight.

Late submissions will have a 2% penalty per hour (i.e. if you submit 12 hours late the grade will be multiplied by 0.76).

Design Project Presentations (Week 11, Tues & Thur), 11:30AM - 12:50PM, AD-S, Room Virtual (10%)

Learning Outcome: 3, 5

Four randomly selected groups will present on Tuesday, March 30th and the remaining four groups will present on Thursday April 1, 2021. However, all groups must submit a copy of their presentation on CourseLink dropbox by Monday March 29th, before midnight. Late submissions will get 2% per hour penalty.

Design Project Final Report - due Monday, April 12, 2021, by 11:59 PM, submit on CourseLink dropbox (20%)

Learning Outcome: 1, 2, 3, 5

In this course, your instructor will be using Turnitin, integrated with the CourseLink Dropbox tool, to detect possible plagiarism, unauthorized collaboration or copying as part of the ongoing efforts to maintain academic integrity at the University of Guelph. All submitted reports will be included as source documents in the Turnitin.com reference database solely for the purpose of detecting plagiarism of such reports. Use of the Turnitin.com service is subject to the Usage Policy posted on the Turnitin.com site. Accounts are available to students on Turnitin to help with the editing of their submissions to ensure that plagiarism did not take place. Late submissions will have a 2% penalty per hour (i.e. if you submit 12 hours late the grade will be multiplied by 0.76).

Final Exam - Friday April 23, 2021 - Start Time: 11:30 am, AD-S, Room Virtual. (20%)

Learning Outcome: 1, 2

6.2 Design Projects

The design projects will be completed in groups of three or four students. Students will begin to self-enroll into pre-defined groups (Groups #1 to 8) within the first week of the classes and

the instructor reserves the right to re-assign group members as students add/drop the course to ensure the number of students in all groups are balanced. Each group will be required to present their design project proposal (in week 5) and the design project solution (in week 11) to the class and be prepared to defend their design solution with regards to safety, economic, social, and environmental considerations. An electronic copy (pdf) of the final design report must be submitted on CourseLink on Monday, April 12, 2021, before midnight. Late submissions will receive 2% per hour penalty.

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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 Bi-Weekly Lecture Quizzes: You have 5 chances to write and the top 4 lecture quizzes would count. However, if you miss more than one of the quizzes due to grounds for granting academic consideration or religious accommodation, the weight of the missed quiz will be added to the final exam.

Final Design Report: An electronic copy (pdf) of the final design report must be submitted on CourseLink due on Monday, April 12, 2021, before midnight. Late submissions will receive 2% per hour penalty.

Grade Dispute: If a student feels that a Pesentation, Design Report, Assignment, or a Quiz was graded unfairly, or if there is an error in the grading, it should be brought to the attention of the Instructor by email within one week after the grade is posted on CourseLink. Scores will not be reconsidered beyond this period.

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.
