



# ENGG\*4250 Watershed Systems Design

01

Winter 2022

Section(s): C01

School of Engineering

Credit Weight: 0.75

Version 1.00 - January 06, 2022

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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 02:30PM - 03:50PM MCKN, Room 309

Thursday 02:30PM - 03:50PM MCKN, Room 309

**Labs:**

Wednesday 10:30AM - 12:20PM THRN, Room 1002

## 1.4 Final Exam

Date: Thursday, April 21, 2022 - Start Time: 11:30 am.

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

<b>Instructor:</b>	Bahram Gharabaghi , Ph.D., P.Eng.
<b>Email:</b>	bgharaba@uoguelph.ca
<b>Telephone:</b>	+1-519-824-4120 x58451
<b>Office:</b>	THRN 2417
<b>Office Hours:</b>	TBA on CourseLink and by appointment

### 2.2 Teaching Assistants

<b>Teaching Assistant (GTA):</b>	Cody Kupferschmidt
<b>Email:</b>	kupfersc@uoguelph.ca

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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.

### 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	1, 4
2.1	Formulate a problem statement in engineering and non-engineering terminology	1, 4
2.2	Identify, organize and justify appropriate information, including assumptions	1, 4
2.3	Construct a conceptual framework and select an appropriate solution approach	1, 4
2.4	Execute an engineering solution	1, 4

#	Outcome	Learning Outcome
2.5	Critique and appraise solution approach and results	1, 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	1, 4, 5
4.1	Describe design process used to develop design solution	1, 4, 5
4.2	Construct design-specific problem statements including the definition of criteria and constraints	1, 4, 5
4.3	Create a variety of engineering design solutions	1, 4, 5
4.4	Evaluate alternative design solutions based on problem definition	1, 4, 5
4.5	Develop and refine an engineering design solution, through techniques such as iteration, simulation and/or prototyping	1, 4, 5
5	Use of Engineering Tools	1, 4, 5
5.1	Select appropriate engineering tools from various alternatives	1, 4, 5
5.2	Demonstrate proficiency in the application of selected engineering tools	1, 4, 5
5.3	Recognize limitations of selected engineering tools	1, 4, 5
6	Individual & Teamwork	1
6.1	Describe principles of team dynamics and leadership	1
6.2	Understand all members' roles and responsibilities within a team	1
6.3	Execute and adapt individual role to promote team success through, for example, timeliness, respect, positive attitude	1
6.4	Apply strategies to mitigate and/or resolve conflicts	1
6.5	Demonstrate leadership through, for example, influencing team vision and process, promoting a positive team culture, and inspiring team members to excel	1

#	Outcome	Learning Outcome
7	Communication Skills	1, 4, 5
7.1	Identify key message(s) and intended audience in verbal or written communication as both sender and receiver	1, 4, 5
7.2	Interpret technical documentation such as device specification sheets, drawings, diagrams, flowcharts, and pseudocode	1, 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	1, 4, 5
7.4	Substantiate claims by building evidence-based arguments and integrating effective figures, tables, equations, and/or references	1, 4, 5
7.5	Demonstrate ability to process oral and written communication by following instructions, actively listening, incorporating feedback, and formulating meaningful questions	1, 4, 5
8	Professionalism	1
8.1	Demonstrate an understanding of what it means to be a professional engineer and distinguish between legislated and non-legislated professions	1
8.2	Effectively describe engineering law and its impact on professional engineering practice	1
8.3	Demonstrate professional behaviour	1
9	Impact of Engineering on Society and the Environment	1, 3, 4
9.1	Analyze the safety, social, environmental, and legal aspects of engineering activity	1, 3, 4
9.2	Evaluate the uncertainties and risks associated with engineering activities	1, 3, 4
9.3	Anticipate the positive and negative impacts of introducing innovative technologies to solve engineering problems	1, 3, 4
11	Economics and Project Management	1
11.1	Apply project management techniques and manage resources within identified constraints	1
11.2	Identify risk and change management techniques, in the context of effective	1

#	Outcome	Learning Outcome
	project management	
11.3	Estimate economic impact and feasibility of an engineering project or design using techniques such as cost benefit analysis over the life of the project or design	1
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

Topics:

Week	Tuesday Lecture	Wednesday Lab	Thursday Lecture
1	Course Outline	Flow Duration Curve	Uniform Flows
2	Flood Routing	Flood Routing	Climate Change
3	Gradually Varied Flows	Water Surface	Gradually Varied
4	Measurement Devices	HEC RAS Tutorial 1	Erodible Channels
5	Proposal Presentations	HEC RAS Tutorial 2	Proposal Present

6	Channel Transitions	Fish Ladder Design	Term Test 1
7	Erodible Channels	Erodible Channels	Erodible Channels
8	Spillway Design	Hydro Power	Review of Old Tests
9	Design of Culverts	Culvert Design	Design of Culverts
10	Hydraulic Jumps	Spillway Design	Stilling Basins
11	Project Presentations	Report Writing	Project Presentations
12	Industry Guest Lecture	Tutorials	Review of Old Exams

#### Weeks 4 and 8

##### Topics:

##### Two 3-Minute Reflection Video Assignments

##### Learning Outcome: 1, 2

You are required to submit two course learning outcome reflection video assignments, each with a maximum length of 3 minutes. You can use your cellphone to record your video and upload to Course link in .mov or .mp4 formats. **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. The first video assignment (**due on Sunday, Feb. 6th**, any time before midnight submitted to the assignment drop box) covering the course contents from preceding weeks. The second recording (**due on Sunday, March 20th**, any time before midnight submitted to the assignment drop box). 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 10% for this activity. One percent per-hour late submission penalty will apply. **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 (i.e. don't write out your recording

and then read it). You should be speaking freely and look at the camera (this is not a podcast).

## 5.2 Lab

**Topics:** Group Design Projects

The design projects will be completed in groups of three (occasionally two) students. Students will begin to self-enroll into pre-defined groups (Groups #1 to 6) 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. 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. An electronic copy (pdf) of the final design report must be submitted on CourseLink on Friday, April 8, 2022, before midnight. Late submissions will receive 2% per hour penalty.

## 5.3 Other Important Dates

<https://calendar.uoguelph.ca/undergraduate-calendar/schedule-dates/winter-semester/>

### Monday, January 10

- Classes commence

### Friday, February 18

- Winter Break begins at end of classes this day

### Monday, February 21

- Winter Break -- **No Classes Scheduled This Week**
- Holiday

### Monday, February 28

- Winter Break ends and classes resume

### Friday, March 11

- 40<sup>th</sup> class day. Instructors have provided



feedback on a min of 20% of final course grade

### Friday, April 8

- Classes conclude
- Last day to drop W22 one-semester courses and F21/W22 two-semester courses
- Last day to apply online for the Credit/No Credit grading option for eligible W22 elective courses

## 6 Assessments

### 6.1 Marking Schemes & Distributions

Name	Weight (%)
Individual 3-min Reflection Video 1 (Week 4)	10
Group Proposal Presentation (Week 5)	10
Term Test 1 (Week 6)	10
Individual 3-min Reflection Video 2 (Week 9)	10
Term Test 2 (Week 10)	10
Group Final Project Presentation (Week 11)	10
Final Project Report (Week 12)	20
Final Exam (April 21st)	20
<b>Total</b>	<b>100</b>

## 6.2 Assessment Details

### Individual 3-min Reflection Video 1 (10%)

**Date:** Week 4, Submit on CourseLink Drop Box

**Learning Outcome:** 3

### Group Project Proposal Presentation (10%)

**Date:** Week 5, In Class

**Learning Outcome:** 3

### Term Test 1 (10%)

**Date:** Week 6, In Class (Thursday Lecture)

**Learning Outcome:** 2

### Individual 3-min Reflection Video 2 (10%)

**Date:** Week 9, Submit on CourseLink Drop Box

**Learning Outcome:** 3

### Term Test 2 (10%)

**Date:** Week 10, In Class (Thursday Lecture)

**Learning Outcome:** 2

### Final Project Presentation (10%)

**Date:** Week 11, In Class

**Learning Outcome:** 3

### Final Project Report (20%)

**Date:** Week 12, Submit on CourseLink Drop Box

**Learning Outcome:** 1, 2, 3, 4, 5

### Final Exam (20%)

**Date:** Thu, Apr 21

**Learning Outcome:** 1, 2

## 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 at the start of the semester to make alternate arrangements. See the undergraduate calendar for more detail on this topic: <http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml>

**Missed Term Tests:** If you miss any of the Term Tests due to grounds for granting academic consideration or religious accommodation, the weight of the missed tests will be added to the final exam.

**Grade Dispute:** If a student feels a Presentation, a Report, or a Term Test 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 make a booking at least 14 days in advance, and no later than November 1 (fall), March 1 (winter) or July 1 (summer). Similarly, new or changed accommodations for online quizzes, tests and exams must be approved at least a week ahead of time.

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, changes in classroom protocols, and academic schedules. Any such changes will be announced via CourseLink and/or class email.

This includes on-campus scheduling during the semester, mid-terms and final examination schedules. 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

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g.. final exam or major assignment).

## 9.11 Covid-19 Safety Protocols

For information on current safety protocols, follow these links:

- <https://news.uoguelph.ca/return-to-campus/how-u-of-g-is-preparing-for-your-safe-return/>
- <https://news.uoguelph.ca/return-to-campus/spaces/#ClassroomSpaces>

Please note, these guidelines may be updated as required in response to evolving University, Public Health or government directives.

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