Syllabus

Instructors: Bruce MacVicar, bmacvicar@uwaterloo.ca

Course Assistants: Mahkameh Taheri (mahkameh.taheri@uwaterloo.ca)
Simon Lin (gmlin@uwaterloo.ca)
Lamisa Malik (l6malik@uwaterloo.ca)

Calendar Description: Introduction to the water cycle, flood frequency analysis, and design storms. Analysis of hydrographs and rainfall-runoff response mechanisms in urban and natural systems. Mass continuity and water budgets at the watershed scale. Impact of land use change on hydrologic response. Quantification and measurement of discharge in channels and pipes, subcritical and supercritical flow regimes. Dynamic forces on submerged structures and flow/scour beneath bridges. Erosion and sedimentation issues in rivers and reservoirs.

Course Overview and Learning Objectives:

Civil and environmental engineers are often tasked with finding, moving, controlling, and protecting our freshwater resources. A solid understanding of surface and subsurface hydrology and open channel flow is needed to estimate flood risk, design urban drainage systems, manage water supplies, and a number of other tasks required by municipal, provincial and federal governments. The objectives of this course are to introduce you to theoretical and practical aspects of hydrological phenomena in the atmosphere, biosphere, and subsurface; learn how to interpret hydrological data; model water resource systems; and design simple hydraulic structures.

When the course is completed you should be able to:

1) Explain the physics of key hydrologic processes and be able to distinguish and prioritize their role in distributing water on the land surface
2) Apply the continuity equation to simple routing and budgeting problems
3) Develop design rainfall hyetographs and streamflow hydrographs for watersheds; conduct flood-frequency analysis
4) Be able to predict streamflow given rainfall and watershed characteristics
5) Be able to quantify the effect of land use changes on streamflow
6) Understand the role of channels (stream and rivers) in land drainage and conveyance of sediment;
7) Determine the normal depth/discharge of flow in an open channel;
8) Determine the force on objects submerged in flowing water; and
9) Determine alternate and sequent depths in channels and use these concepts to design elements such as weirs, gates, and constrictions.
10) Sketch a water surface profile for a channel with changes in slope, control structures, and changes in roughness/geometry.

Software: The course will be entirely on-line this term. As such we are dependent on software to make it work. We will use a combination of software to distribute the notes and assignments, run the classes, and mark your assignments. We will use the following:

Learn – basic course organization, major announcements, distribution of notes, assignments, and quizzes, mark record keeping

Teams – scheduling, synchronous video lectures (and storage of recorded videos through Microsoft Stream), other meetings

Piazza – Q&A. Will be embedded as an app in Teams

Crowdmark – For handing in, marking and receiving feedback on assignments and quizzes

Online synchronous lectures:

Tuesday 1:00 – 2:00 Microsoft Teams*
Thursday 1:00 – 2:00 Microsoft Teams*

All lecture sessions will be recorded and posted with the captioning service on. I will turn the video recording off and on periodically to create short segments so that you can review it by sub-unit.

*for issues with access to Waterloo learning technologies from China, please see: uwaterloo.ca/keep-learning/access-waterloo-learning-technologies-china

Tutorials: Tuesday 2:00 – 2:20 Microsoft Teams*
Thursday 2:00 – 2:20 Microsoft Teams*
These 20 min tutorials will occur immediately following the lecture. Similar to the synchronous lectures they will be recorded and posted with the captioning service on. We will turn the video off and back on for each problem so that they are saved individually.

Office hours: TBA. What works?

Assignment/Quiz Day: Thursday (coordinated with other 3A CIVE and 3B GEOE course instructors). Assignments are due by 5 pm EST. We will use Crowdmark for this course.

Course Notes: Powerpoint slides for each week will be posted Monday morning on the course Learn site. The slides are designed to be nearly complete. Compared to a 'regular' set of notes, the 'Covid Special' notes have many more popups that emphasize the key points, and many of the problems have been set up with animations to roll out with a series of notes and equations so you can take a self-guided approach. In the synchronous time period I will still go over the main points, but I have scheduled an hour instead of 80 min for the lectures because the expectation is that some things are faster with this format.

Text: Water Resources Engineering 3rd ed., Chin, D., Pearson, 2013 (Recommended). You can get this eText version of this book for only $59.99! https://www.pearson.com/store/p/water-resources-engineering/P100000195783. This is an incredible deal for an authoritative reference that will be useful for other courses including ENVE 383 and CIVE 583.

Course Grading Scheme:

ELEMENT	DESCRIPTION	#	VALUE (%
ASSIGNMENTS	Assignments with 1 week or more to complete	4	4 x 6 = 24
LABS	Precipitation monitoring and Hydraulic Jump in a Sink Experiments	2	2x10 = 20
QUIZZES	2 x 1.25 hour timed open-book quizzes (+0.25 hour for upload)	2	2x14 = 28
FINAL TEST	2.5 hour exam (+0.5 hour for upload)	1	1X28 = 28

Assignments: There will be 4 homework assignments distributed throughout the course. All assignments are due at 5 pm on the due date. Assignments which are less than 2 days late will be accepted with a 15% late penalty per day. Assignments more than 2 days late without what is deemed by the instructor to be a legitimate excuse will receive no marks.

Assignments must be well-organized, neat, and legible. They should be organized such that someone can check your work and understand your solution. Messy, incomprehensible work may not be graded.

You will be asked to upload your assignments as a set of pdfs or images to Crowdmark. For best results you should use a scanner or a scanning app for your phone such as Adobe Scan (free app, works great, I use it all the time). Poor quality scans or images will not be accepted. We will practice the procedure with a test assignment.

Labs: Two laboratory assignments will be assigned during the term. All assignments are due at 5 pm on the due date. Assignments which are less than 2 days late will be accepted with a 15% late penalty per day. Assignments more than 2 days late without what is deemed by the instructor to be a legitimate excuse will receive no marks.

Assignments must be well-organized, neat, and legible. They should be engineering report quality.

Outside sources, including from the textbook, reputable online sources, or other appropriate sources must be cited. The quality of your source will also be graded (i.e. textbooks, academic journals, and government documents are considered good sources. Unverified posts in social media or in unaffiliated websites are poor sources). If you are in doubt, contact your instructor.

The submission procedure for labs will be the same as for assignments.

Quizzes: The quizzes will be fixed-time quizzes on our designated assessment day (Thursday). The duration of the quiz will be 90 minutes. The quizzes will be designed to be completed in 75 minutes, with the additional 15 minutes to allow for download and submission. Late penalties will be assessed at 5% per minute unless there is technical reason for the late submission.

Quizzes are open book in the sense that you may consult your textbook, course notes, and materials posted in the course LEARN/Teams site. Use of any other

resource (including file-sharing services) is prohibited. You may not communicate directly or indirectly with any person except the course instructor during the quizzes.

If you are unable to write the quizzes on the assigned date for a legitimate reason, you must self-declare your illness using the form on Quest. For this term you are not required to visit a doctor or get a VIF form signed. ***If the self-declaration form is not completed prior to the quiz, a grade of 0 will be assigned***.

Academic Units (AUs)

MATHEMATICS AUS	NATURAL SCIENCES	COMPLEMENTARY STUDIES	ENGINEERING SCIENCE	ENGINEERING DESIGN
0	11	0	22	11

In-class Activities and Tentative Schedule:

The course the following schedule for in-class material, strongly recommended supplemental reading, and assessments.

WEEK	DATE	TOPIC	READING	ASSESSMENT
1	Jan 12, 14	Intro to Water Resource Engineering	9.1	
2	Jan 19, 21	Rainfall	8.2, 9.2,10.3	
3	Jan 26, 28	Infiltration/Percolation	9.3,14.2	
4	Feb 2, 4	Runoff	9.3	A1 (Feb 4)
5	Feb 9, 11	Hydrograph Analysis	9.4	Q1 (Feb 11)
	Feb 15-19	Winter Break		
6	Feb 23-25	Channels in watersheds	Charlton Ch 1,2,3	
7	Mar 2, 4	Flow measurement and resistance: Uniform flow concepts	4.2, 5.2.2	Assign 2 (Mar 4)
8	Mar 9, 11	Sub and supercritical flow: specific energy concepts	4.2.3	Quiz 2 (Mar 11)
9	Mar 18, 23 (mini break Mar 15 & 16)	Changes in geometry: specific energy concepts and design of weirs	4.2, 7.3, 7.4,	
10	Mar 25, 30	Hydraulic jumps and forces on submerged objects: momentum concepts and design of gates	4.2.2, 7.5	Assign 3 (Mar 25)
11	Apr 1, 6	Putting it all together – sketching water surface profiles	4.3.1, 4.3.2	
12	Apr 8, 13	Everything we missed (likely no class on the 13th)		Assign 4 (Apr 8)
EXAM WEEK				Final Test (Weeks 7-12)

Class Policies

Academic Integrity: Academic integrity is expected from all students and all students are expected to know what that means. Students who are unsure what constitutes an academic offence should take the Academic Integrity Tutorial (https://uwaterloo.ca/library/get-assignment-and-research-help/academic-integrity/academic-integrity-tutorial). For information on various offences and penalties, you should refer to Policy 71 – Student Discipline.

Grievance: A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70, Student Petitions and Grievances, Section 4, www.adm.uwaterloo.ca/infosec/Policies/policy70.htm. When in doubt, please be certain to contact the department's administrative assistant who will provide further assistance.

Discipline: A student is expected to know what constitutes academic integrity [www.uwaterloo.ca/academicintegrity/] to avoid committing an academic offence, and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (e.g., plagiarism, cheating) or about "rules" for group work/collaboration should seek guidance from the course instructor, academic advisor, or the undergraduate Associate Dean. For information on categories of offences and types of penalties, students should refer to Policy 71, Student Discipline, adm.uwaterloo.ca/infosec/Policies/policy71.htm. For typical penalties check Guidelines for the Assessment of Penalties, www.adm.uwaterloo.ca/infosec/guidelines/penaltyguidelines.htm .

Appeals: A decision made or penalty imposed under Policy 70 (Student Petitions and Grievances) (other than a petition) or Policy 71 (Student Discipline) may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72 (Student Appeals) www.adm.uwaterloo.ca/infosec/Policies/policy72.htm.