Civil Engineering
CIVENG 4SM4
Stormwater Management Modeling and Analysis
Winter 2024

Instructor Information

Yiping Guo
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Office Hours:
Thursdays 1:30 PM to 3:30 PM

Course Information

Lectures: MoWeTh 10:30 AM to 11:20 AM
Tutorials: We 12:30 PM to 2:20 PM

Course Dates: 01/08/2024 - 04/10/2024
Units: 4.00
Course Delivery Mode: In Person
Course Description: The course introduces various structural and non-structural stormwater management measures. The design and performance of some of the structural stormwater management measures are examined in detail. Modeling and analyses conducted for the planning, design and operation of stormwater management systems are the focus of this course. Three lectures, one tutorial (two hours); one term Prerequisite(s): CIVENG 3B03

Important Links

- Mosaic

- Avenue to Learn
- Student Accessibility Services - Accommodations
- McMaster University Library
- eReserves

Course Learning Outcomes

- understand why both stormwater quantity and quality control are required, to be aware of and understand the working principles of both structural and non-structural stormwater control measures. Learn the design of stormwater management systems using best management practices (BMPs) and low impact development techniques (LIDs). Understand why watershed planning is needed for the properly design of BMPs and LIDs. Understand why continuous simulation and design storm modelling are both required to better quantify the performance of BMPs and LIDs, also gain a basic understanding of the alternative analytical probabilistic modelling approach.

Required Materials and Texts

Textbook Listing: https://textbooks.mcmaster.ca

There is no required text for this course. However, the following optional course materials are recommended.

Optional Course Materials

Textbook Listing: https://textbooks.mcmaster.ca

Urban Hydrology, Hydraulics, and Stormwater Quality: Engineering Applications and Computer Modeling
ISBN: 0-471-43158-3
Authors: A. Osman Akan and Robert J. Houghtalen
Publisher: John Wiley & Sons, Inc.

Publication Date: 2003

Green Stormwater Infrastructure: Fundamentals and Design
ISBN: 978-1-118-59019-5
Authors: A. P. Davis, W. F. Hunt, and R. G. Traver
Publisher: John Wiley & Sons, Inc.
Publication Date: 2022

Class Format

In Person

Course Evaluation

Five Assignments 20%

One Project 30%, (For graduate students, Two projects 15% each.)

Final Exam 50%

Grading Scale

Grade	Equivalent Grade Point	Equivalent Percentages
A+	12	90-100
A	11	85-89
A-	10	80-84
B+	9	77-79
B	8	73-76
B-	7	70-72
C+	6	67-69
C	5	63-66
C-	4	60-62
D+	3	57-59
D	2	53-56

Grade	Equivalent Grade Point	Equivalent Percentages
D-	1	50-52
F	0	0-49

Course Schedule

Week 1: Introduction to Stormwater Management – Water quantity and quality impacts of urbanization, erosion, nutrient and pesticide/herbicide problems; structural and non-structural stormwater management measures, urban and agricultural BMPs, philosophy of modern stormwater management.

Assignment 1: Review “Understanding Stormwater Management: An Introduction to Stormwater Management Planning and Design” and provide written answers to related questions.

Due Date: Due in one week, submitted at the beginning of Week 2’s lecture.

Week 2: Low-Impact Development – Various types of low-impact development (LID) practices and their hydrologic design and performances, green infrastructure.

Assignment 2: Review literature about the design criteria of one type of end-of-pipe stormwater control measures and one type of LIDs and prepare a presentation type summary. Due Date: Summaries are due in 4 weeks.

Week 3: The Watershed Approach to Stormwater Management and Brief Review of Urban Drainage Systems, watershed hydrologic models.

Project: Use of LID TTT, SWMM, HEC-HMS, or APSWM for the design of flood control detention ponds.

Due Date: Due in 9 weeks, project reports should be submitted at the beginning of Week 12’s class.

Week 4: Urban Hydrology – Point rainfall, IDF curves, design storm concept, meteorological data analysis, temporal distribution of design storms, duration of design storms, continuous simulation.

Assignment 3: Rainfall analysis, design storm construction.

Due Date: Due in 2 weeks, calculation results should be submitted at the beginning of Week 6's class.

Week 5: Urban Hydrology – urban catchments, rainfall-runoff transformation over urban catchments, infiltration modeling, Horton infiltration model, Green-Ampt infiltration model, NRCS curve numbers.

Week 6: Urban Hydrology – overland flow modeling, unit hydrograph method, synthetic unit hydrographs.

Week 7: Urban Hydrology – channel flow routing, hydrologic and hydraulic routing methods.

Week 8: Detention pond design, single event and continuous simulations – Flood control objectives, flood control detention pond design, water quality control, water quality control detention pond design, advantages of continuous simulation.

Week 9: Bioretention cell and other structural LID systems' design, water quality control design storm, storages provided by bioretention cells.

Project (for graduate students only): Use analytical equations coded in spreadsheets to determine the runoff reduction ratios provided by a selected number of structural LID systems.

Due Date: Due in 3 weeks.

Week 10: Storm Event Based Rainfall Analysis and Introduction to the Analytical Probabilistic Approach – Drawbacks of the design storm approach, moving-window versus storm event-based analysis, event characteristics, exponential distributions, Gumbel distribution, derived probability distribution theory.

Assignment 4: Event-based probabilistic rainfall description.

Due Date: Due in 2 weeks, calculation results should be submitted at the beginning of Week 12's class.

Week 11: Analytical Probabilistic Rainfall-Runoff Model – Analytical expressions for the probability distributions of runoff event volume and peak discharge.

Assignment 5: Review the two basic papers related to APSWM and answer related questions.

Due Date: Due in 2 weeks, written answers should be submitted at the beginning of Week 13's class.

Week 12: Analytical Probabilistic Models for Detention Pond Design – Flood control detention pond and water quality control detention pond design.

Week 13: Applications of the Analytical Probabilistic Models for Large and Discretized Catchments as well as LID designs.

Late Assignments

Late submission of assignments and project reports are usually not accepted except under extreme circumstances. No penalty will be given if the student can present a legitimate reason.

Generative AI: Use Prohibited

Students are not permitted to use generative AI in this course. In alignment with McMaster academic integrity policy, it "shall be an offence knowingly to … submit academic work for assessment that was purchased or acquired from another source". This includes work created by generative AI tools. Also state in the policy is the following, "Contract Cheating is the act of "outsourcing of student work to third parties" (Lancaster & Clarke, 2016, p. 639) with or without payment." Using Generative AI tools is a form of contract cheating. Charges of academic dishonesty will be brought forward to the Office of Academic Integrity.

Generative AI: Some Use Permitted

Example One

Students may use generative AI in this course in accordance with the guidelines outlined for each assessment, and so long as the use of generative AI is referenced and cited following citation instructions given in the syllabus. Use of generative AI outside assessment guidelines or without citation will constitute academic dishonesty. It is the

student's responsibility to be clear on the limitations for use for each assessment and to be clear on the expectations for citation and reference and to do so appropriately.

Example Two

Students may use generative AI for [editing/translating/outlining/brainstorming/revising/etc] their work throughout the course so long as the use of generative AI is referenced and cited following citation instructions given in the syllabus. Use of generative AI outside the stated use of [editing/translating/outlining/brainstorming/revising/etc] without citation will constitute academic dishonesty. It is the student's responsibility to be clear on the limitations for use and to be clear on the expectations for citation and reference and to do so appropriately.

Example Three

Students may freely use generative AI in this course so long as the use of generative AI is referenced and cited following citation instructions given in the syllabus. Use of generative AI outside assessment guidelines or without citation will constitute academic dishonesty. It is the student's responsibility to be clear on the expectations for citation and reference and to do so appropriately.

APPROVED ADVISORY STATEMENTS

Academic Integrity

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity. **It is your responsibility to understand what constitutes academic dishonesty.**

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at https://secretariat.mcmaster.ca/university-policies-proceduresguidelines/

The following illustrates only three forms of academic dishonesty:

- plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
- improper collaboration in group work.
- copying or using unauthorized aids in tests and examinations.

Authenticity / Plagiarism

Some courses may use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. Avenue to Learn, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software. **All submitted work is subject to normal verification that standards of academic integrity have been upheld** (e.g., on-line search, other software, etc.). For more details about McMaster's use of Turnitin.com please go to www.mcmaster.ca/academicintegrity.

Courses with an On-line Element

Some courses may use on-line elements (e.g. e-mail, Avenue to Learn, LearnLink, web pages, capa, Moodle, ThinkingCap, etc.). Students should be aware that, when they access the electronic components of a course using these elements, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in a course that uses on-line elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course instructor.

Online Proctoring

Some courses may use online proctoring software for tests and exams. This software may require students to turn on their video camera, present identification, monitor and record their computer activities, and/or lock/restrict their browser or other applications/software during tests or exams. This software may be required to be installed before the test/exam begins.

Conduct Expectations

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities. These expectations are described in the Code of Student Rights & Responsibilities (the "Code"). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, **whether in person or online.**

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g. use of Avenue 2 Learn, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students' access to these platforms.

Academic Accommodation of Students with Disabilities

Students with disabilities who require academic accommodation must contact Student Accessibility Services (SAS) at 905-525-9140 ext. 28652 or sas@mcmaster.ca to make arrangements with a Program Coordinator. For further information, consult McMaster University's Academic Accommodation of Students with Disabilities policy.

Academic Advising

For any academic inquires please reach out to the Office of the Associate Dean (Academic) in Engineering located in JHE-Hatch 301.

Details on academic supports and contact information are available from:

https://www.eng.mcmaster.ca/programs/academic-advising

Requests for Relief for Missed Academic Term Work

In the event of an absence for medical or other reasons, students should review and follow the Policy on Requests for Relief for Missed Academic Term Work.

Academic Accommodation for Religious, Indigenous, or Spiritual Observances (RISO)

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students should submit their request to their Faculty Office ***normally within 10 working days*** of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

Copyright and Recording

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, **including lectures** by University instructors.

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

Extreme Circumstances

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, Avenue to Learn and/or McMaster email.