This course applies the principles of hydraulics and hydrology in the design of municipal water systems and introduces the student to design and analysis tools that are used in practice. The general objectives are for the student to become able to:

- apply knowledge of hydrology and statistics to describe rainfall events;
- use appropriate models to quantify the volume and rate of runoff resulting from rainfall events;
- use current methods to design stormwater drainage structures;
- recognize the effect of urbanization on stormwater runoff and design effective measures to mitigate this impact;
- use stormwater computer models effectively as part of the design process;
- understand municipal water distribution systems;
- improve communication skills by documenting design decisions in coherent and legible design calculations;
- recognize the need for life-long learning to keep abreast of new design and construction methods, enhance one’s abilities as a designer, and maintain one’s professional competence.

**Calendar Copy:**
Application of hydraulics and hydrology in design of water-related municipal systems. Topics include municipal water requirements and waste volumes; surface and ground water supplies; water treatment, transportation and distribution; sewerage, drainage and flood control. 0.5 Course.

**Contact Hours:**
2 lecture hours/week; 2 tutorial hours/week.
Attendance at the tutorial session is mandatory

**Prequisites:**
CEE 2224

**Corequisites:**
None

**Antirequisite:**
None

**Note:** It is the student's responsibility to ensure that all Prerequisite and Corequisite conditions are met or that special permission to waive these requirements has been granted by the Faculty. It is also the student's responsibility to ensure that they have not taken a course listed as an Antirequisite. The student may be dropped from the course or not given credit for the course towards their degree if they violate the Prerequisite, Corequisite or Antirequisite conditions.

**Instructor:**
Professor Jon Southen, P.Eng.; SEB 3116; jsouthen@uwo.ca
Textbook:
Class notes and other pertinent material will be made available via the course website (http://owl.uwo.ca).

Other References:

Stormwater Management Planning and Design Manual, Ontario Ministry of the Environment and Climate Change


Low Impact Development Stormwater Management Planning And Design Guide

Computing:
Students are required to use personal computers running a Windows environment. Assignments may require the use of stormwater modelling programs:
PCSWMM (https://www.pcswwm.com/)
EPA-SWMM (http://www.epa.gov/water-research/storm-water-management-model-swmm)
OTTHYMO (https://civi.ca/visualotthymo-single-and-continuos-events/)

Units:
Both SI and US units will be used in lectures and examinations

Specific Learning Objectives:
1. Hydrologic Modelling
   • Define watershed characteristics (Area, length, slope, soil characteristics, land use, channel geomorphology, travel time)
   • Develop a unit-hyetograph for a watershed
   • Apply the Intensity-Duration-Frequency curve of rain
   • Develop a design storm of given frequency, duration and cumulative rain distribution
   • Use infiltration models to calculate the component of rain that contributes to runoff

2. Rainfall Excess, Open-Channel Flow and Runoff Rates in Urban Watersheds
   • Investigate the hydraulics of open-channel and overland flow
   • Determine the run-off coefficients and time of concentrations of drainage areas
   • Apply the unit hydrograph method to calculate runoff hydrographs at the outlet of a watershed
   • Apply the rational method to calculate peak flows in storm sewers
3. Design of Stormwater Drainage Structures
   • Design drainage structures for street pavements
   • Design storm sewers
   • Design culverts
   • Design open channels for surface drainage

4. Storm Water Management
   • Recognize the detrimental effect of urban development on the quality and quantity of water released into streams and lakes.
   • Compare pre-development and post-development discharge hydrographs
   • Carry out flood routing calculations
   • Design a detention facility to manage stormwater quantity

5. Stormwater Pollution and Stormwater Quality Control
   • Use models to estimate stormwater quality
   • Design detention facilities and other methods of stormwater quality control
   • Recognize appropriate best management practices for stormwater quality

6. Stormwater Computer Modelling
   • Become familiar with current stormwater management models
   • Use these models in the design of stormwater management systems

7. Water Distribution
   • Estimate the population and water demand for a municipality
   • Determine average-day, maximum-day and max-hour water demands
   • Calculate working storage, emergency storage and fire-fighting storage requirements
   • Identify the components of a municipal water supply system and their design capacities
   • Learn about the type of pumps used in the water industry and their hydraulic behaviour
   • Analyse flow and pressure in a pipe network, which has reservoirs and pumps

The instructor may modify course material as appropriate.

**General Learning Objectives**

E=Evaluate, T=Teach, I=Introduce (Advanced Level)

<table>
<thead>
<tr>
<th>Knowledge Base</th>
<th>E</th>
<th>Engineering Tools</th>
<th>E</th>
<th>Impact on Society</th>
<th>I</th>
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<tbody>
<tr>
<td>Problem Analysis</td>
<td>T</td>
<td>Team Work</td>
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<td>Ethics and Equity</td>
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<td>Investigation</td>
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<td>Communication</td>
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<td>Economics and Project Management</td>
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<tr>
<td>Design</td>
<td>E</td>
<td>Professionalism</td>
<td>I</td>
<td>Life-Long Learning</td>
<td>T</td>
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</tbody>
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page 3 of 11
**Evaluation:**

The final course mark will be determined as follows:

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<thead>
<tr>
<th>Component</th>
<th>Weightage</th>
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<tbody>
<tr>
<td>Participation</td>
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</tr>
<tr>
<td>Assignments</td>
<td>20%</td>
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<tr>
<td>Tests</td>
<td>20%</td>
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<tr>
<td>Final examination</td>
<td>50%</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
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</tbody>
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**Note:**

(a) **Students must pass the final examination to pass this course.** Students who fail the final examination will be assigned the aggregate mark, as determined above, or 48%, whichever is less.

(b) **Students who have failed this course previously must repeat all components of the course.** No special permissions will be granted enabling a student to retain laboratory, assignment or test marks from previous years. Previously completed assignments and laboratories cannot be resubmitted.

(c) Should any of the quizzes conflict with a religious holiday that a student wishes to observe, the student must inform the instructor of the conflict no later than two weeks before the scheduled test.

(For further information on Accommodations for Religious Holidays see [http://www.uwo.ca/univsec/handbook/appeals/accommodation_religious.pdf](http://www.uwo.ca/univsec/handbook/appeals/accommodation_religious.pdf))

1. **Quizzes and Examinations:**

Two 60 minute quizzes will be held during tutorial periods, tentatively scheduled on February 13 and March 19. Both quizzes and the final examination will be **OPEN BOOK, and programmable calculators are permitted.**

2. **Weekly Assignments**

Problems and assignments will be discussed during the tutorial hours. Weekly assignments must be submitted for marking by the deadline specified to the locker location indicated in class. Late submissions will be assigned a mark of zero unless an extension has been negotiated in advance with the instructor.

3. **Use of English**

In accordance with Senate and Faculty Policy, students may be penalised up to 10% of the marks on all assignments, tests, and examinations for the improper use of English. Additionally, poorly written work with the exception of the final examination may be returned without grading. If resubmission of the work is permitted, it may be graded with marks deducted for poor English and/or late submission.
Plagiarism Checking:
The University of Western Ontario uses software for plagiarism checking. Students may be required to submit reports in electronic form to Turnitin.com for plagiarism checking.

Cheating:
University policy states that cheating is a scholastic offence. The commission of a scholastic offence is attended by academic penalties that might include expulsion from the program. If you are caught cheating, there will be no second warning.

For more information on scholastic offenses, please see:
http://www.uwo.ca/univsec/handbook/appeals/scholastic_discipline_undergrad.pdf

Attendance:
Any student who, in the opinion of the instructor, is absent too frequently from class, laboratory, or tutorial periods will be reported to the Dean (after due warning has been given). On the recommendation of the Department concerned, and with the permission of the Dean, the student will be debarred from taking the regular final examination in the course.

Accessibility:
Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.

Conduct:
Students are expected to arrive at lectures on time, and to conduct themselves during class in a professional and respectful manner that is not disruptive to others. Late comers may be asked to wait outside the classroom until being invited in by the Instructor. Please turn off your cell phone before coming to a class, tutorial, quiz or exam.

On the premises of the University or at a University-sponsored program, students must abide by the Student Code of Conduct: http://www.uwo.ca/univsec/board/code.pdf
**Sickness and Other Problems:**
Students should immediately consult with the Instructor or Department Chair if they have any problems that could affect their performance in the course. Where appropriate, the problems should be documented (see attached). The student should seek advice from the Instructor or Department Chair regarding how best to deal with the problem. Failure to notify the Instructor or Department Chair immediately (or as soon as possible thereafter) will have a negative effect on any appeal.

For more information concerning medical accommodations, please see: http://www.uwo.ca/univsec/handbook/appeals/accommodation_medical.pdf

**Notice:**
Students are responsible for regularly checking their email, course website (https://owl.uwo.ca) and notices posted outside the Civil and Environmental Engineering Department Office

**Consultation:**
Students are encouraged to discuss problems with their teaching assistant and/or instructor in tutorial sessions. Office hours will be arranged for the students to see the instructor and teaching assistants. Other individual consultation can be arranged by appointment with the appropriate instructor.

**Course breakdown:**
Engineering Science = 25% ; Engineering design = 75%
INSTRUCTIONS FOR STUDENTS UNABLE TO WRITE TESTS OR EXAMINATIONS OR SUBMIT ASSIGNMENTS AS SCHEDULED

If, on medical or compassionate grounds, you are unable to write term tests or final examinations or complete course work by the due date, you should follow the instructions listed below. You should understand that academic relief will not be granted automatically on request. You must demonstrate to your department (or the Undergraduate Services Office) that there are compelling medical or compassionate grounds that can be documented before academic relief will be considered. Different regulations apply to term tests, final examinations and late assignments. Please read the instructions carefully.

NEW: Requests for Academic Consideration using the Self-Reported Absence Form

If you experience an unexpected illness or injury or an extenuating circumstance (48 hours or less) that is sufficiently severe to temporarily render you unable to meet academic requirements (e.g., attending lectures or labs, writing tests or midterm exams, completing and submitting assignments, participating in presentations) you should self-declare using the online Self-Reported Absence portal. This option should be used in situations where you expect to resume academic responsibilities within 48 hours or less.

Each student will be allowed a maximum of two self-reported absences between September and April and one self-reported absence between May and August. Self-reporting may not be used for final exams or assessments (e.g. midterm exams, tests, reports, presentations, or essays) worth more than 30% of any given course.

For full instructions about the Self-Reporting System refer to the Academic Calendar link here.

A. GENERAL REGULATIONS & PROCEDURES (other than self-reported absences)

1. All first year students will report to the Undergraduate Services Office, SEB 2097, for all instances.

2. If you are an upper year student and you are missing a test/assignment/lab or examination that is worth LESS THAN 10% of your mark, you should report to your department office to request relief. If your course work is worth MORE THAN 10% of your final grade, you will report to the Undergraduate Services Office, SEB 2097.

3. Check the course outline to see if the instructor has a policy for missed tests, examinations, late assignments or attendance.

4. Documentation must be provided as soon as possible. If no one is available in your department office or the Undergraduate Services Office, leave a message clearly stating your name & student number and reason for your call. The department telephone numbers are given at the end of these instructions.

5. If you decide to write a test or an examination you should be prepared to accept the mark you earn. Rewriting tests or examinations or having the value of a test or examination reweighted on a retroactive basis is not permitted.

B. TERM/MIDTERM TESTS (other than self-reported absences)
1. If you are in first year and you are unable to write a midterm/term test, contact the Undergraduate Services Office, SEB 2097 PRIOR to the scheduled date of the test.

2. If you are an upper year student and you are unable to write a midterm/term test, inform your instructor PRIOR to the scheduled date of the test. If the instructor is not available, leave a message for him/her at the department office. If the test is worth LESS THAN 10% of your mark, you should report to your department office to request relief. If the test is worth MORE THAN 10% of your final grade you will report to the Undergraduate Services Office, SEB 2097 to request relief.

3. Be prepared to provide supporting documentation to the Department Chair and/or the Undergraduate Services Office (see next page for information on documentation).

4. Discuss with the instructor if and when the test can be rescheduled. N.B. The approval of the Chair or the Undergraduate Services Office is required when rescheduling midterm/term tests.

C. **FINAL EXAMINATIONS** *(cannot be self-reported)*

1. If you are unable to write a final examination, contact the Undergraduate Services Office PRIOR TO THE SCHEDULED EXAMINATION TIME to request permission to write a Special Final Examination. If no one is available in the Undergraduate Services Office, leave a message **clearly** stating your name & student number.

2. Be prepared to provide the Undergraduate Services Office with supporting documentation (see next page for information on documentation) the next day, or as soon as possible (in cases where students are hospitalized). The following circumstances are not considered grounds for missing a final examination or requesting special examinations: common cold, headache, sleeping in, misreading timetable and travel arrangements.

3. In order to receive permission to write a Special Examination, you **must** obtain the approval of the Chair of the Department and the Associate Dean and in order to apply you **must** sign a "Recommendation for a Special Examination Form" available in the Undergraduate Services Office. The Undergraduate Services Office will then notify the course instructor(s) and reschedule the examination on your behalf.

    **PLEASE NOTE:** It is the student's responsibility to check the date, time and location of the Special Examination.

D. **LATE ASSIGNMENTS**

1. Advise the instructor if you are having problems completing the assignment on time (prior to the due date of the assignment).

2. Be prepared to provide documentation if requested by the instructor (see reverse side for information on documentation).

3. If you are granted an extension, establish a due date. The approval of the Chair of your Department (or the Assistant Dean, First Year Studies, if you are in first year) is not required if assignments will be completed prior to the last day of classes.

4. i) Extensions beyond the end of classes must have the consent of the instructor, the department Chair and the Associate Dean, Undergraduate Studies. Documentation is mandatory.

   ii) A Recommendation of Incomplete Form must be filled out indicating the work to be completed and the date by which it is due. This form must be signed by the student, the instructor, the department Chair and the Associate Dean, Undergraduate Studies.
E. SHORT ABSENCES

If you miss a class due to a minor illness or other problem, check your course outlines for information regarding attendance requirements and make sure you are not missing a test, laboratory or assignment. Cover any readings and arrange to borrow notes from a classmate.

F. EXTENDED ABSENCES

If you are absent more than one week or if you get too far behind to catch up, you should consider reducing your workload by dropping one or more courses. (Note drop deadlines listed below). You are strongly encouraged to seek advice from your Academic Counsellor in the Undergraduate Services Office.

G. DOCUMENTATION

If you consulted an off-campus doctor or Student Health Services regarding your illness or personal problem, you must provide the doctor with a Student Medical Certificate to complete at the time of your visit and then bring it to the Department (or the Undergraduate Services Office). This note must contain the following information: severity of illness, effect on academic studies and duration of absence. Regular doctor’s notes will not be accepted; only the Student Medical Certificate will be accepted.

In Case of Serious Illness of a Family Member: Provide a Student Medical Certificate to your family member's physician to complete and bring it to the Department (or the Undergraduate Services Office if you are in first year).

In Case of a Death: Obtain a copy of the death certificate or the notice provided by the funeral director's office. You must include your relationship to the deceased and bring it to the Department (or the Undergraduate Services Office if you are in first year).

For Other Extenuating Circumstances: If you are not sure what documentation to provide, ask the Departmental Office (or the Undergraduate Services Office if you are in first year) for direction.

Note: Forged notes and certificates will be dealt with severely. To submit a forged document is a scholastic offence (see below).

H. ACADEMIC CONCERNS

1. You need to know if your instructors have a policy on late penalties, missed tests, etc. This information may be included on the course outlines. If not, ask your instructor(s).

2. You should also be aware of attendance requirements in some courses. You can be debarred from writing the final examination if your attendance is not satisfactory.

3. If you are in academic difficulty, check out the minimum requirements for progression in the calendar. If in doubt, see your Academic Counsellor.

Calendar References: Check these regulations in your 2019 Western Academic Calendar available at www.westerncalendar.uwo.ca.
Self-Reporting Absences
Absences Due to Illness
Academic Accommodations for Students with Disabilities
Academic Accommodations for Religious or Holy Days
Course Withdrawals
Examinations
Scheduling of Term Assignments
Scholastic Offences
Student Medical Certificate
Engineering Academic Regulations

**Note:** These instructions apply to all students registered in the Faculty of Engineering regardless of whether the courses are offered by the Faculty of Engineering or other faculties in the University.

**Add Deadlines:**
- First term half course (i.e. “A” or “F”)  
  - September 13, 2019
- Full courses and full-year half course (i.e. “E”, “Y” or no suffix)  
  - September 13, 2019
- Second term half course (i.e. “B” or “G”)  
  - January 14, 2020

**Drop Deadlines:**
- First term half course (i.e. “A” or “F”)  
  - November 12, 2019
- Full courses and full-year half courses (i.e. “E”, “Y” or no suffix)  
  - November 30, 2019
- Second term half or second term full course (i.e. “B” or “G”)  
  - March 7, 2020

**Contact Information:**
- Undergraduate Services Office: SEB 2097 Phone: 519-661-2130 E-mail: engugrad@uwo.ca
- Chemical & Green Process Engineering: TEB 477 Phone: 519-661-2131 E-mail: cbeugrad@uwo.ca
- Civil Engineering: SEB 3005 Phone: 519-661-2139 E-mail: civil@uwo.ca
- Computer, Electrical, Mechatronic Systems & Software Engineering TEB 279 Phone: 519-661-3758 E-mail: eceugrad@uwo.ca
- Integrated Engineering ACEB 2410 Phone: 519-661-6725 E-mail: engceli@uwo.ca
- Mechanical Engineering: SEB 3002 Phone: 519-661-4122 E-mail: mmeundergraduate@uwo.ca

Revised 08/01/19