



ENGG*4360 Soil-Water Conservation Systems

Design

01

Fall 2023

Section(s): C01

School of Engineering

Credit Weight: 0.75

Version 2.00 - September 20, 2023

1 Course Details

1.1 Calendar Description

Properties of soils and land use governing the occurrence and magnitude of overland flow, soil erosion, infiltration, percolation of soil water, and variations in soil water storage. Design of soil and water management systems and structures to control soil erosion and protect water quality for environmentally and economically sustainable land use planning. Design of surface and subsurface drainage systems for rural land. Design of sprinkler and trickle irrigation systems.

Pre-Requisites:

ENGG*2230, ENGG*3650, ENGG*3670

Restrictions:

Non-BENG students may take a maximum of 4.00 ENGG credits.

1.2 Timetable

Lectures:

Tuesday	1:00 PM - 2:20 PM	MCKN 307
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Thursday	1:00 PM - 2:20 PM	MCKN 307
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Laboratory:

Monday	9:30 AM - 11:20 PM	MCKN 059
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1.3 Final Exam

There is no Final exam for this course.

2 Instructional Support

2.1 Instructional Support Team

Instructor:	Prasad Daggupati Ph.D.
Email:	pdaggupa@uoguelph.ca
Telephone:	+1-519-824-4120 x58303
Office:	THRN 3523
Office Hours:	Monday 11:30 AM to 12:30 PM or by appointment

3 Learning Resources

3.1 Required Resources

Course Website (Website)

<https://courselink.uoguelph.ca>

Course material, news, announcements, and grades (except final) will be regularly posted to the ENGG*4360 Course link site. You are responsible for checking the site regularly.

Textbook (Textbook)

No text book is available to cover the entire course content. To alleviate this problem, Course notes (prepared by Dr. Rudra, professor at the School of Engineering) are available at a nominal cost. These notes cover the course material in point form, so some of the sentences may not be grammatically complete. These notes are not organized according to the sequence of lectures. They do not replace the book. For detailed descriptions of various topics, the following books are available on the reserve desk in the library.

3.2 Recommended Resources

Soil & Water Conservation Engineering (Textbook)

Authors: Rodney L. Huffman; Delmar D. Fangmeier; William J. Elliot; Stephen R. Workman

Publisher: American Society of Agricultural Engineers

Year: 2013.

Edition: 7th Edition

ISBN - 13: 978-1892769862

Engineering Hydrology for Natural Resources Engineers (Textbook)**Authors:** Ernest W. Tollner**Publisher:** Wiley-Blackwell**Year:** 2016**Edition:** 2nd edition**ISBN - 13:** 978-1118928721**Drainage Engineering (Textbook)****Authors:** James N. Luthin**Publisher:** Krieger Pub Co**Year:** 1978**ISBN - 13:** 9780882755786

3.3 Additional Resources

Lecture Information (Notes)

Material is covered in lectures, with emphasis on the application of agronomic, economic, engineering, environmental, hydraulic and hydrologic principles to farmland and water conservation problems. The laboratory periods require the student to quantitatively analyze farmland and water conservation problems and to specify performance characteristics and components for some sample systems.

Assignments and Projects (Other)

Download the Assignments and projects according to the schedule given in this handout.

3.4 Communication & Email Policy

Please use lectures and lab help sessions as your main opportunity to ask questions about the course. Major announcements will be posted to the course website. **It is your responsibility to check the course website regularly.** As per university regulations, all students are required to check their <uoguelph.ca> e-mail and courselink accounts regularly: e-mail and courselink are the official route of communication between the University and its student

4 Learning Outcomes

This is a design course in soil and water conservation engineering, which is a core course in most water resources engineering programs. The main goals of the course are to teach

students the design concepts in soil and water conservation engineering, including soil erosion, farm drainage, and irrigation systems.

4.1 Course Learning Outcomes

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

1. Develop an analytical approach to the application of design fundamentals in farm soil and water conservation problems.
2. Analyse the hydrologic, soil and crop resources affecting the design of soil and water conservation systems.
3. Identify the drainage and irrigation requirements and soil loss for given climatic, topographic, soil and crop conditions.
4. Assess the technical, economic and environmental feasibility of installing soil and water conservation systems in given situation.
5. Apply principles of hydraulics to the design of soil and water conservation facilities.
6. Concisely and articulately communicate quantitative specifications for farm soil and water conservation systems.

4.2 Engineers Canada - Graduate Attributes (2018)

Successfully completing this course will contribute to the following:

#	Outcome	Learning Outcome
1	Knowledge Base	1
1.4	Recall, describe and apply program-specific engineering principles and concepts	1
2	Problem Analysis	2
2.2	Identify, organize and justify appropriate information, including assumptions	2
2.3	Construct a conceptual framework and select an appropriate solution approach	2
2.4	Execute an engineering solution	2
3	Investigation	3
3.3	Analyze and interpret experimental data	3
3.4	Assess validity of conclusions within limitations of data and methodologies	3
4	Design	4, 5
4.1	Describe design process used to develop design solution	4, 5

#	Outcome	Learning Outcome
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	1, 4
5.1	Select appropriate engineering tools from various alternatives	1
5.2	Demonstrate proficiency in the application of selected engineering tools	4
7	Communication Skills	6
7.4	Substantiate claims by building evidence-based arguments and integrating effective figures, tables, equations, and/or references	6
7.5	Demonstrate ability to process oral and written communication by following instructions, actively listening, incorporating feedback, and formulating meaningful questions	6
9	Impact of Engineering on Society and the Environment	4
9.1	Analyze the safety, social, environmental, and legal aspects of engineering activity	4
9.3	Anticipate the positive and negative impacts of introducing innovative technologies to solve engineering problems	4
11	Economics and Project Management	4
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	4
12	Life Long Learning	4
12.3	Demonstrate capability for continuous knowledge and skill development in a changing world	4

4.3 Relationships with other Courses & Labs

Previous Courses:

- **ENGG*2230 Fluid Mechanics**
- **ENGG*3650 Hydrology**
- **ENGG*3670 Soil Mechanics**

The fundamentals of fluid mechanics covered in ENGG2230, soil and water principles covered in ENGG3670, and hydrology covered in ENGG3650, are applied for the design of soil and water conservation systems (this course).

Follow-on Courses:

- **ENGG*4150**

5 Teaching and Learning Activities

5.1 Lecture

Week 1

Topics: Introduction & outline of the subject

Week 2

Topics: Statics and dynamics of soil water. Types of soil water and their relationship to soil and water conservation. Soil water, methods of measurements and limitations (LO1, LO2)

Week 3

Topics: Hydraulic properties of soils. Flow of water into and through soils. Runoff and infiltration, methods of determination infiltration (LO1, LO2)

Week 4

Topics: Methods of estimation of runoff. Review of basic hydraulics,

Soil and water conservation principles. Design of grassed waterways and open channels (LO1, LO2)

Week 5

Topics: Tools for prediction of soil erosion. Universal Soil Loss Equation (USLE) and Revised Universal Soil Loss Equation (RUSLE). Cost-benefit analysis. Soil erosion by water. Type of erosion. Classification of processes of soil erosion by water. Factors affecting soil erosion by water. Tools for prediction of water erosion (LO1, LO2, LO4, LO5)

Week 6

Topics: Management and control of soil erosion. Design of terrace system. Drainage principles, necessity and benefits. Subsurface drainage theory. depth and spacing of drains (LO1, LO2, LO4, LO5)

Week 7

Topics: Drainage design factors and drainage investigations. Size of drain pipe. Estimation of drainage requirements. Surface drainage systems (LO1, LO2, LO3,LO4)

Week 8

Topics: Surface drainage systems. Subsurface drainage systems. Comprehensive drainage system planning and layout. Subsurface drainage accessories (LO1,LO2,LO3,LO4,LO5)

Week 9

Topics: Subsurface drainage accessories, inlets and outlets. Special drainage problems. Drainage problems in Ontario. Drainage improvement needs in Canada (LO3, LO4)

Week 10

Topics: Concept of irrigation. Irrigation in humid areas. Estimation of irrigation requirement. Estimation of evapotranspiration. Irrigation efficiencies. Sources of irrigation water (LO1, LO2, LO3)

Week 11

Topics: Methods of irrigation. Irrigation system planning. Sprinkler or trickle irrigation, advantages and limitations. (LO1, LO3, LO4)

Week 12

Topics: Design of sprinkler or trickle irrigation systems. (LO1, LO3, LO4)

Week 13

Topics: Presentation of soil and water conservation project. Summary and Review (LO1, LO3, LO4)

5.2 Schedule and Description of Group Assignments:

1. **Soil Water Concept:** Preliminary investigations of the feasibility of drainage and irrigation using statics and dynamics of soil water (LO1, LO2, LO3, LO6, LO7)
2. **Infiltration and Runoff:** Estimation of runoff (volume and rate) for the design of soil and water conservation systems for a specific soil and land use conditions (LO2, LO6, LO7)
3. **Design of Open Channel Waterway (Surface Drainage Systems):** Design of open channels (surface drainage ditches or lined irrigation channels) for water management and grassed waterways for erosion control (LO2, LO5, LO6, LO7)
4. **Design of Soil Erosion Control Systems:** Estimation of soil loss for a specific site (climatic region, land use, soil type, and complex topography), and selection of best management practice to reduce soil loss within the acceptable limit (LO2, LO4, LO6, LO7)
5. **Design of Subsurface (Tile) Drainage Systems:** Design of subsurface drainage system (depth and spacing of pipe drains) including cost analysis for a given soil and crop conditions (LO2, LO5, LO6, LO7)
6. **Design of Irrigation Systems (Sprinkler/Trickle):** Design of an efficient and economical sprinkler (solid set and portable set or travelling gun sprinkler) or trickle irrigation system. Details include estimation of irrigation requirements, and design and specification of all major components of the system (pipe, sprinklers or emitters, valves, fittings, pump, etc.) and cost analysis (LO1, LO3, LO6, LO7)

5.3 Schedule and Description of Final Project

Soil and Water Conservation Project: Design of a complete soil and water conservation

system for a subwatershed considering environmental and institutional constraints. Details include hydrologic computations, design of surface drainage, subsurface drainage and erosion control systems with detailed specification and layout of all major components (LO1, LO2, LO3, LO4, LO5, LO6, LO7)

5.4 Other Important Dates

Monday, October 9, 2023: Holiday--NO CLASSES SCHEDULED

Tuesday, October 10, 2023: Holiday--NO CLASSES SCHEDULED

Thursday, November 30, 2023: Classes rescheduled from Tuesday, October 10

Friday, December 1, 2023: Classes rescheduled from Monday, October 9

6 Assessments

6.1 Marking Schemes & Distributions

Name	Scheme A (%)
Weekly or Bi Weekly Assignments	30
Final Project	30
Two Tests	40
Total	100

6.2 Assessment Details

Weekly or Bi Weekly Assignments (30%)

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

Groups of two students must be formed before September 15th, 2023. There will be 6 assignments in the course (see section 5.2). **Each assignment will be introduced and discussed in the lab (Mondays). The assignment report is due one week after assigned. Each assignment weighs 5%.** It is essential to stay up to date with assignments (especially one to five) to complete the final project and be successful on the two tests. More information will be provided in the class/lab and will be posted to the CourseLink.

Final Project (30%)

Learning Outcome: 1, 2, 3, 4, 5, 6

The final project will be introduced in the lab on October 24th. Project presentations will be on Monday, November 27. The final report is also due on November 27. See further instructions on CourseLink and in class. The project **presentation will be 5% of the grade and the project report will be 25%**. More information will be provided in class prior and will be posted to the CourseLink.

Two Tests (40%)**Learning Outcome:** 1, 2, 3, 5

There will be two tests held during the lab period (Fridays). The first test will be on October 16th and the second test will be on November 20th. Tests weigh **40% of the final grade** (Each Test weighs 20% of the grade).

Tests weigh 40% of the final grade (Each Test weighs 20% of the grade).

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 contact the course instructor. See the undergraduate calendar for information on regulations and procedures for Academic Consideration: <https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/academic-consideration-appeals-petitions/>

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: <https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/academic-accommodation-religious-obligations/>

Missed Term Tests: If you miss one of the Term Tests due to grounds for granting academic consideration or religious accommodation, the weight of the missed test will be added to the Test 2.

Passing grade: The overall passing grade for this course is 50%. Students must also achieve a 50% or greater mark on the individual components of the course (group assignments, final project, and term tests) to pass the course.

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 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).
