# ENGG*4360 Soil-Water Conservation Systems Design

Fall 2018
Section(s): C01

School of Engineering
Credit Weight: 0.75
Version 1.00 - September 05, 2018

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# 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-Requisite(s):** ENGG*2230, ENGG*3650, ENGG*3670

## 1.2 Timetable

**Lectures**:

| | | |
|---|---|---|
| Monday | 8:30 AM - 9:50 AM | MCKN 234 |
| Friday | 8:30 AM - 9:50 AM | MCKN 234 |

**Laboratory:**

| | | |
|---|---|---|
| Thursday | 12:30 PM - 14:20 PM | MKN 236 |

## 1.3 Final Exam

There is no Final exam for this course.

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# 2 Instructional Support

## 2.1 Instructor(s)

**Prasad Daggupati Ph.D.**
**Email:** pdaggupa@uoguelph.ca
**Telephone:** +1-519-824-4120 x58303
**Office:** THRN 3523
**Office Hours:** Friday 10:30 AM to 12:30 PM or by appointment

## 2.2 Teaching Assistant(s)

**Teaching Assistant:** Taranjot Singh Brar
**Email:** taranjot@uoguelph.ca

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# 3 Learning Resources

## 3.1 Required Resource(s)

**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 School of Engineering) is 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 sequence of lectures. They do not replace the book. For detailed description of various topics following books are available on the reserve desk in the library.

## 3.2 Recommended Resource(s)

**Soil & Water Conservation Engineering (Textbook)**
Guffman, R. L., D, D. Fangmeier, W. J. Elliot and S. R. Workman. 2013. 7th Edition.

**Drainage Engineering (Textbook)**
Luthin, J. N. 1978. Robert Krieger Co., New York, U.S.A

## 3.3 Additional Resource(s)

**Lecture Information (Notes)**
Material is covered in lectures, with emphasis on the application of agronomic, economic, engineering, environmental, hydraulic and hydrologic principles to farm land and water conservation problems. The laboratory calculations periods require the student to quantitatively analyse farm land and water conservation problem solutions and to specify performance characteristics and components for some sample systems.

**Projects (Other)**
Download the 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

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# 4 Learning Outcomes

This course is a design course in soil and water conservation engineering, which is a core course in most water resources engineering program. The main goals of the course are (1) 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 Set Name | Course 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 |

| # | Outcome Set Name | Course Learning Outcome |
|---|---|---|
| 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 |
| 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 |
| 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 fundamental 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

**Follow-on Courses:**

- ENGG*4150

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# 5 Teaching and Learning Activities

## 5.1 Lecture

**Week 1**

**Topic(s):** Introduction & outline of the subject. Statics and dynamic of soil water. Types of soil water and their relationship to soil and water conservation. Soil water, methods of measurements and limitations

**Week 2**

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

**Week 3**

**Topic(s):** Methods of estimation of runoff. Review of basic hydraulics, Soil and water conservation principles. Design of grassed waterways and open channels (LO1, LO2)

**Week 4**

**Topic(s):** 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)

**Week 5**

**Topic(s):** Tools for prediction of soil erosion. Universal Soil Loss Equation (USLE) and Revised Universal Soil Loss Equation (RUSLE) (LO1, LO2, LO4, LO5)

**Week 6**

**Topic(s):** 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**

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

**Week 8**

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

**Week 9**

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

**Week 10**

**Topic(s):** 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**

**Topic(s):** Methods of irrigation. Irrigation system planning. Sprinkler or trickle irrigation, advantages and limitations. Design of sprinkler or trickle irrigation systems (LO1, LO3, LO4)

**Week 12**

**Topic(s):** Design of sprinkler or trickle irrigation system. Presentation of soil and water conservation project. Summary and Review (LO1, LO3, LO4)

## 5.2 Schedule and Description of Projects:

1. 1. **Soil Water Concept:** Preliminary investigations of the feasibility of drainage and irrigation using static 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 with in 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 s given soil and crop conditions (LO2, LO5, LO6, LO7)
   6. **Soil and Water Conservation Project (Final Project):** Design of a complete soil and water conservation system for two lots at a given site considering environmental and institutional constraints of the site (Provincial Laws such as Drainage Act). Details include hydrologic computations, design of surface drainage, subsurface

drainage and erosion control systems with detailed specification and layout (profile of surface drains, layout of pipe drains, laterals, mains, inlets and outlets etc.) of all major components (LO1, LO2, LO3, LO4, LO5, LO6, LO7)

7. **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 Other Important Dates

**Monday, October 8, 2018:** Thanksgiving Day, No Classes

**Tuesday, October 9, 2018:** Study Day, No Classes

**Friday, November 2, 2018:** 40$^{th}$ Class Day - Last day to drop classes

**Thursday, November 29, 2018:** Make up for Study Day (Tuesday Schedule)

**Friday, November 30, 2018:** Make up for Thanksgiving Day (Monday Schedule)

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# 6 Assessments

## 6.1 Marking Schemes & Distributions

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

## 6.2 Assessment Details

**Weekly or Bi Weekly Projects (30%)**

Project groups of two or three students must be formed before the start of the lab period which is on Thursday, September 13th. There will be seven projects in the course (see section 5.2). Six of them are class projects and one is a final project. The final project is discussed in

the next section. Each class project will be introduced and discussed in the lab (Thursday's) and step-by-step instructions will also be provided to successfully finish the class project. The project report for the class projects is due one week after assigned. **Each class project weighs 5%.** It is essential to stay up to date with projects (especially one to five) to complete in the final project and be successful on the two tests. More information will be provided in the lab and will be posted to the Courselink.

**Final Project (30%)**

The final project will be introduced in the lab on October 25th. Project presentations will be on Friday, November 30. The final report is also due on Friday, November 30. See further instructions on CourseLink and in class. **Project presentation will be 5% of the grade and project report will be 25%.** More information will be provided in class prior and will be posted to the Courselink.

**Two Tests (40%)**

There will be two tests held during the lab period (Thursdays). The first test will be on October 11th and the second test will be on November 15th. T**ests weigh 40% of the final grade.** However, if you do better in one test than the other, then the better test will be given more weightage as indicated below:

$T = (0.6HT + 0.4LT)$

## 6.3 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://www.uoguelph.ca/registrar/calendars/undergraduate/2016-2017/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 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: http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml\

The passing grade for this course is 50%.

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# 7 School of Engineering Statements

## 7.1 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.

## 7.2 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.

## 7.3 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.

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# 8 University Statements

## 8.1 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.

## 8.2 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 regulations and procedures for Academic Consideration are detailed in the Undergraduate Calendar.

## 8.3 Drop Date

Courses that are one semester long must be dropped by the end of the fortieth class day; two-semester courses must be dropped by the last day of the add period in the second semester. The regulations and procedures for Dropping Courses are available in the Undergraduate Calendar.

## 8.4 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.

## 8.5 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 book their exams at least 7 days in advance, and not later than the 40th Class Day.

More information: www.uoguelph.ca/sas

## 8.6 Academic Misconduct

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 discourages misconduct. 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.

The Academic Misconduct Policy is detailed in the Undergraduate Calendar.

## 8.7 Recording of Materials

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

## 8.8 Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs.

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