School of Engineering
University of Guelph

ENGG*4360 Soil-Water Conservation Systems Design

Course Description & Outlines - Fall 2010

Calendar Description

Properties of soil 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 water management systems and structures to control soil erosion and protect water quality for environmentally and economically land use planning. Design of surface and subsurface drainage systems for rural land. Design of sprinkler/trickle irrigation systems.

Prerequisites

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

Instructor

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Office Hours: Open Door Policy

Class Time & Locations

Lecture	Monday	-	09:30 - 10:20 - Room 308, MACK (MacKinnon)
	Wednesday	-	09:30 - 10:20 - Room 308, MACK (MacKinnon)
	Friday	-	09:30 - 10:20 - Room 308 MACK (MacKinnon)
Lab	Wednesday	-	13:30 - 15:20 - Room 317, MACK (MacKinnon)

Text Book

No text book is available to cover the entire course content. To alleviate this problem I have prepared class notes, which 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 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.

Schwab, G. O., D, D. Fangmeier, W. J. Elliot and R. K. Frevert. 1993. **Soil & Water Conservation Engineering.** 4th Edition. John Wiley & Sons, Toronto.

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

James, Larry, G. **Principles of Farm Irrigation System Design**. John Wiley & Sons, Toronto.

Course Objectives

By the end of the term, the successful students will have demonstrated ability 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. Write quantitative specifications for farm soil and water conservation systems.

Methods of Presentation

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.

Methods of Evaluation

A student must pass sum of all quizzes in order to pass the course. Any student failing quiz sum will receive sum of quizzes marks as the marks for the course. For student passing the quiz sum the final grades will be determined using the following scheme:

Weekly or Bi-weekly Projects (4 or 5)	25%
Soil & Water Conservation Project	30%
Tests	45%

Disclaimer: *The instructor reserves the right to change any or all of the above in the event of appropriate circumstances, subject to University of Guelph Academic Regulations*.

Course Description

Week	Subject
1	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.
2	Hydraulic properties of soils. Flow of water into and through soils. Runoff and infiltration, methods of determination infiltration..
3	Methods of estimation of runoff. Review of basic hydraulics, Soil and water conservation principles. Design of grassed waterways and open channels.
4	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.
5	Tools for prediction of soil erosion. Universal Soil Loss Equation (USLE) and Revised Universal Soil Loss Equation (RUSLE).
6	Management and control of soil erosion. Design of terrace system. Drainage principles, necessity and benefits. Subsurface drainage theory. depth and spacing of drains.
7	Drainage design factors and drainage investigations. Size of drain pipe. Estimation of drainage requirements. Surface drainage systems.
8	Surface drainage systems. Subsurface drainage systems. Comprehensive drainage system planning and layout. Subsurface drainage accessories.
9	Subsurface drainage accessories, inlets and outlets. Special drainage problems. Drainage problems in Ontario. Drainage improvement needs in Canada.
10	Concept of irrigation. Irrigation in humid areas. Estimation of irrigation requirement. Estimation of evapotranspiration. Irrigation efficiencies.. Sources of irrigation water.
11.	Methods of irrigation. Irrigation system planning. Sprinkler or trickle irrigation, advantages and limitations. Design of sprinkler or trickle irrigation systems.
12.	Design of sprinkler or trickle irrigation system. Presentation of soil and water conservation project. Summary and Review.

List of Laboratory Projects

1 Soil Water Concept

2 Infiltration and Runoff

3 Design of Open Channel Waterway (Surface Drainage Systems)

4 Design of Soil Erosion Control Systems

5 Design of Subsurface (Tile) Drainage Systems

6 Soil and Water Conservation Project

7 Design of Irrigation Systems (Sprinkler/Trickle)

Every student is required to do projects #4, #6 and #7 (#4 and #7 in a group of 2 students and #6 in a group of 3 or 4 students); and any 3 projects from #1, #2, #3 and #5 (in a group of 2 students). Minor changes can be made in this arrangement depending upon the progress of the course.

You are encouraged to discuss the project with the instructor and with members of the class but copying is not allowed. Copying is similar to plagiarism in that it involves the appropriation of others' work as one's own. It includes copying in whole or in part another's test or examination answer(s), laboratory report, essay, or other assignment. Copying also includes submitting the same work, research or assignment for credit on more than one occasion in two or more courses, or in the same course, without the prior written permission of the instructor(s) in all courses involved (including courses taken at other post-secondary institutions

University Policy on Academic Misconduct

Academic misconduct, such as plagiarism, is a serious offence at the University of Guelph. Please consult the Undergraduate Calendar 2010-2011 and School of Engineering programs guide, for offences, penalties and procedures relating to academic misconduct.
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

Brief Description of Laboratory Projects

1. **Soil Water Concept**
   Preliminary investigations of the feasibility of drainage and irrigation using static and dynamics of soil water.

2. **Infiltration-Runoff**
   Estimation of runoff (volume and rate) for the design of soil and water conservation systems for a specific soil and land use conditions.

3. **Design of Grassed Waterway (Surface Drainage Systems)**
   Design of open channels (surface drainage ditches or lined irrigation channels) for water management and grassed waterways for erosion control.

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.

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.

6. **Soil and Water Conservation System Design 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.

7. **Estimation of irrigation requirements (Evapotranspiration). 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.

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Schedule of Assignments, Projects & Tests

Week	Assignment/Project	Test
1	1[1]	-
2	2[1]	-
3	3[2]	-
4	4[2]	1
5	-	-
6	5[1]	-
7	6[3]	-
8	-	2
9	-	-
10	7[2]	-
11	-	3
12	-	Project Presentation

[1] Group project (any three projects, two students per group).

[2] Group project, two students per group.

[3] Group project, three or four students per group