ENGG*4360 Soil and Water Conservation System Design

Fall 2014

UNIVERSITY of GUELPH

School of Engineering

Revised: August 26, 2014

1. INSTRUCTIONAL SUPPORT

1.1 Instructor

Instructor: Ramesh Rudra, Ph.D., P.Eng.
Office: THRN 2343, ext. 52110
Email: rrudra@uoguelph.ca
Office hours: Open door policy or by appointment

1.2. Teaching Assistants

None

1.3. LAB ASSISTANTS

NONE

2 LEARNING RESOURCES

2.1 Course Website

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

2.2 Required Resources

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.

2.3 Recommended Resources

1. Schwab, G. O., D, D. Fangmeier, W. J. Elliot and R. K. Frevert. 1993. Soil & Water Conservation Engineering. 4th Edition. John Wiley & Sons, Toronto.
2. Luthin, J. N. 1978. Drainage Engineering. Robert Krieger Co., New York, U.S.A
3. James, Larry, G. Principles of Farm Irrigation System Design. John Wiley & Sons, Toronto.

2.4 Additional Resources

Lecture Information: 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: Download the projects according to the schedule given in this handout.

2.5. 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 <mail.uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its student

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3. Assessment

A student must pass sum of all tests in order to pass the course. Any student failing test sum will receive sum of tests marks as the marks for the course. For student passing the quiz sum the final grades will be determined using the following scheme: Further if you do better in one test than the other then the better test will be given more weightage and worst test will be given the less weightage. The final grade will be computed using the following weighing scheme

Weekly or Bi-weekly Projects	25%
Soil & Water Conservation Project	30%
Three Tests (each 15%) `	45%

$$E = (0.4\,HT + 0.33\,MT + 0.27LT)$$

$$\textbf{Course Grade} = \mathbf{0.45\,E + 0.25\,WP + 0.3\,SWCP}$$

HT = Test with highest marks, LT = Test with lowest marks, MT = Test with middle marks
WP= Weekly Projects, SWCP = Soil & Water Conservation Project

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*

3.1 Date and Distribution

Week	Project	Project Weightage	Project Due/ Test Date	Test Weightage
1	1[1] (Sep. 12th)		-	
2	2[1] (Sep.19th)		P1	
3	3[1] (Sep. 26th)	Note 3	P2	
4	4[1] (Oct. 3rd)		P3, T1	15%
5	-		-	
6	5[1] (Oct. 17th)		P4	
7	6[2] (Oct. 24th)	25%	P5	
8	(Oct. 31st)		P6,T2	15%
9	-		-	
10	7[1](Nov. 14st)	Note 3	-	
11	(Nov. 21st)		T3	15%
12	(Nov. 28th)	5%	P6, P7	Project 6 Presentation

P - Project; T - Test

[1] Group project, two students per group
[2] Group project, three or four students per group
[3] Projects 1 to 5 and 7 constitute 25%

3.2 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:
http://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/sec_d0e1400.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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4. Aims, Objectives and Graduate Attributes

4.1 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 , ENGG*3650, ENGG*3670

4.2 Course Aims

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.

4.3 Learning Objectives

At successful completion of this course, the 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.
7) Concisely and articulately communicate the results of an evaluation of a soil and water conservation system design, as well as the relevance and implications of the results

4.4 Graduate Attributes

Graduate Attribute	Learning Objectives	Assessment
1. Knowledge Base for Engineering	1	Test, Project
2. Problem Analysis	2	Project
3. Investigation	3	Test, Project
4. Design	5, 6	Project
5. Use of Engineering Tools	1, 5	Project
6. Communication	6	Project
7. Individual and Teamwork	1,2,3,4,5	Test , Project
8. Professionalism	5,6	Project
9. Impact of Engineering on Society and the Environment	2, 4	Test, Project
10. Ethics and Equity	-	-
11. Environment, Society, Business, & Project Management	2, 4, 5	Project
12. Life-Long Learning	2,3,4	Test, Project

4.5 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. 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. Scheduled classes will be the principal venue to provide information and feedback for tests and project.

4.6 Students' Learning Responsibilities

Students are expected to take advantage of the learning opportunities provided during lectures and tutorials. 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. 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.

Students 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

4.7 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 Time Table

Lectures:

Monday	10:30 – 11:20	MCKN 316
Wednesday	10:30 – 11:20	MCKN 316
Friday	10:30 – 11:20	MCKN 316
Laboratory:		
Friday	15:30 - 17:20	MCKN 317

5.2 Lecture Schedule

Week 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 (LO1, LO2).

Week 2: Hydraulic properties of soils. Flow of water into and through soils. Runoff and infiltration, methods of determination infiltration (LO1, LO2.

Week 3: 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: 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, LO3, LO4).

Week 5: Tools for prediction of soil erosion. Universal Soil Loss Equation (USLE) and Revised Universal Soil Loss Equation (RUSLE) (LO1,LO2, LO4, LO5).

Week 6: 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: Drainage design factors and drainage investigations. Size of drain pipe. Estimation of drainage requirements. Surface drainage systems(LO1,LO2,LO3,LO4) .

Week 8: Surface drainage systems. Subsurface drainage systems. Comprehensive drainage system planning and layout. Subsurface drainage accessories(LO1,LO2,LO3, LO4,LO5). .

Week 9: Subsurface drainage accessories, inlets and outlets. Special drainage problems. Drainage problems in Ontario. Drainage improvement needs in Canada (LO3, LO4).

Week 10: 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: 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: Design of sprinkler or trickle irrigation system. Presentation of soil and water conservation project. Summary and Review (LO1,LO3,LO4).

5.3 Schedule and Description of Projects:

1) **Soil Water Concept: (Sep. 12, 2014)**
   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 (Sep 19, 2014)**
   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) (Sep. 26, 2014)**
   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 (Oct. 3, 2014)**
   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 (Oct. 17, 2014)**
   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 (Oct. 24, 2014)**
   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) (Nov. 14, 2014)**
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).

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.

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

5.4 Lab Schedule: Not applicable

5.5. Other Important Dates: Not applicable

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6. 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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7. 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.

7.1 Resources

The Academic Misconduct Policy is detailed in the Undergraduate Calendar:
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

A tutorial on Academic Misconduct produced by the Learning Commons can be found at:
http://www.academicintegrity.uoguelph.ca/

Please also review the section on Academic Misconduct in your Engineering Program Guide.

The School of Engineering has adopted a Code of Ethics that can be found at:
http://www.uoguelph.ca/engineering/undergrad-counselling-ethics

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8. Accessibility:

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability for a short-term disability should contact the Centre for Students with Disabilities as soon as possible.

9. 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.

10. 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: http://www.uoguelph.ca/registrar/calendars/index.cfm?index