University of Manitoba

University of Manitoba
Department of Biosystems Engineering

Course Details

Course Title & Number:	BIOE 4600 Design of Water Management Systems (Fall 2019)
Class Times & Days of Week:	Lectures: MWF 1:30 - 2:15 Labs: W 2:30 - 4:30
Location for classes/labs/tutorials:	Lectures: Room E2-351 EITC Bldg Tutorials: Room E2-125 EITC Bldg
Pre-Requisites:	SOIL 4060 or CIVL 3730.

Course Description:
(Formerly 034.460) To introduce the basic theoretical principles in the design of irrigation and drainage systems. Topics covered include the determination of irrigation depth and interval, evapotranspiration, measurement and analysis of precipitation, design of sprinkler and drip irrigation systems, selection of pumps, surface and subsurface drainage design, water quality issues, salinity management, and the environmental impact of water management practices. Corequisite: SOIL 4060 (or 040.406) or CIVL 3730 (or 023.373) or consent of instructor.

Instructor Information

Instructor(s) Name:	Dr. (Ranjan) R. Sri Ranjan, P.Eng., Professor
Office Location:	E1-346 EITC
Office Hours or Availability:	By appointment
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Teaching Assistant:	Mr. Emeke Ndulue
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Textbook, Readings, Materials

Required textbook
Course hand-outs will be available through the Campus Copy Centre.

Supplementary material

Huffman, R. L., D.D. Fanmeier, W.J. Eliot, S.R. Workman, and G.O. Schwab. 2011. Soil and water conservation engineering. 6th Edition. ASABE, St. Joseph, MI

Hoffman, G.J., R.G. Evans, M.E. Jensen, D.L. Martin, and R.L. Elliott. 2007. Design and operation of farm irrigation systems. 2nd Edition. ASABE, St. Joseph, MI

Food and Agriculture Organization of the United Nations. 2002. Crop evapotranspiration: guidelines for computing crop water requirements. Eds. R. G. Allen et al. FAO, Rome.

Hoffman, G.J., T.A. Howell and K.H. Solomon.(Editors) 1990. Management of Farm Irrigation Systems. American Society of Agricultural Engineers, St. Joseph, Michigan.

Nijiland, H.J., F.W. Croon and H.P. Ritzema. 2005. Subsurface Drainage Practices. Wageningen, Alterra, ILRI Publication No. 60, pp. 608

Ritzma, H.P. (Editor-in-Chief). 2006. Drainage Principles and Applications. Wageningen, Alterra, ILRI Publication No. 16, pp. 1125.

Smedema, L.K., W.F. Vlotman, and D.W. Rycroft, 2004. Modern Land Drainage – Planning, design and management of agricultural drainage systems

Tanji, K.K. (Editor). 1990. Agricultural Salinity Assessment and Management. ASCE, New York. NY.[ISBN #0-87262-762-4]

Hillel, D. 1998. Environmental Soil Physics. Academic Press (ISBN: 0-12-348525-8)

Additional Materials

The following journals provide recent research information on the topics covered in this course:

Canadian Biosystems Engineering Journal
Transactions of the ASABE
Applied Engineering in Agriculture
Biosystems Engineering
Agricultural Water Management
Journal of Soil and Water Conservation

Useful Websites

www.bioeng.ca
www.asabe.org
www.asce.org
www.fao.org

Course Philosophy

Students' Learning Responsibilities

Students are expected to study the material covered during the lecture and make additional notes. They are expected to review the material already covered before they come to the next class. The assignments are due on the designated dates. This course relies heavily on your knowledge of basic concepts in soil physics. You are encouraged to review soil physics from any textbook. i.e. Many books by Daniel Hillel are available in the library. Please respect both us as instructors and your classmates by turning off your cell phone during class time. Laptops/iPads may be used during lectures only if you are using it in connection with this course.

Why this course is useful?

The course covers soil and water engineering. Then it uses these concepts to design different types of irrigation and drainage systems to meet the water and aeration needs of the crops. If you plan a career in Agricultural/Environmental Engineering dealing with alleviation of soil salinization this course will equip you with the tools necessary for your career.

Who should take this course?

Students interested in the Agricultural/Environmental Engineering focus area.

How this course fits into the curriculum

Water management is a major part of the responsibilities of an engineer working in the agricultural/ environmental area. Knowledge gained through this course will provide a key component of the agricultural/environmental stream.

Course Policies

Late Assignments

10% per day will be deducted for late assignments. Assignments will not be accepted after the marked assignments of others have been returned to the class.

Missed Assignments

Zero marks for missed assignments.

Missed Exams

There is NO make-up examination for a missed mid-term! If missed, and student has a valid medical certificate or compassionate reason (e.g., death of an immediate family member), marks assigned to the mid-term will be added to marks assigned for the final examination. Students who miss the examination without a valid reason will receive a grade of zero (0) for the mid-term examination.

In case of a missed final examination, a student will be assigned an F no paper grade for the course unless an acceptable medical certificate or a confirmable compassionate reason is provided in which case a supplementary examination will be allowed.

Instructional Methods

The lecture will consist of discussion of concepts using Keynote slides with additional descriptive notes in class. The slides will be available as course handouts for students to take additional notes during the lecture.

Description of Examinations

All tests/examinations will consist of two parts. Part A will be closed book/notes testing your ability to recall concepts. Part B will be open book/notes/assignments testing your ability to solve a field problem, and quantify inputs and outputs.

Description of Assignments

Assignments are usually problem-solving type questions to provide practice for what was discussed in class. We will briefly review the assignments at the beginning of the class and get you started on problem solving. You are expected to complete the assignment and submit by the due date.

Assignment Due Dates

Deadlines are a reality in the world of engineering; we expect assignments to be completed on time to the UMLearn portal. Assignments submitted after the due date will be docked 10% per day. All assignments must be submitted to pass the course. Assignments are given on Wednesdays. They are due to be uploaded to the UMLearn as .pdf file by 4:30 pm on the following Monday. Your papers can be scanned in the library.

General Guidance Resources on Campus

Students are encouraged to familiarize themselves with the resources available to them by visiting the Student Affairs website at http://umanitoba.ca/student/index.html The site contains helpful general information as well as links to webpages for the Aboriginal Student Centre, the International Centre for Students, the Academic Learning Centre, Student Advocacy & Accessibility, the Student Counselling & Career Centre, and University Health Service. Please make use of these resources to enhance your academic learning and life as a student.

Important Dates

October 9:	No class – Thanksgiving Day
November 4:	Mid-term test
November 11-15:	No class – Fall term break
November 18:	Last date for Voluntary Withdrawal for fall term courses.

Course Goals

The intent of this course is:
The theoretical basis for the engineering design of different irrigation and drainage systems will be presented. Methods for calculating plant water use and precipitation analysis will be covered. The students will learn about friction losses in pipes, design irrigation and drainage systems for a model farm. The students will also learn to calculate leaching requirement for salinity alleviation.

Intended Learning Outcomes

At the conclusion of the course, the student should be able to:

1. Explain the principles associated with the design of irrigation and drainage systems.
2. Analyze an existing field scenario to determine the most appropriate irrigation/drainage strategy.
3. Use models to predict requirements of an irrigation system.
4. Design and evaluate irrigation and drainage systems for specified scenarios.
5. Summarize and present the results of the design process in an oral presentation and formal report.
6. Apply what was learned in the classroom to novel situations in the workplace.

Expected Level of Development in Course **

Learning Outcome	Attribute*											
	KB	**PA**	**IN**	**DE**	**ET**	**IT**	**CS**	**PR**	**IE**	**EE**	**EP**	**LL**
1	A											
2		A		D								
3					D							A
4												
5				A	A	A	A	A				A
6									A			A

***Attributes*:**
KB A knowledge base for engineering
PA Problem analysis
IN Investigation
DE Design
ET Use of engineering tools
IT Individual and team work
CS Communication skills
PR Professionalism
IE Impact of engineering on society/ environment
EE Ethics and equity
EP Economics and project management
LL Life-long learning

**Expected Level of Development:
I – Introductory
D – Developed
A – Advanced

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Supplemental Course Information for BIOE 4600

All courses in the Biosystems Engineering program are expected to contribute, in some way, to the development of one or more of the 12 graduate attributes that have been identified by the Canadian Engineering Accreditation Board. The 12 graduate attributes have been defined below for your information. While there are likely some aspects of many of these attributes that can be found in this course, the attributes being emphasized in this course are: 1) *A Knowledge Base for Engineering, 2) Problem Analysis, 4) Design, 5) Use of engineering tools 6) Individual and team work, 7) Communication Skills, 8) Professionalism 9) Impact of Engineering on Society and the environment, 11) Economics and Project Management, and 12) Life-long learning.*

Graduate Attributes

1. A Knowledge Base for Engineering

Demonstrated competence in university level mathematics, natural sciences, engineering fundamentals, and specialized engineering knowledge appropriate to the program.

2. Problem Analysis

An ability to use appropriate knowledge and skills to identify, formulate, analyze, and solve complex engineering problems in order to reach substantiated conclusions.

3. Investigation

An ability to conduct investigations of complex problems by methods that include appropriate experiments, analysis and interpretation of data, and synthesis of information in order to reach valid conclusions.

4. Design

An ability to design solutions for complex, open-ended engineering problems and to design systems, components or processes that meet specified needs with appropriate attention to health and safety risks, applicable standards, and economic, environmental, cultural and societal considerations.

5. Use of Engineering Tools

An ability to create, select, apply, adapt, and extend appropriate techniques, resources, and modern engineering tools to a range of engineering activities, from simple to complex, with an understanding of the associated limitations.

6. Individual and Team Work

An ability to work effectively as a member and leader in teams, preferably in a multi-disciplinary setting.

7. Communication Skills

An ability to communicate complex engineering concepts within the profession and with society at large. Such ability includes reading, writing, speaking and listening, and the ability to comprehend and write effective reports and design documentation, and to give and effectively respond to clear instructions.

8. Professionalism

An understanding of the roles and responsibilities of the professional engineer in society, especially the primary role of protection of the public and the public interest.

9. Impact of Engineering on Society and the Environment

An ability to analyze social and environmental aspects of engineering activities. Such ability includes an understanding of the interactions that engineering has with the economic, social, health, safety, legal, and cultural aspects of society, the uncertainties in the prediction of such interactions; and the concepts of sustainable design and development and environmental stewardship.

10. Ethics and Equity

An ability to apply professional ethics, accountability, and equity.

11. Economics and Project Management

An ability to appropriately incorporate economics and business practices including project, risk, and change management into the practice of engineering and to understand their limitations.

12. Life-long Learning

An ability to identify and address their own educational needs in a changing world in ways sufficient to maintain their competence and to allow them to contribute to the advancement of knowledge.

Course Evaluation

Assessment Element	Value	Attributes Covered	Indicators being assessed	Level *
Tutorial/Lab	20%	Problem Analysis (10%) Design (10%)	**PA.3** – Analyzes and solves complex engineering problems. **DE.3** – Designs a component based on real-life scenario.	A
Mid-term Test	15%	Knowledge base (6%) Problem Analysis (4%) Design (5%)	**KB.3** – Recalls and defines, and/or comprehends and applies information, principles and concepts in engineering dign. **PA.3** – Analyzes and solves complex engineering problems. **DE.3** – Designs a component based on real-life scenario.	A
Project Presentation/Report	15%	Design (10%) Communication (5%)	**DE.3** – Designs a component based on real-life scenario. **CS.3** – Make an oral presentation and submit a report.	A
Final Examination	50%	Knowledge base (20%) Problem Analysis (10%) Design (20%)	**KB.3** – Recalls and defines, and/or comprehends and applies information, principles and concepts in engineering dign. **PA.3** – Analyzes and solves complex engineering problems. **DE.3** – Designs a component based on real-life scenario.	A

*Level of Development of Graduate Attributes (I = Introductory; D = Intermediate; A = Advanced)

Tutorials (20%)

Each **Wednesday** we will have a tutorial, which is **due at 4:30 pm on the following Monday**. Students will lose 10% of their mark per additional late day. Once the marked assignments are posted to UMLearn no further submissions will be allowed. Please upload a clearly scanned .pdf file to the UMLearn site for grading. Scanners are available in the Engineering Library.

Midterm Test (15%)

One 50 minute Midterm tests will be administered during the lecture period on November 4, 2019. Part A of the midterm will be closed-book; In Part B, students will be permitted to bring a ***double-***sided 8.5 x11" crib sheet. This sheet can contain any information you'd like.

Design Project (15%)

A group irrigation system design project will be completed for a model farm and presented and the Report is **due Oct 30th.**

Final exam (50%)

A cumulative final exam worth 50% of your grade will be administered during the final examination period. Part A of this exam will be closed-book; In Part B, students will be permitted to bring a ***double-***sided 8.5x11" crib sheet. This sheet can contain any information you'd like. Any student who receives a grade of 100% on the final exam will automatically receive a grade of A+ for the course.

Assessment method

Tutorials	20%
Project Reports/Presentation	15%
Midterm Test	15 %
Final Exam (comprehensive)	50 %
	100 %

Letter Grade	Percentage out of 100
A+	92-100
A	85-91
B+	78-84
B	72-77
C+	66-71
C	60-65
D	50-59
F	Less than 50