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## CE464 WATER RESOURCES ENGINEERING



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<b>Course Coordinator:</b>	Andrew Ireson <a href="mailto:andrew.ireson@usask.ca">andrew.ireson@usask.ca</a>	Global Institute for Water Security 306-966-2923
<b>Course times:</b>	October 30 <sup>th</sup> to November 12 <sup>th</sup> , 2019 – Monday to Friday – 9:30am to 3:00pm.	
<b>Course notes:</b>	See course website <a href="http://bblearn.usask.ca">http://bblearn.usask.ca</a>	
<b>Assessment:</b>	Assignments	80%
	Term Project	20%
<b>Prerequisites:</b>	Undergraduate degree in engineering or natural sciences or enrolled in the MWS	
<b>Enrollment limit:</b>	30	

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### Course Description

Water Resources Engineering is a highly interdisciplinary field that links physical sciences, basic sciences, and social sciences together. The course focuses on three major parts of water resources engineering practice: watershed analysis and simulation; water use and associated analysis; and flood management and associated analysis. It includes consideration of water resources systems and their management, establishment of the various data needs for water resource systems analysis, and the use of economics as a decision-making tool in water resources engineering. While focused on the engineering aspects of water resource management, the student is also exposed to the broader issues, which impact the management decisions of the resource (e.g., social, environmental, ethical).

### Learning Outcomes

Upon completion of the course, students will be able to:

- define different terminologies in hydrologic analysis and modeling, water uses and withdrawal, hydropower generation, droughts, floods, and water resources planning.
- defend the type of analysis and modeling they choose for various water resources analysis and design problems and situations
- breakdown water resources problems into smaller components, identify the data needs and availability, outline the assumptions made, and conduct comprehensive analysis and design.
- compile data and information on water resources problems, generate alternative solutions, explain the tradeoffs, summarize the findings, and write well organized reports.

### Course Outline

Most days will begin with a lecture (~1.5 hours). This will be followed by an in-class exercise (2-3 hours). Students will need to have their personal laptops to be able to run the exercise. The exercises need Microsoft Excel and MATLAB. The second half of an exercise session is supervised by the instructor. Each day will end with a discussion (20-30 minutes) on the materials presented that day.

## Course details:

This course will be delivered as a series of 13 blocks, each block comprising a 1-hour lecture, followed by a 2-hour tutorial session. For the tutorials, students will need a laptop with Excel and MATLAB installed. We will be using the Hydrological model HBV-Sask (developed by Dr Saman Razavi). Worked examples will be used to help the students complete the assignments, and time will be allocated in the tutorial sessions for students to get help from the instructor on the assignments.

## Sequence of topics:

**1. INTRODUCTION:** Overview; Water resources engineering practice and other socio-economic domains; Water resources system.

**2. HYDROLOGIC ANALYSIS AND DESIGN:** The concept of hydrologic analysis; Systems analysis; The inductive approach; The deductive approach

**3. WATERSHED SIMULATION:** The principles of watershed simulation; WMS operating system; spatial hydrologic analysis; model calibration and validation

**4: MODEL CALIBRATION AND VALIDATION:** Students will learn about different model performance metrics and how local optimization works.

**5. PROBABILITY, RISK, AND UNCERTAINTY ANALYSIS:** Basic probability; Flood frequency analysis; Area and regional analysis; Definition and quantification of uncertainty

**6. URBANIZATION:** Effect of Urbanization on Hydrology; Design of reservoirs and ponds; Reservoir routing; Design of street drainage;

**7. WATER WITHDRAWALS AND USES:** Definition of terminology: use, withdrawal, and sustainable use; Water for agriculture (irrigation); Water for power generation; Drought and drought management; Risk-based and economic analysis of drought

## Assessment criteria

### Assignments

There are four assignments. All the assignments must be completed to pass the course. Late assignments will be accepted up to 3 days after the assignment due date but will be penalized at 10% per day.

**Assignment 1 (20%):** Topic: Hydrologic analysis

**Assignment 2 (20%):** Topic: Flood frequency analysis

**Assignment 3 (20%):** Topic: Hydrological model application and calibration

**Assignment 4 (20%):** Topic: Hydrological model uncertainty analysis

### Term project

An assessment of the anticipated consequences of wetland drainage at the St Denis National Wildlife Area, SK  
**Objective**

The objective of this term project is to synthesize and apply the skills and knowledge that you have acquired from your Term 1 classes. You must demonstrate understanding and apply techniques from each class:

ENVS806 Field Skills in Water Security Research; GEOG898 Fundamentals of Hydrology; ENVS805 Data Analysis and Management - MWS; ENVS898 Modeling for Water Security; ENVS898 River, Lake, and Wetland Science.

### **Problem**

Wetland drainage is a major issue in the Canadian prairies. Wetlands are drained to acquire more agriculturally productive land, but wetland drainage is associated with some negative hydrological and ecological consequences. You are to assess a (hypothetical) proposal to drain Pond 109 into Pond 90 at St Denis. You will be provided with hydrological and biogeochemical data for the various ponds and surrounding uplands and watershed. You are to use your knowledge of hydrological processes and biogeochemical processes and your skills in data analysis and modelling to assess the likely impact of this drainage, with particular emphasis on downstream flood risk, and changes in the productivity and eutrophic status of the various wetlands involved.

### **Assessment**

The project will be undertaken and assessed in teams, with a collectively agreed upon assignment of duties. This project is worth 20% of each of the five 3CU classes: ENVS806 Field Skills in Water Security Research; GEOG898 Fundamentals of Hydrology; ENVS805 Data Analysis and Management - MWS; ENVS898 Modeling for Water Security; ENVS898 River, Lake, and Wetland Science. Hence the project is worth of total of 3 CU.

A single report (pdf file) is to be submitted electronically to Andrew Ireson. The report should contain the following sections, with the mark breakdown provided

<b>Item</b>	<b>Mark</b>
Cover sheet: Title and team members	NA
Executive summary (1 page max)	15%
Table of contents	NA
Assignment of duties	5%
Description of the problem	10%
Data analysis and interpretation	20%
Modelling	20%
Synthesis	10%
Conclusions and recommendations	10%
Peer evaluation	10%

The peer evaluation is completed individually, and submitted separately from the report. In the peer evaluation you must provide an assessment of the contribution of each of the other members of your team and a mark out of 10 for their performance. This will be confidential.

## School and University policy statements

### 1. Grading System Description

SENS uses the following grading system as adopted by the College of Graduate Studies and Research:

#### 90-100 Exceptional

A superior performance with consistent strong evidence of

- a comprehensive, incisive grasp of subject matter;
- an ability to make insightful, critical evaluation of information;
- an exceptional capacity for original, creative and/or logical thinking;
- an exceptional ability to organize, to analyze, to synthesize, to integrate ideas, and to express thoughts fluently;
- an exceptional ability to analyze and solve difficult problems related to subject matter.

#### 80-89 Very Good to Excellent

A very good to excellent performance with strong evidence of

- a comprehensive grasp of subject matter;
- an ability to make sound critical evaluation of information;
- a very good to excellent capacity for original, creative and/or logical thinking;
- a very good to excellent ability to organize, to analyze, to synthesize, to integrate ideas, and to express thoughts fluently;
- a very good to excellent ability to analyze and solve difficult problems related to subject matter.

#### 70-79 Satisfactory to Good

A satisfactory to good performance with evidence of

- a substantial knowledge of subject matter;
- a satisfactory to good understanding of the relevant issues and satisfactory to good familiarity with the relevant literature and technology;
- a satisfactory to good capacity for logical thinking;
- some capacity for original and creative thinking;
- a satisfactory to good ability to organize, to analyze, and to examine the subject matter in a critical and constructive manner;
- a satisfactory to good ability to analyze and solve moderately difficult problems.

#### 60-69 Poor

A generally weak performance, but with some evidence of

- a basic grasp of the subject matter;
- some understanding of the basic issues;
- some familiarity with the relevant literature and techniques;
- some ability to develop solutions to moderately difficult problems related to the subject matter;
- some ability to examine the material in a critical and analytical manner.

#### <60 Failure

An unacceptable performance.

### 2. Midterm and Final Examination Scheduling

n/a

### **3. Assessment Issues and Grade Disputes**

A student shall be permitted to see any examination unless otherwise stated at the beginning of the course. Students dissatisfied with the assessment of their work in any aspect of course work, including midterm or final examination should consult the University policy '*Student Appeals or Evaluation, Grading and Academic Standing*' found at the Office of the University Secretary

([http://www.usask.ca/university\\_secretary/policies/student/policy-on-student-appeals-of-evaluation,-grading-and-academic-standing.php](http://www.usask.ca/university_secretary/policies/student/policy-on-student-appeals-of-evaluation,-grading-and-academic-standing.php)).

### **4. Disability Services for Students (DSS)**

Students who have disabilities (learning, medical, physical, or mental health) are strongly encouraged to register with Disability Services for Students (DSS) if they have not already done so. Students who suspect they may have disabilities should contact DSS for advice and referrals. In order to access DSS programs and supports, students must follow DSS policy and procedures. For more information, check

<http://www.students.usask.ca/disability/>, or contact DSS at 966-7273 or [dss@usask.ca](mailto:dss@usask.ca). Students registered with DSS may request alternative arrangements for mid-term and final examinations. Students must arrange such accommodations through DSS by the stated deadlines. Instructors shall provide the examinations for students who are being accommodated by the deadlines established by DSS.

### **4. University Learning Centre (ULC)**

The ULC offers academic support to UofS students, including: workshops, writing help, math help, community service-learning, learning communities, study skills support, technology help and Peer Mentor Programs.

More information can be found at <http://www.usask.ca/ulc/>

### **5. Academic Honesty**

The University of Saskatchewan is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty and to uphold the policies of the University in this respect. Students are particularly urged to familiarize themselves with the provisions of the Student Conduct & Appeals section of the University Secretary Website and avoid any behavior that could potentially result in suspicions of cheating, plagiarism, misrepresentation of facts and/or participation in an offence. Academic dishonesty is a serious offence and can result in suspension or expulsion from the University.

All students should read and be familiar with the Regulations on Academic Student Misconduct ([http://www.usask.ca/university\\_secretary/honesty/StudentAcademicMisconduct.pdf](http://www.usask.ca/university_secretary/honesty/StudentAcademicMisconduct.pdf)) as well as the Standard of Student Conduct in Non-Academic Matters and Procedures for Resolution of Complaints and Appeals ([http://www.usask.ca/university\\_secretary/honesty/StudentNon-AcademicMisconduct2012.pdf](http://www.usask.ca/university_secretary/honesty/StudentNon-AcademicMisconduct2012.pdf))

For more information on what academic integrity means for students see the Student Conduct & Appeals section of the University Secretary Website at:

[http://www.usask.ca/university\\_secretary/pdf/dishonesty\\_info\\_sheet.pdf](http://www.usask.ca/university_secretary/pdf/dishonesty_info_sheet.pdf)



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## Academic Integrity Checklist

Honesty and integrity are expected of every student at the University of Saskatchewan. There are many forms of academic misconduct; perhaps the most common is plagiarism. According to the University of Saskatchewan Guidelines for Academic Conduct:

*“Plagiarism is the theft of the intellectual creation of another person without proper attribution. It is the use of someone else’s words or ideas or data without proper documentation or acknowledgment. Quotations must be clearly marked, and sources of information, ideas, or opinions of others must be clearly indicated in all written work. This applies to paraphrased ideas as well as to direct quotations. A student must acknowledge and fairly recognize any contributions made to their personal research and scholarly work by others, including other students.”*

There are many resources on campus to assist you with proper citation and paraphrasing.

- For guidance on when and how to quote from other documents and how to properly paraphrase information in other documents, see <http://library.usask.ca/howto/honesty.php>.
- To learn about different styles of citation and how to properly cite a variety of different sources including statistics, archival materials, maps, legal documents and government reports, see <http://libguides.usask.ca/citation>.

When in doubt about a citation requirement or your approach to paraphrasing, ask your librarian or your course instructor or your academic supervisor for assistance.

### Before you submit any written work, review it against the following checklist:<sup>1</sup>

- I have acknowledged the use of all ideas with accurate citations.
- I have used the words of another author, instructor, information source, etc., and I have properly acknowledged this and used proper citation.
- In paraphrasing the work of others, I have put the idea into my own words and did not just change some words or rearrange the sentence structure.
- I have checked my work against my notes to be sure that I have correctly referenced all quotes or ideas.
- When using direct quotations I have used quotation marks (or other means to clearly identify the quoted text) and provided full citations.
- Apart from material that is a direct quotation, everything else in the work is presented in my own words.
- When paraphrasing the work of others I have acknowledged the source or the central idea.
- I have checked all citations for accuracy (e.g. page numbers, journal volume, dates, web page addresses).
- I have used a recognized reference style (i.e. APA, MLA, Chicago etc.) consistently throughout my work.
- My list of references/ bibliography includes all of the sources used to complete the work.
- I have accurately and completely described any data or evidence I have collected or used.
- I fully understand all of the content (e.g., terms, concepts, theories, data, equations, ideas) of the work that I am submitting.
- The content of the work has not been shared with another student, unless permitted by the instructor.
- The content of the work reflects wholly my own intellectual contribution or analysis and not that of another student(s), unless the instructor approved the submission of group or collaborative work.
- If another person proofread my work it was for the sole purpose of indicating areas of concern, which I then corrected myself.
- This work has not been submitted, whole or in part, for credit in another course or at another institution, without the permission of the current course instructor(s).
- I understand the University of Saskatchewan’s policy and expectations concerning academic honesty and the consequences of plagiarism or other forms of academic misconduct.

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<sup>1</sup> Compiled based on York University ([http://www.yorku.ca/tutorial/academic\\_integrity/acadintecheklist.html](http://www.yorku.ca/tutorial/academic_integrity/acadintecheklist.html)), Curtin University (<http://academicintegrity.curtin.edu.au/global/checklist.cfm>), University of Toronto (<http://www.utoronto.ca/academicintegrity/resourcesforstudents.html>), and Skidmore College (<http://cms.skidmore.edu/advising/integrity/checklist.cfm>) checklists for academic integrity.