

SC 301
Applied Hydrology
3 Credits

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SC 301 Version: 18



Applied Hydrology

Calendar Description

This course focuses on the main components of the hydrologic cycle and how this impacts quantity, quality and distribution of water resources within a watershed basin. Precipitation, evapotranspiration, runoff, streamflow and groundwater flow are examined with reference to drought, flooding, erosion and sedimentation. Students are introduced to field techniques in stream discharge measurement, and geomorphic characterization of watersheds.

Rationale

This course is required for second year students within the Environmental Sciences diploma. As human activities continue to increase, the need for responsible management of the resources within the watershed becomes increasingly important. Water is a vital natural resource that requires diligent management in order to preserve. This course is fundamental to the understanding of the interrelationships between water, the environment and human requirements.

Prerequisites

None

Co-Requisites

None

Course Learning Outcomes

Upon successful completion of this course, students will be able to

1. conduct common field and data analysis techniques used to conduct a stream crossing assessment, and estimate stream discharge using a variety of methods.
2. manipulate and interpret hydrologic data to determine parameters such as event frequency, flood elevation, recurrence intervals, evaporation rates and evaporation amounts.
3. describe and explain the fundamental processes occurring within both the hydrological cycle and the atmospheric energy cycle.

4. describe and explain the fundamental surface water, ground water and fluvial geomorphic processes and occurring within a watershed.
5. describe and explain the fundamental hydrologic processes occurring in the atmosphere such as cloud and precipitation formation and adiabatic lapse rates.
6. predict how environmental changes occurring in a watershed can impact both surface and groundwater.
7. describe and explain issues surrounding water resources on the prairies and how policy and regulations are used as a management tool.

Essential Employability Skills

Essential employability skills are critical for workplace success and lifelong learning. Lakeland College prepares its graduates for the workplace and lifelong learning by integrating and promoting essential employability skills development in its curricula. Each credit course offered at Lakeland College emphasizes one or more of the following five essential employability skills:

- A. **Communication Skills** that enable individuals to listen, interpret, express, and convey knowledge and ideas so that they are received and understood.
- B. **Teamwork Skills** that enable individuals to respect the thoughts and opinions of others as they work together to plan activities, meet deadlines, complete projects, and contribute to an organization's goals.
- C. **Critical Thinking Skills** that enable individuals to conceptualize and analyze issues from various perspectives while rationally evaluating the strengths and limitations of each perspective and deciding what action to take.
- D. **Adaptability Skills** that enable individuals to respond quickly, willingly, and positively to new conditions and changing times.
- E. **Positive Attitude and Behavioural Skills** that enable individuals to be confident about themselves and to deal with people, problems, and situations with honesty, integrity, and personal ethics.

Please refer to the Knowledge/Skills Matrix of this course outline to review the essential employability skills emphasized in this course.

Resource Materials

Required Text:

None

Reference Texts:

Dingman, S.L. 2015. Physical Hydrology. 3rd ed. Waveland Press.

http://www.library.ualberta.ca/permalink/opac/7848217/LAKELND_LLWEB

Freeze, R.A., and J.A. Cherry. 1979. Groundwater. Prentice-Hall Inc., Englewood Cliffs, N.J.

Gordon, N.D., T.A. McMahon, B.L. Finlayson, C.J. Gippel, and R.J. Nathan. 2004.

Stream Hydrology: an introduction for Ecologists. Wiley, Inc.

Hewlett, J.D. 1990. Principles of Forest Hydrology. The University of Georgia Press, Athens.

Ward, A. D., Trimble, S. W., Burckhard, S. R., & Lyon, J. G. (2016). Environmental hydrology

(3rd ed.). CRC Press, Taylor & Francis Group.

http://www.library.ualberta.ca/permalink/opac/8150364/LAKELND_LLWEB

Maidment D.R. 1992. Handbook of Hydrology. McGraw-Hill Inc.

Conduct of Course

This course consists of approximately 30 hours of lecture and 30 hours of lab.

Evaluation Procedures

The final mark consists of:

Midterm Lecture Exam	30%
Final Lecture Exam (non comprehensive)	30%
Laboratory Assignments	30%
Quizzes/Assignments	10%
TOTAL	100%

The distribution of weights may slightly change depending on progress, unforeseen class cancellations or other circumstances.

The final exam is not comprehensive, but the course builds upon previous concepts.

Attendance for laboratories is mandatory. To obtain credit for this course, all labs must be **attended** and all lab assignments must be **completed and handed in**. If you cannot make it to your respective lab session, please discuss it with the instructor beforehand to see if alternate arrangements can be made. If the absence is excused, the instructor may assign an alternative assignment.

Late lab reports are given a mark of zero unless alternate dates are discussed with the instructor beforehand. In an effort to prepare for the laboratory exam, it is a very good idea to complete each assignment as independently as possible.

Knowledge/Skills Matrix

Students apply and demonstrate their knowledge and skills to use

A. Communication Skills

A1. by listening, reading, interpreting information, and communicating effectively
Evaluation(s)/Goal(s): Labs & assignments, examinations/Goals 1-7
A2. by using written, spoken, and/or visual formats and media to communicate and meet needs of each particular audience
Evaluation(s)/Goal(s): Labs & assignments/Goals 1-7
A3. by using libraries, Internet, technical publications, journals and other sources to find pertinent information
Evaluation(s)/Goal(s): Labs & assignments/Goals 1-7

B. Teamwork Skills

B1. by using interpersonal skills to create an atmosphere that maximizes the strengths of group members to accomplish tasks
Evaluation(s)/Goal(s): Labs & assignments/Goals 1-7
B2. by using interpersonal skills to resolve conflict, relate to others, and assist others
Evaluation(s)/Goal(s): Labs & assignments/Goals 1-7
B3. by contributing and listening to others as group determines realistic objectives, prioritizes tasks, and identifies resources and timelines
Evaluation(s)/Goal(s): Labs & assignments/Goals 1-7
B4. by treating other members of the group open-mindedly and fairly
Evaluation(s)/Goal(s): Labs & assignments/Goals 1-7
B5. by developing tactics/strategies to accomplish tasks
Evaluation(s)/Goal(s): Labs & assignments/Goals 1-7

C. Critical Thinking Skills

C1. by seeing critical thinking as a lifelong process of self-assessment
Evaluation(s)/Goal(s): Labs & assignments, examinations/Goals 1-7
C2. by examining problems closely
Evaluation(s)/Goal(s): Labs & assignments, examinations/Goals 1-7
C3. by examining beliefs, assumptions, and opinions, and weigh them against the facts
Evaluation(s)/Goal(s): Labs & assignments, examinations/Goals 1-7
C4. by seeking out the truth
Evaluation(s)/Goal(s): Labs & assignments, examinations/Goals 1-7
C5. by finding solutions; make decisions
Evaluation(s)/Goal(s): Labs & assignments, examinations/Goals 1-7
C6. by incorporating new ideas that may not necessarily agree with previous thought on the topic
Evaluation(s)/Goal(s): Labs & assignments/Goals 1-7
C7. by seeing connections between topics and use knowledge from other disciplines to enhance reading and learning experiences
Evaluation(s)/Goal(s): Labs & assignments, examinations/Goals 1-7

D. Adaptability Skills

D1. by working independently or as part of team
Evaluation(s)/Goal(s): Labs & assignments, examinations/Goals 1-7
D2. by carrying out multiple tasks or projects
Evaluation(s)/Goal(s): Labs & assignments/Goals 1-7
D3. by being innovative and resourceful: identify and suggest alternative ways to get the job done
Evaluation(s)/Goal(s): Labs & assignments/Goals 1-7
D4. by being open and respond constructively to change and uncertainty
Evaluation(s)/Goal(s): Labs & assignments/Goals 1-7

E. Positive Attitude and Behavioural Skills

E1. by dealing with people, problems, and situations with honesty, integrity, and personal ethics
Evaluation(s)/Goal(s): Labs & assignments, examinations/Goals 1-7
E2. by showing interest, initiative, and effort
Evaluation(s)/Goal(s): Labs & assignments/Goals 1-7
E3. by affirming the need for positive solutions and encourage positive interaction and feedback
Evaluation(s)/Goal(s): Labs & assignments, examinations/Goals 1-7
E4. by balancing personal and family activities with job-related activities
Evaluation(s)/Goal(s): Labs & assignments/Goals 1-7

Grade Equivalents and Course Pass Requirements

A minimum grade of D (50%) (1.00) is required to pass this course.

Letter	F	D	D+	C-	C	C+	B-	B	B+	A-	A	A+
Percent Range	0-49	50-52	53-56	57-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94	95-100
Points	0.00	1.00	1.30	1.70	2.00	2.30	2.70	3.00	3.30	3.70	4.00	4.00

Students must maintain a cumulative grade of C (GPA - Grade Point Average of 2.00) in order to qualify to graduate.

Attendance

Classroom and laboratory attendance is considered vital to the learning process and as significant to the students' evaluation as examinations and reports, therefore absenteeism is recorded.

- a. Students having a combination of excused and/or unexcused absence of 20 percent or higher for the scheduled course hours can be required to withdraw and would then automatically receive a "RW" (required withdrawal) for the course, regardless of any other evaluation results. (RW is a failing grade).
- b. An excused absence is one that is verified with your instructor. Verification should be prior to the absence or the next class day following the absence. Verification of the

absence may take the form of a note from your doctor/College nurse regarding illness, or a note from another instructor regarding a field trip or other activity, or authorization by your instructor following an in-person meeting. Be sure to contact your instructor and ask what they will require from you as verification of each absence. An unexcused absence is anything NOT verified by the instructor prior to the absence or the next class day following the absence.

NOTE: Any exceptions to the above attendance policy (e.g. timetable conflicts, work-related issues) must be approved in writing by the Department Chair prior to the beginning of the course.

It is the students' responsibility to know their own absentee record.

Normal hours are 8:30 a.m. to 6:30 p.m., with potential for evening courses, exams or extended field trips. Students are expected to be available for classes during these times.

Course Units/topics

Course and laboratory units are given below. The topics under each unit title are examples of what may be discussed during each unit. To facilitate required prior knowledge for laboratories or unforeseen circumstances, some units may be discussed out of the order found below.

Introduction to Hydrologic Concepts

- Hydrology
- Water on earth and water cycle
- Watersheds
- Water budget

Evaporation and Transpiration

- Sources of evaporation and transpiration
- Evapotranspiration and potential evapotranspiration
- Estimating evaporation and transpiration

Precipitation

- Atmospheric Moisture
- Humidity and measurement techniques
- Precipitation forms and measurement techniques
- Rainfall intensity, duration and distribution
- Storm and flood frequency analysis

Surface Water

- Components of runoff
- Hydrographs and their components
- Basin lag and time of concentration
- Streamflow

- Open channel flow equations
- Measuring and estimating discharge

Groundwater

- Groundwater resources
- Subsurface distribution of water
- Aquifers
- Darcy's law and
- Regional groundwater flow
- Surface water / groundwater interaction

Watershed Morphology

- Erosion and deposition processes
- Classification of stream channels
- Fluvial landforms
- Effects of engineered structures on erosion and deposition
- Drainage patterns

Water Quality

- Water quality parameters
- Water pollution
- Point and non-point sources of surface water pollution

Watershed Management

- Water resources management
- Integrated Watershed Management
- Water uses in Western Canada
- Water use and quality regulations

Laboratory Schedule:

Laboratory activities include combinations of field data collection and in-class analysis, and may address the following topics:

- Stream Discharge
- Cross Section Surveying
- Estimating Bankfull Discharge
- Water and Energy Balance
- Hydrologic Graphs
- Precipitation and Evaporation
- Watershed Morphology
- Flood Hazard Maps
- Water Quality and Management



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