ENVS*4210 Meteorological and Environmental Instrumentation

Winter 2020
Section(s): 01

School of Environmental Sciences
Credit Weight: 0.50
Version 1.00 - January 06, 2020

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1 Course Details

1.1 Calendar Description

This course covers the design and implementation of measurement systems for atmospheric and environmental studies. Principles of operation and practical consideration of various meteorological and soil sensors will be discussed along with overall design and implementation procedures for environmental monitoring. Students will propose and perform a small independent experiment or field measurement of their own design.

Pre-Requisites: 1 of ENVS*3050, ENVS*3130, ENVS*3340, PHYS*3100
Equates: MET*4210

1.2 Timetable

T/Th 10:00am--11:20am

Alexander Hall 020

1.3 Final Exam

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2 Instructional Support

2.1 Instructional Support Team

Instructor: Jon Warland
Email: jwarland@uoguelph.ca
Telephone: +1-519-824-4120 x56374
Office: ECBA 1106

3 Learning Resources

3.1 Required Resources

Brock and Richardson "Meteorological Measurement Systems" (Textbook)
http://primo.tug-libraries.on.ca/primo_library/libweb/action/display.do;jsessionid=485499AFCF7F6D63F09B9F86CC5EDC0

CourseLink (Website)

4 Learning Outcomes

4.1 Course Learning Outcomes

By the end of this course, you should be able to:

1. Analyze instrument systems in terms of the functional model.
2. Describe a suite of meteorological and environmental sensors in terms of the underlying physics of response, static and dynamic characteristics, and pros, cons and issues when using the sensors in outdoor monitoring scenarios.
3. Demonstrate facility at collecting digital data from sensors and analyzing and interpreting it graphically and statistically.
4. Explain and demonstrate linear and non-linear calibration of an instrument.
5. Define and use common terminology in instrumentation including concepts such as resolution, bias, time constant, precision, frequency response, and so forth.
6. Present experimental results and methods in scientific format including text, figures, captions and statistical descriptors.

5 Teaching and Learning Activities

The list below outlines the general topics covered and the order they appear in the assignments. Note that in class the order will vary, as some topics will depend on knowing something about later topics.

5.1 Lecture

Topics:	Course introduction, calibration, sensor model, barometry
References:	Chapters 1 & 2
Topics:	Thermometry and static performance characteristics
References:	Chapters 3 & 4

Topics:	Scientific writing and graphical presentation of data
References:	handout
Topics:	Energy balance of thermometer, atmospheric water, hygrometery
References:	Chapter 5
Topics:	Dynamic performance characteristics
References:	Chapter 6
Topics:	Anemometry and precipitation
References:	Chapters 7 & 9
Topics:	Radiation and data management
References:	Chapter 10
Topics:	Heat pulse probes and soil thermal properties
Topics:	Analog-to-digital conversion (ADC)
References:	Chapter 13
Topics:	Trace gas measurement and eddy covariance flux measurement
Topics:	Student-driven topics, work on labs and final projects

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6 Assessments

6.1 Assessment Details

Chapter 2, problems 1, 2, 4, 8, 12, 17, 19 (4%)
Due: Tue, Jan 14
Learning Outcome: 1, 2, 6

Chapter 3, problems 1, 2, 4, 7, 8, 9, 11, 16, 17 (4%)
Due: Tue, Jan 21
Learning Outcome: 1, 5, 6

Chapter 4, problems 2, 8, 9, 13, 14, 20 (4%)
Due: Tue, Jan 28
Learning Outcome: 1, 2, 6

Chapter 5, problems 1, 2, 4, 5, 15, 23 (4%)
Due: Tue, Feb 4
Learning Outcome: 1, 2, 5, 6

Chapter 6, problems 1, 3, 5, 12, 13, 15 (4%)
Due: Tue, Feb 12
Learning Outcome: 2, 5, 6

Chapter 7, problems 2, 3, 4, 7, 9, 15 (4%)
Due: Tue, Feb 25

Learning Outcome: 1, 2, 6

Chapter 9, problems 1, 2, 3, 5, 7, 10, 12, 13 (4%)
Due: Tue, Mar 3
Learning Outcome: 2, 5, 6

Chapter 10, problems 1, 3, 4, 7, 8, 14 (4%)
Due: Tue, Mar 10
Learning Outcome: 1, 2, 6

Chapter 13, problems 1, 2, 11, 12, 19 (4%)
Due: Tue, Mar 17
Learning Outcome: 2, 6

Lab 1: Calibration of Thermistor (16%)
Date: Thu, Jan 30
Learning Outcome: 1, 2, 3, 5, 6, 7

Lab 2: Construct and test weighing rain gauge (16%)
Due: Thu, Feb 27

Lab 3: Radiation shield lab (16%)
Due: Thu, Mar 26
Learning Outcome: 1, 3, 5, 6, 6, 7

Lab 4: Student's choice (16%)
Due: Thu, Apr 2
Learning Outcome: 6

6.2 Note on labs

Students may substitute other lab exercises for labs 2, 3, and/or 4. Alternative labs are on CourseLink, with some other suggestions as well. Speak to Jon if this interests you.

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7 Course Statements

7.1 Group work

You are encouraged, and in some cases it will be necessary due to equipment limitations, to work in pairs or trios. However, all final assignments and reports should be completed independently. In other words, it is fine for a small group to collect data together and all analyze the same data for their reports, but each report must be completed individually.

8 University Statements

8.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

8.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Graduate Calendar - Grounds for Academic Consideration
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions
https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml

8.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml

Graduate Calendar - Registration Changes
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml

Associate Diploma Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml

8.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

8.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is

required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to book their exams at least 7 days in advance and not later than the 40th Class Day.

For Guelph students, information can be found on the SAS website
https://www.uoguelph.ca/sas

For Ridgetown students, information can be found on the Ridgetown SAS website
https://www.ridgetownc.com/services/accessibilityservices.cfm

8.6 Academic Integrity

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 encourages academic integrity. 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 or faculty advisor.

Undergraduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

Graduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

8.7 Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

8.8 Resources

The Academic Calendars are the source of information about the University of Guelph’s procedures, policies, and regulations that apply to undergraduate, graduate, and diploma

programs.

Academic Calendars
https://www.uoguelph.ca/academics/calendars
