

**ENVS\*4210 Meteorological and Environmental Instrumentation**

Winter 2018

Section(s): C01

School of Environmental Sciences Credit Weight: 0.50

Version 1.00 - January 08, 2018

# Course Details

## 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-Requisite(s): Equate(s):

* 1. **Timetable**

T/Th 10:00am--11:20am Alexander Hall 020

## Final Exam

1 of ENVS\*3050, ENVS\*3130, ENVS\*3340, PHYS\*3100 MET\*4210

# Instructional Support

## Instructor(s)

### Jon Warland Email: Telephone: Office:

[jwarland@uoguelph.ca](mailto:jwarland@uoguelph.ca)

+1-519-824-4120 x56374

ECBA 1106

## Teaching Assistant(s)

### Teaching Assistant:

Olivia Kaminski

### Email:

[okaminsk@uoguelph.ca](mailto:okaminsk@uoguelph.ca)

# Learning Resources

## Required Resources(s)

### Brock and Richardson "Meteorological Measurement Systems" (Textbook)

[http://primo.tug-](http://primo.tug-/) [libraries.on.ca/primo\_library/libweb/action/display.do;jsessionid=485499AFCF7F6D63F09B9F86CC5](http://primo.tug-libraries.on.ca/primo_library/libweb/action/display.do%3Bjsessionid%3D485499AFCF7F6D63F09B9F86CC5EDC04?tabs=detailsTab&amp;ct=display&amp;fn=search&amp;doc=vtug3562547&amp;indx=1&amp;recIds=vtug3562547&amp;recIdxs=0&amp;elementId=0&amp;renderMode=poppedOut&amp;displayMode=full&amp;frbrVersion&amp;dscnt=0&amp;submit=Search%2BPrimo&amp;query=any%2Ccontains%2Cmeteorological%2Bmeasurement%2Bsystems&amp;scp.scps=scope%3A%28%22CENTRAL%22%29%2Cscope%3A%28GUELPH%29%2Cscope%3A%28LAURIER%29%2Cscope%3A%28WATERLOO%29%2Cscope%3A%28HATHI%29%2Cprimo_central_multiple_fe&amp;tab=search&amp;dstmp=1482335662724&amp;dym=true&amp;highlight=true&amp;search_scope=search_tab&amp;displayField=title&amp;bulkSize=10&amp;vl(freeText0)=meteorological%20measurement%20systems&amp;vid=GUELPH&amp;vl(397404693UI0)=any&amp;query_tug=meteorological%2Bmeasurement%2Bsystems&amp;institution=GUELPH&amp;gathStatIcon=true)

### CourseLink (Website)

1. **Learning Outcomes**
   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.

## BSc (Env) Program Learning Outcomes

Successfully completing this course will contribute to the following:

|  |  |  |
| --- | --- | --- |
| # | Outcome Set Name | Course Learning Outcome |
| 3 | Select and execute appropriate technical and analytical methods to answer questions in the environmental sciences through field and laboratory experiences. | 2, 3, 5 |
| 4 | Choose and utilize appropriate quantitative and qualitative methods to analyze and interpret environmental data. | 3 |
| 6 | Effectively communicate ideas and information in graphic, oral and written formats, while demonstrating fluency in the terminology of environmental sciences. | 3, 5, 6, 7 |

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| --- | --- | --- |
| # | Outcome Set Name | Course Learning Outcome |
| 7 | Apply the scientific process and demonstrate an understanding of its value and limitations across a spectrum of academic activities, from the practical to the philosophical. | 1, 2 |
| 8 | Develop an appreciation for the historical evolution of environmental issues and associated changes in analytical and field techniques. | 2, 6 |
| 9 | Apply existing knowledge and understanding to unfamiliar scenarios and environments. | 1 |
| 10 | Demonstrate personal and professional integrity by respecting diverse points of view. This can be achieved through discussions, teamwork, and debates. | 7 |
|  |  |  |

# 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.

## Lecture

### Topic(s): Reference(s):

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**Topic(s):**

Course introduction, calibration, sensor model, barometry Chapters 1 & 2

Thermometry and static performance characteristics Chapters 3 & 4

Scientific writing and graphical presentation of data handout

Energy balance of thermometer, atmospheric water, hygrometery Chapter 5

Dynamic performance characteristics Chapter 6

Anemometry and precipitation Chapters 7 & 9

Radiation and data management Chapter 10

Heat pulse probes and soil thermal properties Analog-to-digital conversion (ADC)

Chapter 13

Trace gas measurement and eddy covariance flux measurement Student-driven topics, work on labs and final projects

# Assessments

## Assessment Details

### Chapter 2, problems 1, 2, 4, 8, 12, 17, 19 (4.00%) Due: Tue, Jan 16

**Chapter 3, problems 1, 2, 4, 7, 8, 9, 11, 16, 17 (4.00%) Due:** Tue, Jan 23

**Chapter 4, problems 2, 8, 9, 13, 14, 20 (4.00%) Due:** Tue, Jan 30

**Chapter 5, problems 1, 2, 4, 5, 15, 23 (4.00%) Due:** Tue, Feb 6

**Chapter 6, problems 1, 3, 5, 12, 13, 15 (4.00%) Due:** Tue, Feb 13

**Chapter 7, problems 2, 3, 4, 7, 9, 15 (4.00%) Due:** Tue, Feb 27

**Chapter 9, problems 1, 2, 3, 5, 7, 10, 12, 13 (4.00%) Due:** Tue, Mar 6

**Chapter 10, problems 1, 3, 4, 7, 8, 14 (4.00%) Due:** Tue, Mar 13

**Chapter 13, problems 1, 2, 11, 12, 19 (4.00%) Due:** Tue, Mar 20

**Lab 1: Calibration of Thermistor (12.00%) Date:** Thu, Jan 25

**Lab 2 Weighing Rain Gauge (12.00%) Due:** Thu, Mar 1

Lab 2: Construct and test weighing rain gauge.

**Lab 3: Radiation Shield (12.00%) Due:** Tue, Mar 20

Radiation shield lab

### Lab 4 (12.00%)

**Due:** Tue, Apr 3 Lab of your choice

### Lab 5 (16.00%)

**Due:** Fri, Apr 13

Lab of your choice, often building and testing a weather station.

# Course Statements

## 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.

# University Statements

## 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.

## 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 regulations and procedures for [Academic Consideration](https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml) are detailed in the Undergraduate Calendar.

## Drop Date

Courses that are one semester long must be dropped by the end of the fortieth class day; two- semester courses must be dropped by the last day of the add period in the second semester. The regulations and procedures for [Dropping Courses](https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml) are available in the Undergraduate Calendar.

## 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.

## 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.

More information: [www.uoguelph.ca/sas](http://www.uoguelph.ca/sas)

## 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 or faculty advisor.

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

## 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.

## 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.

## 8.8 Resources

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