



# **ENVS\*6060 Meteorological Instrumentation**

Winter 2019

Section(s): C01

School of Environmental Sciences

Credit Weight: 0.50

Version 1.00 - January 04, 2019

---

## **1 Course Details**

### **1.1 Calendar Description**

Theoretical and practical aspects of electronic circuits, sensors, and equipment used in meteorological research.

**Pre-Requisite(s):** ENVS\*4210 or equivalent

### **1.2 Course 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 an independent experiment or field measurement of their own design.

### **1.3 Timetable**

T Th 10:00-11:20

### **1.4 Final Exam**

No final exam

---

## **2 Instructional Support**

## 2.1 Instructional Support Team

<b>Instructor:</b>	Jon Warland
<b>Email:</b>	jwarland@uoguelph.ca
<b>Office:</b>	ECBA 1107
<b>Office Hours:</b>	Office hours by chance or appointment

---

## 3 Learning Resources

### 3.1 Required Resource(s)

#### Required Texts (Textbook)

'Meteorological Measurement Systems' by Brock and Richardson. There are two copies on 2 hour reserve, and copies for sale at the bookstore.

### 3.2 Additional Resource(s)

#### Lab Manual (Lab Manual)

Other lab material to be handed out in class and posted on CourseLink.

---

## 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

## 5.1 Lecture

<b>Topic(s):</b>	Course Introduction, Calibration, Sensor Model, Barometry
<b>Reference(s):</b>	Chapters 1 & 2
<b>Topic(s):</b>	Thermometry and Static Performance Characteristics
<b>Reference(s):</b>	Chapters 3 & 4
<b>Topic(s):</b>	Scientific Writing and Graphical Presentation of Data
<b>Reference(s):</b>	handout
<b>Topic(s):</b>	Energy Balance of Thermometer, Atmospheric Water, Hygrometry
<b>Reference(s):</b>	Chapter 5
<b>Topic(s):</b>	Dynamic Performance Characteristics
<b>Reference(s):</b>	Chapter 6
<b>Topic(s):</b>	Anemometry and Precipitation
<b>Reference(s):</b>	Chapters 7 & 9
<b>Topic(s):</b>	Radiation and Data Management
<b>Reference(s):</b>	Chapter 10

**Topic(s):** Heat Pulse Probes and Soil Thermal Properties

**Reference(s):** handout

**Topic(s):** Analog-to-Digital Conversion (ADC)

**Reference(s):** Chapter 13

**Topic(s):** Trace gas Measurement and Eddy Covariance Flux Measurement

**Topic(s):** Student-Driven Topics, Work on Labs and Final Projects

## 6 Assessments

### 6.1 Marking Schemes & Distributions

Name	Scheme A (%)	Scheme B (%)
Chapter 2	4	4
Chapter 3	4	4
Chapter 4,	4	4
Chapter 5	4	4
Chapter 6	4	4
Chapter 7	4	4
Chapter 9	4	4
Chapter 10	4	4
Chapter 13	4	4
Lab 1: Calibration of Thermistor	16	16
Lab 2: Rain gauge	16	16

Name	Scheme A (%)	Scheme B (%)
Lab 3: Radiation shield	16	0
Lab 4: Student choice	16	0
Final Project	0	32
Total	100	100

## 6.2 Assessment Details

### Chapter 2, Problems 1, 2, 4, 8, 12, 17, 19 (4%)

Due: Tue, Jan 15

Learning Outcome(s): 1,2,5

### Chapter 3, Problems 1, 2, 4, 7, 8, 9, 11, 16, 17 (4%)

Due: Tue, Jan 22

Learning Outcome(s): 1,4,5

### Chapter 4, Problems 2, 8, 9, 13, 14, 20 (4%)

Due: Tue, Jan 29

Learning Outcome(s): 1,2,5

### Chapter 5, Problems 1, 2, 4, 5, 15, 23 (4%)

Due: Tue, Feb 5

Learning Outcome(s): 1,2,4,5

### Chapter 6, Problems 1, 3, 5, 12, 13, 15 (4%)

Due: Tue, Feb 12

Learning Outcome(s): 2,4,5

### Chapter 7, Problems 2, 3, 4, 7, 9, 15 (4%)

Due: Tue, Feb 26

Learning Outcome(s): 1,2,5

### Chapter 9, Problems 1, 2, 3, 5, 7, 10, 12, 13 (4%)

Due: Tue, Mar 5

Learning Outcome(s): 2,4,5

### Chapter 10, Problems 1, 3, 4, 7, 8, 14 (4%)

Due: Tue, Mar 12

Learning Outcome(s): 1,2,5

### Chapter 13, Problems 1, 2, 11, 12, 19 (4%)

Due: Tue, Mar 19

Learning Outcome(s): 2,5

### Lab 1: Calibration of Thermistor (16%)

Due: Thu, Jan 31

Learning Outcome(s): 1,2,3,4,5,6

### Lab 2: Weighing Rain Gauge (16%)

Due: Thu, Feb 28

**Learning Outcome(s):** 1,3,4,5,6

**Lab 3: Radiation Shield (16%)**

**Due:** Thu, Mar 21

**Lab 4: Student Choice (16%)**

**Due:** Thu, Apr 4

**Final project report (32%)**

**Due:** Thu, Apr 4

**Learning Outcome(s):** 1,3,4,5,6

## 6.3 Additional Notes

Several labs are provided for students to use for Labs # 2, 3 and 4. Students may choose from these, or create their own lab exercise in consultation with the instructor.

## 7 University Statements

### 7.1 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.

### 7.2 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>

### 7.3 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 course registration are available in the Undergraduate and Graduate 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>

## 7.4 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.

## 7.5 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.

More information can be found on the SAS website  
<https://www.uoguelph.ca/sas>

## 7.6 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>

## **7.7 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.

## **7.8 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>

---