New Course

New Data

Program Affected? Y
Program Change Form Submitted? Y
Subject/Course/Term ATOC 357
• one term
Credit Weight or CEU’s 3 credits

Course Activities

<table>
<thead>
<tr>
<th>Schedule Type</th>
<th>Hours per week</th>
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<tbody>
<tr>
<td>A - Lecture</td>
<td>1.5</td>
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<tr>
<td>L - Laboratory</td>
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Total Hours per Week: 6
Total Number of Weeks: 13

Course Title

<table>
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<th>Official Course Title</th>
<th>Atmospheric &amp; Oceanic Sci Lab</th>
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Rationale

This course provides an opportunity for students to receive hands-on training in atmospheric and oceanic laboratory and field work. It thus provides an ideal opportunity to gain real-world exposure to the physical concepts taught in this program. Such a course is typically required of meteorology programs in North America. A survey of current undergraduates in the AOS department showed overwhelming support for adding this course.

Responsible Instructor

Professor Frederic Fabry

Course Description

Students will gain hands-on experience in several fundamental atmospheric and oceanic science topics through practical experimentation. A diverse set of experiments will be conducted, ranging from in situ observations in Montreal, to remote sensing of clouds and radiation, to laboratory chemistry and water-tank experiments. As a background for these experiments, students will receive training on sensor principles and measurement error analysis, as well as the fundamental physical processes of interest in each experiment. They will learn to operate, and physically interpret data from, various sensors for in situ and remote observation of meteorological variables. Their training will also extend to operational weather observations, analysis, and
<table>
<thead>
<tr>
<th>Approvals Summary</th>
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</thead>
</table>

### Teaching Dept.
- 0291 : Atmospheric & Oceanic Sciences

### Administering Faculty/Unit
- SC : Faculty of Science

### Prerequisites
- ATOC 214 or permission of instructor
- Web Registration Blocked? : N

### Corequisites

### Restrictions

### Supplementary Calendar Info

### Additional Course Charges

### Campus
- Downtown

### Projected Enrollment
- 12

### Requires Resources
- Not Currently Available
- N

### Explanation for Required Resources

### Required Text/Resources Sent To Library?
- Y

### Library Consulted About Availability of Resources?
- Y

### Consultation Reports Attached?

### Effective Term of Implementation
- 201309

### File Attachments
- No attachments have been saved yet.

### To be completed by the Faculty

### For Continuing Studies Use

### Approvals Summary

<table>
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<tr>
<th>Version No.</th>
<th>Departmental Curriculum Committee</th>
<th>Departmental Meeting</th>
<th>Departmental Chair</th>
<th>Other Faculty</th>
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<td>Submitted to Curriculum/Academic Committee for</td>
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|   |   |   |   |   |   | approved
|   |   |   |   |   |   | Edited by: Josie D'Amico on: Dec 6 2012

| 2 |   |   |   |   |   | Submitted to Curriculum/Academic Committee for approval
|   |   |   |   |   |   | Edited by: Josie D'Amico on: Dec 5 2012

| 1 |   |   |   |   |   | Submitted to Curriculum/Academic Committee for approval
|   |   |   |   |   |   | Created on: Dec 3 2012

Course Syllabus (OUTLINE)
ATOC 357: Atmospheric and Oceanic Sci Lab (3 credits; fall or winter)

Course description:
Students will gain hands-on experience in several fundamental atmospheric and oceanic science topics through practical experimentation. A diverse set of experiments will be conducted, ranging from in situ observations in Montreal, to remote sensing of clouds and radiation, to laboratory chemistry and water-tank experiments. As a background for these experiments, students will receive training on sensor principles and measurement error analysis, as well as the fundamental physical processes of interest in each experiment. They will learn to operate, and physically interpret data from various sensors for in situ and remote observation of meteorological variables. Their training will also extend to operational weather observations, analysis, and forecasting.

Instructors: Dr. Frederic Fabry
Prerequisites: ATOC 214 or permission of instructor
Suggested time: 1.5 hours lecture and 4.5 hours of labs
Location: BH 8th floor labs
Expected numbers: 12; Maximum: 15

Opening lectures: Discussions of measurement principles and techniques; measurement errors and error propagation and introduction to data-assimilation theory; preliminary hands-on usage of basic sensors

Experiment 1. Emission
To provide training in the concepts of Blackbody emission, Planck function, and brightness temperature, students will measure and compare the electromagnetic spectra of light sources at different emitting temperatures (e.g., sunlight, Tungsten lamp, and candle).

Experiment 2. Absorption
To learn about Beer's Law and the absorbing properties of atmospheric gases, students will measure the emission spectrum of a light source (e.g., Tungsten lamp) and compare the emission spectrum to the spectra attenuated by different amounts of water vapor.

Experiment 3: Effects of Topography on Meteorology
To gain field experience and solidify conceptual understanding, students will take in situ measurements of meteorological variables (air temperature, pressure, humidity, and winds) as they walk up and down Mont Royal. They will compare their measurements to theory of adiabatic processes, hydrostatic balance, and local air circulations.

Experiment 4: Forecasting
To gain practical experience in weather forecasting, students will be provided with various available global forecast products and asked to merge this information with knowledge of local circulations to generate a local forecast at Burnside Hall. The skill of the forecasts will be quantified through comparison with observations.

**Experiments 5 & 6: clouds and precipitation**
To build understanding of cloud processes, students will use a variety of instruments to measure relevant air properties. A psychrometer will be used to obtain surface temperature and humidity, and an infrared thermometer will measure cloud-base temperature. Cloud and aerosol counters may also be used to link in-cloud droplet concentrations with sub-cloud aerosols. Under rainy conditions, measured raindrop size distributions may be obtained on stained filter paper and compared to the classic Marshall-Palmer distributions.

**Experiments: 7, 8 and 9 (rotating tank experiments)**
To learn about geophysical fluid dynamics, students will carry out laboratory experiments using a rotating water tank. These experiments provide analogues to well known atmospheric and oceanic circulations (e.g., fronts, baroclinic instability, gyre circulations, and Ekman pumping/suction).

**Experiments 10 and 11: Atmospheric chemistry experiments**
To better understand the distribution of chemicals within the atmospheric boundary layer, students will learn to operate instruments for sampling and analysis of air pollutants such as ozone and nitrogen oxides as well as use aerosol analyzers for size-aggregated analysis of particles. The effects of diurnal and seasonal variation of selected atmospheric pollutants, along with smog and cloud formation in the lower boundary layer, will be considered.

**Experiment 12: Field applications to meteorology**
For additional observational data analysis, students will document local air circulations caused by differential heating. These include katabatic downslope winds arising from snowmelt over Mont Royal (winter term) and thermally forced convergence over Montreal’s urban heat island. Environment Canada’s surface-station network, along with McGill radar observations, will facilitate this analysis.

**Grading Breakdown:** 100% Lab Reports

**Resources:**