

**ENV 237H1S/238H1S – PHYSICS OF THE CHANGING ENVIRONMENT
DEPARTMENT OF PHYSICS, UNIVERSITY OF TORONTO
WINTER 2020**

This course will cover basic physics of environmental processes and of measurement techniques in the atmosphere, the ocean, terrestrial biosphere systems, and other biological systems. It will place its work in the context of climate change and other aspects of environmental change.

COURSE CONTACT INFORMATION:

Lecturer: Prof. Debra Wunch

Office: Room MP 707A (South side of the 7th floor of the Burton Tower, Department of Physics, 60 St. George Street)

E-mail: dwunch@atmosph.physics.utoronto.ca

I will try to reply to email inquiries from students within 2 business days (i.e., excluding weekends). I will not answer detailed questions about physics problems by e-mail, as these are best addressed by coming to see me (or your tutors) during our office hours or by appointment.

Office Hours: I will hold group problem-solving sessions during the week a problem set is due. In addition to these hours, you can contact me by e-mail to arrange an appointment.

TA: Liz Cunningham

Office: MP710

E-mail: ecunning@physics.utoronto.ca

TA: Alexandre Audette

Office: MP619

E-mail: alexandre.audette@utoronto.ca

Marker: Laura Saunders

Office: MP710

E-mail: l.saunders@utoronto.ca

COURSE WEBSITE:

Quercus will be used for the course website. The home page of the website will be used for all class announcements. It is your responsibility to check regularly to keep up on course announcements and assignment due dates!

COURSE MEETING TIMES:

- Lectures: 2 hours/week; Tuesdays and Thursdays 1-2 PM in MP 408
- Practicals: 2 hours/week; Mondays 2 PM - 4 PM in MP 124 (starting **13 January 2020**)

COURSE OBJECTIVES:

In this course, we will be considering the physical concepts, processes and phenomena that are relevant to understanding our changing environment. We will be investigating the physical principles through hands-on practicals, classroom lectures and demonstrations. We will be covering topics in areas of thermodynamics, fluid mechanics and interaction of electromagnetic radiation with matter. There will be a focus on how we measure environmental parameters in the latter part of the course. The primary goal of the course is to describe our environment and its changes quantitatively using physical concepts and models through calculations, error analysis and written descriptions. The secondary goal is to develop physics skills and intuition by making quantitative measurements, analyzing data and determining physical parameters. The balance between these goals will differ for ENV 237 and 238.

At the end of the course you will be able to:

1. Demonstrate a solid foundational understanding of the physical environment, including buoyancy, forces, thermodynamics, and electromagnetism. Mastery of these concepts will be demonstrated and evaluated as part of the problem sets, Practicals, midterm test, and exam.
2. Solve quantitative problems by applying the physical concepts developed in class. Distinguish important from extraneous information in a word problem, and solve the problem using physical concepts developed in class. This will be demonstrated and evaluated as part of the problem sets, midterm test and exam.
3. Critically evaluate and interpret datasets in order to answer questions about the physical environment. Plot digital data such that they can be usefully interpreted to describe physical phenomena. This will be demonstrated and evaluated as part of the problem sets, Practicals, and the Formal Report, where you will collect and analyse you own data.
4. Develop a hypothesis about an environmental property, and design and implement a measurement scheme to address that hypothesis. This will be demonstrated and evaluated as part of the Formal Report. This assignment will be a group assignment, so you will also work productively as part of a team.

COURSE MATERIAL REQUIREMENTS:

For this course, you will need a non-programmable scientific calculator (for both course work and test/exams), access to a computer with data graphing and analysis capability (such as a spreadsheet/graphing program or scientific programming suite) and internet access to retrieve the course readings (from electronic resources at the Library and other websites).

PRACTICALS OBJECTIVES:

These are an integral part of the course and attendance at all the Practicals is expected. Throughout the term, the Practicals will be used to divide the class into smaller groups (~3-4 students) for a different mode of learning. During these Practicals, you will have the opportunity to perform hands-on experiments, work on problems like those that will be included on assignments and to discuss course topics in a different environment. As part of the Practicals, you will design and conduct an experiment to measure solar irradiance.

COURSE TEXTS:

This course will use one main text for the course in combination with supplementary readings (all linked on the course website). The main text is *Environmental Physics by Clare Smith, copyright 2001 (2005 electronic) by Taylor and Francis*. There are copies of the textbook at the U of T bookstore, and the text is also available online through the library. Please note that the page numbers differ between the online version and the print version. I will provide section titles for readings to avoid confusion. Additional readings will be from *Environmental Physics by Boeker and van Grondelle, copyright 2011, Third edition by Wiley* and other texts and articles.

COURSE EVALUATION (differs by course):

ENV237	ENV238	
15 %	5 %	Problem Sets
20 %	25 %	Midterm Test (Monday 2 March during Practicals period)
15 %	15 %	Practicals
20 %	25 %	Solar Irradiance Measurement Project
30 %	30 %	Final Exam (to be scheduled during April Exam Period)

PROBLEM SETS:

- Five problem sets will be due during the term (approximately every two weeks). The problem sets will be posted on the course website approximately a week prior to the due date. No paper copies of the problem sets will be distributed in class. Due dates for the problem sets are as follows:
 - January 24, 2020
 - February 7, 2020
 - February 28, 2020
 - March 13, 2020
 - March 27, 2020
- In preparing your answers for the problem sets, you may use your textbook and other resources and discuss the problems with your classmates. However, each student must prepare their final answers to the problem sets individually and must provide all answers and explanations using their own words. Copying from a source is plagiarism (see section on Academic Integrity)!
- IMPORTANT: Note that if an academic offence is committed in any one problem set assignment, the entire grade for the problem set component of the course may be affected.
- Problem sets will be due in your tutor's drop box by 1:10 PM on the announced due date.

PRACTICALS:

- Your mark for the Practicals will be based on participation in experiments and activities during the sessions and correct completion of assigned work. This work will be done in groups of 3-4 students.
- Each group is responsible for writing complete records of their work in their lab notebook and submitting it for marking at the end of the practical period. Details on marking of work will be provided in Practicals and on the course website.
- A Pre-Practical assignment to be completed by each student individually, worth 1/8 of the Practical mark, will be due at the beginning of each Practicals period.

MIDTERM TEST AND FINAL EXAM:

The Midterm Test and Final Exam will both be closed-book examinations and will consist of calculation, definition, and explanation questions. *It should be noted that the Midterm Test will have more calculation type questions and the Final Exam will consist of a more equal balance of calculation and explanation questions.* You should take this into account as you prepare.

- You will be provided with an equation sheet and a table of constants for the Midterm Test and Final Exam. The equation sheet will be provided prior to the test or examination to aid in your studying.
- You must bring your non-programmable scientific calculator for the Midterm Test and Final Exam. You will not be able to borrow one during the test or examination!

SOLAR IRRADIANCE MEASUREMENT PROJECT:

In the latter part of the course, you will be designing and conducting your own experiment to investigate solar irradiance. You will be working with a group of classmates to formulate your hypothesis and collect your data over the month of March. There will be two components submitted for this project:

- An outline for your project stating your hypothesis, measurement plan and other parameters for your project will be due on **March 6, 2020**. You will develop this in collaboration with your group and one outline will be submitted on behalf of the group.
- A formal lab report on your results and analyses will be due on the last day of class (**April 3, 2020**). This will be completed by you individually and must show your own work and comprehension of the project.
- Both your outline and your formal report will be due in your tutor's drop box by 1:10 PM on the announced due date. You must also provide your own calculation spreadsheet for your project to your tutor and Prof. Wunch by email by 1:10 PM on the due date for your lab report to be on time.
- Marking rubrics and assignment expectations will be provided for both the outline and formal lab report as part of these assignment sheets.

ABSENCES:

- You are responsible for making up missed material from lectures and Practicals. If you miss a test or assignment deadline, please contact Prof. Wunch as soon as possible and no later than one week after returning to class.
- Legitimate absences from class for medical, personal, family or other unavoidable reasons must be documented by a detailed letter requesting consideration and one of the following:
 - 1) UofT Verification of Illness or Injury Form;
 - 2) Student Health or Disability Related Certificate;
 - 3) A College Registrar's Letter or
 - 4) Accessibility Services Letter.

These must be submitted to Prof. Wunch in person directly and not by email or in her mailbox.

- **The late penalty for assignments is a reduction in your mark of 10% per day of lateness. After five days, late assignments will not be accepted.**

WRITING AT THE UNIVERSITY OF TORONTO:

There are a number of College Writing Centres at the University of Toronto (<http://www.writing.utoronto.ca/writing-centres/arts-and-science>) that you can use as resources to assist you in organizing and writing your formal report and other assignments. The main Writing at the University of Toronto website can be found via the web (<http://www.writing.utoronto.ca/>). They provide a lot of useful information under the Advice section of their website and you are encouraged to consult them for assistance with your written assignments. They also offer a series of workshops entitled “Writing Plus”. These are detailed at <http://www.writing.utoronto.ca/writing-plus>. Finally, the English Language Learning program (ELL) offers different skills development programs that may be beneficial (<http://www.artsci.utoronto.ca/current/advising/ell>).

REMINDER ABOUT UNIVERSITY POLICY ON POSTAL ADDRESSES AND ELECTRONIC MAIL ACCOUNTS:

You are required to keep your contact information your ROSI account up to date with current and valid postal and university-issued e-mail addresses. It is your responsibility to monitor this e-mail account as it is the one that will be used to contact you during this course. For more information, please refer to <http://www.governingcouncil.utoronto.ca/policies/studentemail.htm>.

ACCOMMODATIONS:

If you have a learning need requiring an accommodation the University of Toronto recommends that students immediately register at Accessibility Services at <http://www.studentlife.utoronto.ca/as>.

Location: 4th floor of 455 Spadina Avenue, Suite 400

Voice: 416-978-8060

Fax: 416-978-5729

Email: accessibility.services@utoronto.ca

The University of Toronto supports accommodations of students with special learning needs, which may be associated with learning disabilities, mobility impairments, functional/fine motor disabilities, acquired brain injuries, blindness and low vision, chronic health conditions, addictions, deafness and hearing loss, psychiatric disabilities, communication disorders and/or temporary disabilities, such as fractures and severe sprains, recovery from an operation, serious infections or pregnancy complications.

You are also invited to communicate with Prof. Wunch at any time about your learning needs. Confidentiality of learning needs is respectfully and strictly maintained.

EQUITY, DIVERSITY, and EXCELLENCE

[This is from <http://www.governingcouncil.utoronto.ca/policies/stateequdivexc.htm>, but it is included here because it is important.]

At the University of Toronto, we strive to be an equitable and inclusive community, rich with diversity, protecting the human rights of all persons, and based upon understanding and mutual respect for the dignity and worth of every person. We seek to ensure to the greatest extent possible that all students enjoy the opportunity to participate as they see fit in the full range of activities that the University offers, and to achieve their full potential as members of the University community.

Our support for equity is grounded in an institution-wide commitment to achieving a working, teaching, and learning environment that is free of discrimination and harassment as defined in the Ontario Human Rights Code. In striving to become an equitable community, we will also work to eliminate, reduce or mitigate the adverse effects of any barriers to full participation in University life that we find, including physical, environmental, attitudinal, communication or technological.

Our teaching, scholarship and other activities take place in the context of a highly diverse society. Reflecting this diversity in our own community is uniquely valuable to the University as it contributes to the diversification of ideas and perspectives and thereby enriches our scholarship, teaching and other activities. We will proactively seek to increase diversity among our community members, and it is our aim to have a student body and teaching and administrative staffs that mirror the diversity of the pool of potential qualified applicants for those positions.

We believe that excellence flourishes in an environment that embraces the broadest range of people, that helps them to achieve their full potential, that facilitates the free expression of their diverse perspectives through respectful discourse, and in which high standards are maintained for students and staff alike. An equitable and inclusive learning environment creates the conditions for our student body to maximize their creativity and their contributions, thereby supporting excellence in all dimensions of the institution.

ACADEMIC INTEGRITY:

Academic integrity is fundamental to learning and scholarship at the University of Toronto. Participating honestly, respectfully, responsibly, and fairly in this academic community ensures that the U of T degree that you earn will be valued as a true indication of your individual academic achievement, and will continue to receive the respect and recognition it deserves.

Familiarize yourself with the University of Toronto's *Code of Behaviour on Academic Matters* (<http://www.governingcouncil.utoronto.ca/policies/behaveac.htm>). It is the rulebook for academic behaviour at the U of T, and you are expected to know the rules. Potential offences include, but are not limited to:

In papers and assignments:

- Using someone else's ideas or words without appropriate acknowledgement
- Copying material word-for-word from a source (including lecture and study group notes) and not placing the words within quotation marks
- Submitting your own work in more than one course without the permission of the instructor
- Making up sources or facts
- Including references to sources that you did not use
- Obtaining or providing unauthorized assistance on any assignment including:
 - working in groups on assignments that are supposed to be individual work
 - having someone rewrite or add material to your work while "editing"
- Lending your work to a classmate who submits it as his/her own without your

permission On tests and exams:

- Using or possessing any unauthorized aid, including a cell phone
- Looking at someone else's answers

- Letting someone else look at your answers
- Misrepresenting your identity
- Submitting an altered test for re-

grading Misrepresentation:

- Falsifying or altering any documentation required by the University, including doctor's notes
- Falsifying institutional documents or grades

You can get further guidance on academic integrity from the website of the Office of Student Academic Integrity at: www.artsci.utoronto.ca/osai/students.

All suspected cases of academic dishonesty will be investigated following the procedures outlined in the [Code of Behaviour on Academic Matters](#). If you have any questions about what is or is not permitted in this course, please do not hesitate to contact me. If you have questions about appropriate research and citation methods, you are expected to seek out additional information from me or other available campus resources like the [College Writing Centres](#), the [Academic Success Centre](#), or the [U of T Writing Website](#).