



CLIM/SPACE/EARTH 380/381: Introduction to Atmospheric Radiation

Monday, Wednesday, Friday 12:30 to 1:20pm

Location – In Person: CSRB 2236

Instructor: Dr. Claire Pettersen

Email: pettersc@umich.edu

Office: CSRB 2543A

Class Website on Canvas:

<https://umich.instructure.com/courses/634192>

Class Website on Piazza:

<https://piazza.com/umich/fall2023/climate380001fa2023>

Instructor office hours:

Synchronous: **In Office (CSRB 2543A)**
Monday 2:30 to 4pm (In Person)
Wednesday 2:30 to 3:30pm (In Person / Zoom)
Friday 9 to 10am (In Person)

Asynchronous: Piazza, Monday - Friday

Course Information

Catalog description: Radiation and energy budget. Flux and intensities. Absorption, emission, scattering and diabatic heating by shortwave and longwave radiative processes.

Credits: 3

Prerequisite: MATH 216

Please consult with the Instructor if these prerequisites are not met

COURSE LEARNING OUTCOMES

Upon successful completion of this course, students will be able to:

- Understand the impacts of solar and terrestrial radiative transfer on energy balance
- Relate spectral atmospheric absorption, emission, transmission, and reflection to different atmospheric constituents
- Solve fundamental radiative transfer problems involving absorption, emission, transmission, and scattering

Course Details

Instructional Modality: In person, synchronous

Meeting time: MWF 12:30pm – 1:20pm Eastern Time Zone

Location: CSRB 2236

Canvas Course URL: <https://umich.instructure.com/courses/634192>

Required Textbooks/Chapters:

Authors: Petty

Title: A First Course in Atmospheric Radiation (2nd Ed.)

ISBN: 0972903318

Recommended Textbooks/Chapters:

Authors: Wallace and Hobbs

Title: Atmospheric Science an Introductory Survey, 2nd Edition

ISBN: 0127329501

Chapters: 1 (Overview), 3 (Thermodynamics), 5 (Composition)

(Some books and chapters are provided on Canvas under **Library Tools**)

Class Discussion: This term we will be additionally be using Piazza for online class discussion (please see Participation Expectations below). The system is highly catered to getting you help fast and efficiently from classmates and myself. Rather than emailing questions to the teaching staff, you should post your homework or topic questions on Piazza. I will be active on Piazza Monday through Friday, but only student feedback should be expected on weekends. If you have any problems or feedback for the developers, email team@piazza.com.

If you are not yet signed up, please sign up here:

<https://piazza.com/umich/fall2023/climate380001fa2023>

Tentative Schedule

This schedule is approximate and will possibly change during the semester. Updates will be reflected on Canvas.

Week	Lectures	Topics	Theme	Reading	Assignments
1	Aug 28, 30 Sept 1	Introduction Basics of Radiation Flux and Intensity	<i>Radiation Basics</i>	Petty Ch. 1 and 2	
2	Sept 6, 8	Flux and Intensity	<i>Radiation Basics</i>	Petty Ch. 2	HW #1 (Due Sunday)
3	Sept 11*, 13*, 15	Electromagnetic Spectrum Reflection / Refraction	<i>Radiation Basics</i>	Petty Ch. 2, 3 and 4	

4	Sept 18, 20*, 22	Reflection / Refraction Surface Interactions	<i>Radiation Basics</i>	Petty Ch. 4 and 5	HW #2 (Due Sunday)
5	Sept 25, 27, 29	Exam 1 Thermal Emission	<i>Emission / Transmission</i>	Petty Ch. 6	Exam 1
6	Oct 2, 4, 6	Thermal Emission	<i>Emission / Transmission</i>	Petty Ch. 6	
7	Oct 9, 11, 13	Thermal Emission Atmospheric Gases	<i>Emission / Transmission</i>	Notes (CP) Petty Ch. 6	HW #3 (Due Sunday)
8	Oct 18, 20	Atmospheric Gases Atmospheric Transmission	<i>Emission / Transmission</i>	Notes (CP) Petty Ch. 7	Fall Break
9	Oct 23, 25, 27	Atmospheric Transmission	<i>Emission / Transmission</i>	Petty Ch. 7	HW #4 (Due Sunday)
10	Oct 30* Nov 1*, 3	Exam 2 Atmospheric Transmission	<i>Emission / Transmission</i>	Petty Ch. 7	Exam 2
11	Nov 6, 8, 10	Atmospheric Emission	<i>Emission / Transmission</i>	Petty Ch. 8	
12	Nov 13, 15, 17	Atmospheric Emission Atmospheric Gases	<i>Scattering / Absorption</i>	Petty Ch. 8 and 9	HW #5 (Due Sunday)
13	Nov 20	Radiative Transfer with Scattering	<i>Scattering / Absorption</i>	Petty Ch. 11	Holiday Break
14	Nov 27, 29 Dec 1	Radiative Transfer with Scattering	<i>Scattering / Absorption</i>	Petty Ch. 11	
15	Dec 4, 6	Atmospheric Particles	<i>Scattering / Absorption</i>	Petty Ch. 12	HW #6 (Due Sunday)
Finals Week	Dec 15				Exam #3

* The dates indicated with an Asterix will have a guest lecturer or recording *

GRADING

Exams 1, 2, 3 (12% each)	36%
Homeworks	50%
Class Participation	14%

The following grading scale will be used:

- A : [93.3 – 100]
- A- : [90.0 - 93.3)
- B+ : [86.7 - 90.0)
- B : [83.3 - 86.7)
- B- : [80.0 - 83.3)
- C+ : [76.7 - 80.0)
- C : [73.3 - 76.7)
- C- : [70.0 - 73.3)
- D : [60.0 - 70.0)
- F : <60

Weekly Time Management

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
CLIMATE/ SPACE/ EARTH 380 / 381 Weekly Overview	Lecture		Lecture		Lecture		
	Office Hours			Office Hours	Office Hours		
	Required Readings, Homework, Write ups						
	Discussion Post Due 12pm		Discussion Posted 12pm (Week –1)		Homework Posted 12pm (Week –1)		Homework Due 10pm
	Piazza Discussions - instructor and students					Piazza Discussions - students	

Exams (36%)

- All exams will be done in class. No working together.
- Exams 1, 2, and 3 will not be cumulative – they will only encompass the topics reviewed between exams. This includes Exam 3, which will be given during the Final Exam time.

Homework (50%)

- Homework is assigned to Canvas on Fridays by 12N and due Sunday at 10pm (+1 week).
- Questions on the homework may be on concepts presented during the same week it is due or from prior classes.
- Graded homework will be returned the following Friday before class.
- Homework should be submitted via Canvas (see notes on Canvas on how to submit and scan)
- **Late Homework Policy:** Homework received after the due date and time will incur a 25% reduction and homework turned in more than 72 hours after the due date will not be accepted.
- Please contact me if you require additional time due to unforeseen circumstances.

Participation (14%)

Lecture: *You are expected to attend lecture in person and be alert and engaged.* However, if you miss class due to circumstances beyond your control, lecture recordings and the presentations will be posted on the Canvas page. Please let me know if you are expecting a

long absence from live lectures. **There will be periodic in person assigned participation exercises. These are designed to reinforce key topics from the lectures and readings.**

You are also encouraged to ask questions during lecture. If you have a question after lecture, please use Piazza and post your question there. I encourage you to ask any and all relevant questions – it is cliché, but there really are no bad questions when it comes to cloud physics and radiation.

Piazza Forum: The purpose of the course Piazza is for students to help each other get through difficult homework problems and understand course concepts. ***You are expected to participate in the assigned class discussions on Piazza.*** Each week there will be a posted participation or discussion question or topic to be answered/addressed on Piazza. These exercises are meant to help you become familiar with topics in class through the application of online tools and resources. Additionally, these Piazza posts can and will lead to further discussion on topics of particular interest in class.

University of Michigan Policies

DIVERSITY & INCLUSION STATEMENT

Diversity is a source of strength, creativity, and innovation. Our dedication to engineering for the public good is inseparable from our commitment to diversity, equity and inclusion (DEI). We lead with an equity-centered engineering mindset in how we teach, do research and support each other.

The Michigan Engineering community includes people from different races and ethnicities, gender identities, sexual orientations, ages and socio-economic backgrounds. We speak different languages, come from different cultures and countries and practice different religions. We have different abilities and disabilities, different political perspectives and life experiences. We all belong here. (Source: <https://www.engin.umich.edu/culture/diversity-equity-inclusion/>)

QUARANTINE OR ISOLATION DUE TO COVID-19

As they have throughout the past year and a half, policies around academic and public health are subject to change as this pandemic evolves. This course will follow all policies issued by the University, which are documented on the Campus Blueprint's FAQ (<https://campusblueprint.umich.edu/faqs/>). These policies may change over the course of the term, so please review the Campus Blueprint's FAQ for the most up to date information.

ACADEMIC CALENDAR & RELIGIOUS OBSERVANCES

- See: https://ro.umich.edu/sites/default/files/calendar/pdfs/Cal_2023-2024.pdf

HONOR CODE

The Honor Code outlines certain standards of ethical conduct for persons associated with the College of Engineering at the University of Michigan. The policies of the Honor Code apply to graduate and undergraduate students, faculty members, and administrators. The Honor Code is based on these tenets:

- Engineers must possess personal integrity both as students and as professionals. They must be honorable people to ensure safety, health, fairness, and the proper use of available resources in their undertakings.

- Students in the College of Engineering community are honorable and trustworthy persons.
- The students, faculty members, and administrators of the College of Engineering trust each other to uphold the principles of the Honor Code. They are jointly responsible for precautions against violations of its policies.
- It is dishonorable for students to receive credit for work that is not the result of their own efforts.

Source: <https://ecas.engin.umich.edu/honor-council/honor-code/>

SEXUAL AND GENDER-BASED HARASSMENT POLICY

As an instructor, one of my responsibilities is to help create a safe learning environment on our campus. As such, I am dedicated to providing a harassment-free experience for everyone, regardless of gender, gender identity and expression, age, sexual orientation, disability, physical appearance, body size, race, ethnicity, religion (or lack thereof), or technology choices. *Sexual and/or gender-based harassment will not be tolerated in any form, including in class discussions, group work (homework and/or projects), or on social media or other online media.*

INDIVIDUAL WITH REPORTING OBLIGATIONS

It is my goal that you feel able to share information related to your life experiences in classroom discussions, in your written work, and in our one-on-one meetings. I will seek to keep information that you share with me private to the greatest extent possible. However, due to my role within the University, I am considered an "Individual with Reporting Obligations (IRO)". This means that I am required to share information regarding sexual misconduct or information about a crime that may have occurred on U-M's campus with the University. The University will use this information to inform you of your rights and access to services.

Students may speak to someone confidentially by contacting the Sexual Assault and Prevention Awareness Center's (SAPAC) Crisis Line at (734) 936-3333, or using any of the other confidential resources provided on the following website: <https://sexualmisconduct.umich.edu/student-resources/>

ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

It is the policy of the University of Michigan to maintain an academic and work environment free of discrimination and harassment for all students, faculty, and staff. The University's commitment to diversity and inclusiveness extends to students with disabilities. The University is committed to the academic success, personal development and general well-being of all students.

Source: <https://registrar.engin.umich.edu/university-policy-for-students-faculty-and-staff-with-disabilities/>

COURSE EVALUATIONS

Students will be provided with an opportunity to anonymously evaluate this course and your learning experience. Student participation is an integral component of this course, and your feedback is important to me. I strongly encourage you to participate in the course evaluation.

RECORDING OF CLASS LECTURES

Course lectures may be recorded and made available to other students in this course. As part of your participation in this course, you may be recorded. ***If you do not wish to be recorded, please contact me during the first week of class to discuss alternative arrangements.***