AOSS 532: Radiative Transfer
Winter 2016

Instructor: Mark Flanner (flanner@umich.edu)

Credits: 4

Lecture: MWF 10:30-12:00 in 2238 Space Research Building (SRB)

Office Hours: Monday 1:00-2:00 and Tuesday 4:00-5:00 in 2527B SRB, or by appointment.

Pre-requisites: Physics and calculus.

Course website: (via canvas)

Required Text: *A First Course In Atmospheric Radiation (2nd Ed.)* by Grant W. Petty (Sundog Publishing, 2006, ISBN-13: 978-0-9729033-1-8.)
*Available for a discounted rate of $36 directly from publisher: http://www.sundogpublishing.com/Ordering/index.html

Supplemental Texts:

1) *An Introduction to Atmospheric Radiation (2nd Edition)* by K. N. Liou (ISBN: 978-0124514515). Library record: http://mirlyn.lib.umich.edu/Record/012437279
2) *Radiative Transfer in the Atmosphere and Ocean* by Gary Thomas and Knut Stamnes (ISBN: 978-0521890618). Library record: http://mirlyn.lib.umich.edu/Record/004062126
3) *Absorption and scattering of light by small particles* by Craig Bohren (ISBN: 978-0471293408). Library record: http://mirlyn.lib.umich.edu/Record/009854729

Course Description:

We will explore concepts and processes of atmospheric radiative transfer, including radiometric quantities, the electromagnetic spectrum, absorption, emission, and scattering. We will cover the physical laws governing these processes, including Planck's Law and Kirchhoff's Law. We will also explore radiative transfer approximations, modeling techniques, and methods to represent broad band quantities. Throughout the course we will treat relevant topics, such as radiative properties of atmospheric constituents, reflection and refraction, within the context of applications in atmospheric science and climate physics (including remote sensing).

Course Structure, Policy, and Honor Code:

Readings: All required readings will come from *Petty* or specific sections of other texts. Readings are listed for the expected date we will begin covering the assigned material in lecture.

Homework: There will be about 9 homework sets, assigned weekly and posted on the course website. Most assignments will require programming in a high-level language such as Matlab. You may (and are encouraged to) form study groups to discuss homework problems and approaches, **but your homework responses must be prepared and completed individually, using your own formulations and wording.** Verbatim copying of another student's work (including source code) is forbidden. You may not consult homework solutions from a previous term unless they are made available in a publicly accessible form. You may complete these assignments in (legible) written or typed form. For assignments requiring programming, you will also be asked to upload your source code to canvas. Unless prior arrangements have been made with the instructor, assignments turned in late will be docked 10% per weekday.

Exams: There will be one midterm, administered in-class, and a final exam. If you have a conflict with either exam time, you must make arrangements to take the exam at an earlier date. Each student must complete the exams solely by her or his own efforts. The exams must be completed within the specified time.

We will apply the College of Engineering honor code in this course: http://honorcode.engin.umich.edu/. You are responsible for understanding these terms. The basic theme of the honor code is that unfair advantage cannot be sought.

Resolving conflict: We will assign a volunteer ombudsman to represent the student body. If you have concerns related to any aspect of the course, and wish to remain anonymous, you are encouraged to communicate your concerns with the assigned ombudsman, whose job it is to relay these concerns to the instructor or appropriate authority.

Grading:

The weighting applied to determine final grades will be:
Homework: 45%, Midterm: 25%, Final: 30%.

Grade assignment will be based on absolute performance (i.e., grading is non-competitive). We will start with the following fixed-scale, but may loosen it as needed, based on course performance:

A+	97%	A	93%	A-	90%
B+	87%	B	83%	B-	80%
C+	77%	C	73%	C-	70%
D+	67%	D	63%	D-	60%

Course Schedule (tentative, next page):

Date	Lec #	Topics (by week, timing will change)	Reading	Homework
W 1/6	1	**Introduction**	Petty Ch. 1	
F	2	**Properties of Radiation**	Petty Ch. 2	HW1 assigned
M 1/11				
W				
F				HW1 due, HW2
M 1/18		**NO CLASS, UM Holiday**		
W		**NO CLASS**		
F	3	**Electromagnetic Spectrum**	Petty Ch. 3	
M 1/25	4	**Reflection and Refraction**	Petty Ch. 4	
W				HW2 due, HW3
F	5	**Radiative Properties of Surfaces**	Petty Ch. 5	
M 2/1				
W	6	**Thermal Emission**	Petty Ch. 6	HW3 due, HW4
F				
M 2/8				
W	7	**Atmospheric Transmission**	Petty Ch. 7	
F				HW4 due
M 2/15				
W				
F		**MIDTERM (in class)**		
M 2/22	8	**Atmospheric Emission**	Petty Ch. 8	
W				HW5 assigned
F				
M 2/29		**Spring Break**		
M 3/7	9	**Gaseous Absorption**	Petty 9.3, 9.5	
W				HW5 due, HW6
F				
M 3/14	10	**Broadband representations**	Petty Ch.10	
W				HW6 due, HW7
F				
M 3/21	11	**Radiative Transfer Equation**	Petty Ch. 11	
W		**with Scattering**		HW7 due, HW8
F				
M 3/28				
W				HW8 due, HW9
F	12	**Scattering & Absorption by Particles**	Petty Ch. 12	
M 4/4				
W				
F				
M 4/11	13	**RT Approximations**	Petty Ch.13	HW9 due
W				
F				
M 4/18				
M 4/25		**FINAL EXAM 4:00-6:00**		