

CLIM 429 Atmospheric Thermodynamics – Fall 2021
TR 10:30-11:45am – Research Hall 121 “The Climate Lab”

Instructor: Paul Dirmeyer pdirmeye@gmu.edu

Office Hours: R 9:00-10:15 or by appointment

Catalogue Description:

Thermodynamics of the atmosphere, properties of dry and moist air, air parcel as a thermodynamic system, atmospheric stability and convection, cloud formation and stability indices

Course Objectives:

1. Develop an understanding of atmospheric thermodynamic processes.
2. Acquire the mathematical skill and physical principles of atmospheric thermodynamics.
3. Apply the mathematical skill and physical principles to solving atmospheric thermodynamics problems.

Prerequisites: CLIM 111 and MATH 114, or permission of instructor

Grading: Homework: 35%, Mid-term: 30%, Final: 35%

There are 7 HW problem sets. Each set carries 5% of total grade. HW problems are due on Thursdays as indicated in the syllabus @11:59PM. Late submission will be accepted only in case of sickness or pre-approval by the instructor at least two days before due day (i.e., Tuesday). You will get a *second chance* on all homework – after graded homework is returned, resubmit up to the day before the Final Exam is distributed for an improved grade!

Grading Scale: Final grade out of 100 points

A+	A	A-	B+	B	B-	C+	C	C-	D	F
≥97	<97;≥93	<93;≥90	<90;≥87	<87;≥83	<83;≥80	<80;≥77	<77;≥73	<73;≥70	<70;≥60	<60

Course Textbook (required reading in advance of each class – see syllabus):

Petty, G. W., 2008: *A First Course in Atmospheric Thermodynamics*, Sundog Publishing, 334pp
This book is in the GMU bookstore, or may be purchased directly from the publisher [Sundog Publishing, LLC](http://www.sundogpublishing.com) or through on-line booksellers.

Bring to Class:

Laptop (or tablet); calculator (or calc app); a way to take notes; your brain! ☺

Other Course Resources:

Skew-T log-P diagrams: <http://sundogpub.com/AtmosThermo/Resources/SkewT.html>

Atmospheric soundings <http://weather.uwyo.edu/upperair/sounding.html>

AMS glossary of meteorology http://glossary.ametsoc.org/wiki/Main_Page

Syllabus and Schedule (Fall 2021)

Week	Topics	Reading	Homework Due (Thu)
1 (Aug 24, 26)	Atmospheric composition and structure; Math review, dimensions	Section 1.1-1.4; Appendix C, D	
2 (Aug 31, Sep 2)	Tutorial on problem solving; Thermodynamic systems and variables	Appendix B; 2.1-2.2	Ch1
3 (Sep 7, 9)	Physical properties of air	3.1-3.3	
4 (Sep 14, 16)	Moisture in the air	3.4-3.5	Ch3
5 (Sep 21, 23)	Atmospheric pressure	4.1; 4.2-4.3	
6 (Sep 28, 30)	Pressure-volume work; First law of thermodynamics	5.1; 5.2-5.3	Ch4
	Take home Mid-term distributed Thu. Sep 30; due Mon. Oct 4 @ 11:59pm	Covers Ch 1-4	
7 (Oct 5, 7)	Dry adiabatic processes; Carnot cycle	5.4; 5.5-5.6	
8 (Oct 14)*	Skew-T diagram	5.7-5.8	
9 (Oct 19, 21)	Entropy, Second law; Moist processes	6.1-6.2; 7.1-7.2	Ch5
10 (Oct 26, 28)	Clausius-Clapeyron, Moisture variables	7.3-7.5	
11 (Nov 2, 4)	LCL, HCF; Moist adiabatic lapse rate	7.6; 7.7	HW Ch7i
12 (Nov 9, 11)	Equivalent potential and wet-bulb temperature	7.8; 7.9-7.10	
13 (Nov 16, 18)	Atmospheric stability	8.1-8.3;8.3-8.4	HW Ch7ii
14 (Nov 23)	Atmospheric convection and stability indices	8.4-8.5	
15 (Nov 30)	Review		HW Ch8
	Final Exam distributed Fri. Dec 10; due Tue. Dec 14 @ 1:15pm	Emphasis on Ch 5-8	

***Fall Break** – no class on Oct 12.

Homework sets and exams will be administered using [Gradescope](#), which allows you to scan and uploaded hand-written assignments.

Homework Assignments [number of problems]:

Ch1: 1.1, 1.2, 1.3, 1.4, 1.5 [5]

Ch3: 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.10, 3.11 [8]

Ch4: 4.2, 4.4, 4.5, 4.6, 4.9, 4.15, 4.16 [7]

Ch5: 5.3, 5.4, 5.5, 5.6, 5.8, 5.10, 5.11, 5.12 [8]

Ch7i: 7.1, 7.2, 7.4, 7.6, 7.8, 7.9, 7.10, 7.11 [8]

Ch7ii: 7.13, 7.16, 7.21, 7.22, 7.23, 7.24 [6]

Ch8: 8.2, 8.3, 8.4, 8.5, 8.6, 8.7, 8.9 [7]

Evolving COVID Situation

All students are required to follow the university's public health and safety precautions and procedures outlined on the university [Safe Return to Campus webpage](#). All students in this course must also complete the Mason COVID Health Check daily. Only students who receive a **green** notification are permitted to attend courses in class. Faculty are allowed to ask you to show them your **green** notification. If you suspect that you are sick or have been directed to self-isolate, please quarantine or get testing.

GMU requires vaccinations for all students who work, study, or live on campus. This includes those who attend classes. There is nothing better than the in-person learning experience, but if you have a medical or religious exemption, I will set up an online live stream of the lectures via Blackboard. I will also set up the streaming option on Blackboard in the case of excused absence options for students receiving vaccination, with side effects after vaccination, or receiving positive test results or diagnosis requiring quarantine. Let me know in advance of class if you need the streaming option. If you are healthy – please be in class!

If the campus closes, or if a class meeting needs to be canceled or adjusted due to weather or other reasons, notices will be posted to Blackboard and emailed to all registered students.

Accommodations for Disabilities

If you have a documented learning disability or other condition that may affect academic performance you should: 1) contact the Office for Disability Services (SUB I, Rm. 4205; 993-2474; <http://ods.gmu.edu>) to determine the accommodations you need; and 2) talk with me to discuss your accommodation needs. In addition to providing your professor with the appropriate form, please take the initiative to discuss accommodation with me at the beginning of the semester and as needed during the term. Because of the range of learning differences, faculty members need to learn from you the most effective ways to assist you.

Academic Integrity

GMU is an Honor Code university; please see the Office for Academic Integrity for a full description of the code and the honor committee process. The principle of academic integrity is taken very seriously, and violations are treated gravely. Discussions inside and outside of the classroom with me or your fellow students are encouraged, however, copying HW directly is prohibited. Cheating during exams is a violation of the code and will be reported to the university for appropriate action. More information: <https://oai.gmu.edu/mason-honor-code/>

Inclusivity

Tolerance of your fellow humans is expected in this class and in the University as a whole. Mason has been a model in the Commonwealth of Virginia, and we should take great pride in our 21st Century vision. Racism and other forms of bias are divisive and destructive – in this course you will become aware of our common place in nature, and how diversity in background, abilities, interests and viewpoints makes society better for us all.