

**CLIM 429 Atmospheric Thermodynamics – Fall 2022**  
**TR 10:30-11:45am – Research Hall 121 “The Climate Lab”**

**Instructor:** Paul Dirmeyer [pdirmeye@gmu.edu](mailto:pdirmeye@gmu.edu)  
**Office Hours:** Thu 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: 25%, Final: 40%**

There are 7 HW problem sets. Each set carries 5% of total grade. HW problems are due on the date 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. You will get a *second chance* on all homework – after graded homework is returned, resubmit up to the day before the Final Exam 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.

**Prior to First Day of Class:**

**Read and understand the Appendices of the textbook!**

**Bring to Class:**

Calculator (or calc app); laptop computer; 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](http://glossary.ametsoc.org/wiki/Main_Page)

## Syllabus and Schedule (Fall 2021)

Week	Topics	Reading	Homework Due
1 (Aug 23, 25)	Atmospheric composition and structure; Thermodynamic systems and variables	Section 1.1-1.4; 2.1-2.2	
2 (Aug 30, Sep 1)	Physical properties of air	3.1-3.3	Ch1 (Tue)
3 (Sep 6, 8)	Moisture in the air	3.4-3.5	
4 (Sep 13, 15)	No class (Professor on travel)		Ch3 (Tue)
5 (Sep 20, 22)	Atmospheric pressure	4.1; 4.2-4.3	
6 (Sep 27, 29)	Pressure-volume work, First law of thermodynamics, <b>Mid-term</b>	5.1-5.3	Ch4 (Tue)
7 (Oct 4, 6)	Dry adiabatic processes; Carnot cycle	5.4; 5.5-5.6	
8 (Oct 13)*	Skew-T diagram	5.7-5.8	
9 (Oct 18, 20)	Entropy, Second law; Moist processes	6.1-6.2; 7.1-7.2	Ch5 (Tue)
10 (Oct 25, 27)	Clausius-Clapeyron, Moisture variables	7.3-7.5	
11 (Nov 1, 3)	LCL, HCF; Moist adiabatic lapse rate	7.6; 7.7	Ch7i (Thu)
12 (Nov 8, 10)	Equivalent potential and wet-bulb temperature	7.8; 7.9-7.10	
13 (Nov 15, 17)	Atmospheric stability	7.8-7.10; 8.1-8.3	Ch7ii (Thu)
14 (Nov 22)	More atmospheric stability	8.3-8.4	
15 (Nov 29, Dec 1)	Atmospheric convection and stability indices; Review	8.4-8.5	Ch8 (Thu)
<b>Dec 13</b>	<b>Final Exam</b> 10:30am to 1:10pm	Emphasis on Ch 5-8	

\***Fall Break** – no class on Oct 11.

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, 8.4, 8.5, 8.6, 8.7, 8.9 [6]

### Post-Chapter Surveys:

After each chapter, a survey will be distributed on Blackboard for you to provide feedback on the teaching and textbook. Bonus points towards the final grade will be given for responding.

## **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](#). Mason classrooms are mask-optional, but masks are encouraged, especially in close quarters or where ventilation is low. If you're more comfortable wearing a mask, feel free to continue. If you feel ill or test positive for COVID, please do not attend class, inform the instructor and observe [quarantine guidance](#).

GMU strongly recommends 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. Mason offers flexible excused absence options for students receiving vaccination and those with side effects after vaccination. 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 any other reason, 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 21<sup>st</sup> 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.