11:670:323 ATMOSPHERIC THERMODYNAMICS

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Professor Alan Robock (http://www.envsci.rutgers.edu/~robock), Room 225, Environmental and Natural Resources Building
Phone: 848-932-5751, E-mail: **robock@envsci.rutgers.edu** (mailto:robock@envsci.rutgers.edu?subject=Thermo)

Classes in Room 223, Environmental and Natural Resources Building
Tuesday and Thursday, 3:50 - 5:10 p.m.

Prerequisites: 01:640:152 Calculus for Mathematical and Physical Sciences II, **and** 01:750:204 General Physics II, *or equivalent*.

Required Text: ***A First Course in Atmospheric Thermodynamics*** *(https://sundogpublishingstore.myshopify.com/products/a-first-course-in-atmospheric-thermodynamics-g-w-petty)*, by Grant W. Petty (Sundog Publishing, Madison, Wisconsin), 2008. [Available at **Sundog Publishing** (https://sundogpublishingstore.myshopify.com/products/a-first-course-in-atmospheric-thermodynamics-g-w-petty) for $36.00.]

Supplemental texts:

Atmospheric Science, An Introductory Survey, Second Edition, by John M. Wallace and Peter V. Hobbs (Academic Press), 2006. [mostly Chapters 1, 3, and 6] **Wallace and Hobbs web site** (http://booksite.elsevier.com/9780127329512/)

Atmospheric Thermodynamics, by Craig F. Bohren and Bruce A. Albrecht (Oxford University Press), 1998.

The Use of the Skew T, log p Diagram in Analysis and Forecasting *(https://rutgers.instructure.com/courses/244049/files/31647255/download)*, Air Weather Service, AWS/TR-79/006, Revised March 1990.

What is expected of you:

1. Check your email every day.

2. Read every assignment in the text before class, and come prepared to discuss it and ask questions about it.
3. Participate in class discussions. But be respectful of your listeners and give everyone time to talk.
4. Listen attentively and respectfully to whomever is talking in class, be it the professor or a fellow student. (This means no texting or web browsing.)
5. Attend every class. Arrive on time. You cannot pass the course if you miss the lectures and class discussions.
6. Be curious.
7. Be skeptical. Demand evidence before you believe something.
8. Enjoy the class, and if you are not, express your concerns and work to change things.
9. Work three hours outside of class for every hour in a class.
10. Many decisions are based on your values. But be sure to be aware of your values and to state then when appropriate.

Learning Goals:

Upon completion of this class, students will be able to:

1. Demonstrate an understanding of atmospheric thermodynamics, including how the vertical structure of the atmosphere changes with vertical motion.
2. Exhibit critical thinking when confronting new information.
3. Communicate clearly orally and in writing, including by electronic means.
4. Apply the mathematical and physical foundations of meteorology and climatology to solve problems using analytical and computational methods.

Schedule		
Date	**Subject**	**Reading: Chapter ___**
Sept. 5	Introduction to course	
Sept. 7	Scientific method, How to do problems, Metric practice	Preface, Appendix B

Sept. 12	Atmospheric variables and their measurement: Pressure and density, Origin of the atmosphere, Composition of the atmosphere, Vertical structure	1
Sept. 14	Atmospheric variables and their measurement: Temperature	1
Sept. 19	Temperature in practice, Radiosonde observations, water vapor and humidity variables, virtual temperature	1, 3.4.2
Sept. 21	Adiabatic diagrams, the Skew-*T* diagram	1, **AWS manual on thermodynamic diagrams (https://rutgers.instructure.com/courses/244049/files/31647255/download)**
Sept. 26	Thermodynamics systems and variables, parcels	2
Sept. 28	The gas law **TERM PAPER TOPICS DUE**	3
Oct. 3	Hydrostatic balance, vertical motion	4

Oct. 5	**MEET IN ROOM 323** Vertical temperature profiles, hypsometric equation	4
Oct. 10	**EXAM I**	
Oct. 12	Pressure in practice	4
Oct. 17	The first law of thermodynamics	5
Oct. 19	Dry adiabatic processes, Heat engines	5
Oct. 24	Enthalpy, subsidence	5
Oct. 26	Entropy, Second law of thermodynamics	6
Oct. 31	Water vapor and moist adiabatic processes	7
Nov. 2	Clausius-Clapeyron equation **TERM PAPER OUTLINE DUE**	7

Nov. 7	Moist adiabatic lapse rate	7
Nov. 9	Mixing	7
Nov. 14	Atmospheric stability	8
Nov. 16	**EXAM II**	
Nov. 21	Atmospheric stability	8
Nov. 23	***THANKSGIVING***	8
Nov. 28	Convection **TERM PAPERS DUE**	8
Nov. 30	Conditional instability, CAPE	8
Dec. 5	Oral term paper presentations	
Dec. 7	Oral term paper presentations	
Dec. 21, 4-7 pm	**FINAL EXAM, ROOM 223**	

Course grade will be determined by:

Homework	20%
Term paper	15% (paper 10%, oral 5%)
Exams	40%
Final exam	25%
	100%

Prepared by ***Alan Robock*** (http://www.envsci.rutgers.edu/~robock) *(* ***robock@envsci.rutgers.edu*** (mailto:robock@envsci.rutgers.edu) *) - Last updated on August 31, 2023*