AOSC 431: Atmospheric Thermodynamics
Fall 2016

Instructor
Daryl T. Kleist
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http://www.aosc.umd.edu/~dkleist/aosc431.html

Classes: Tu/Th 9:30-10:45 a.m., CSS 2416, 3 Credits
Office Hours: M/W 1:00-2:00 p.m. or by appointment

Undergraduate Teaching Assistant: Ms. Kelsey Malloy, kmalloy@umd.edu (Office Hours M 6-7p.m. or by appointment, CSS 3416 and 3400)
Volunteer Teaching Assistant: Mr. David New, CSS 4339

Course Catalog Description:
Classical thermodynamics applied to both the dry and the moist atmosphere. Composition; phase changes of water; stability concepts; Properties of aerosols and clouds, cloud nucleation and precipitation processes, atmospheric electricity, cloud and precipitation chemistry.

Prerequisites:
MATH141 (Calculus II)
PHYS161/171 (General Physics, Mechanics and Particle Dynamics, Mechanics and Relativity)
Recommended:
MATH246 (Differential Equations for Scientists and Engineers)

Course Objectives:
1. Quantitative description and application of atmospheric thermodynamics
2. Analysis and interpretation of atmospheric variables on thermodynamic diagrams
3. Introduction to cloud physics and precipitation processes

Required Text
Atmospheric Science: An Introductory Survey (2nd Edition), by J.M. Wallace and P. V. Hobbs, Elsevier.

Strongly Recommended Text
A First Course in Atmospheric Thermodynamics, by G.W. Petty, Sundog Publishing (available for purchase at
https://www.sundogpublishing.com/ordering/for-students/).

Other Reference Texts
An Introduction to Atmospheric Thermodynamics, by A. A. Tsonis, Cambridge.

Homework Assignments
Various homework assignments will be handed out throughout the semester. Homework will make up 30% of the final grade and is an integral part of learning the material. No late homework will be

accepted without arrangements made prior to due dates. Late homework will have reduced value (25% same day, 50% one day late). Students are encouraged to study and work together, but all solutions submitted should be your own in your own writing and using your own words.

Exams
Two "mid-term" exams and one cumulative final will be given. All exams will be closed book (relevant constants, equations, etc. will be provided).

Attendance
Attendance and participation is mandatory. Make-up exams and late assignments will not be acceptable without documented, appropriate reasoning and advanced notice.

Honor Code
Academic dishonesty will not be tolerated. Students are responsible for educating themselves and following the university honor code:
http://www.shc.umd.edu/SHC/default.aspx

Student Rights
Please visit the following page regarding University policies and resources
http://www.ugst.umd.edu/courserelatedpolicies.html

Grading
Homework (30%), Two Mid-Term Exams (20% each), Final Exam (25%), Attendance and Participation (5%)

Letter grades will be assigned using the following breakdown:
A+ (97-100), A (93-97), A- (90-93)
B+ (87-90), B (83-87), B- (80-83)
C+ (77-80), C (73-77), C- (70-73)
D+ (67-70), D (63-67), D- (60-63)
F (<60)

Approximate **Lecture Schedule by Week (detailed lectures and material available on course website)**
1 – Introduction, Structure and Composition of the Atmosphere
2 – Atmospheric Patterns, Temperature, Air Parcels, Skew-T
3 – Gas Laws, Equation of State for Moist Air
4 – Buoyancy, Hydrostatic, Hypsometric, Sea Level Correction, Standard Atmosphere
5 – First Law of Thermodynamics, Adiabatic Processes
6 – Poisson's Equation, Dry Adiabats, Potential Temperature, Heat Engine
7 – Diabatic Processes, Second Law of Thermodynamics
8 – Water Vapor Saturation, Clausius-Clapeyron
9 – LCL, Moist Adiabatic Lapse Rate, Theta-e, Wet-Bulb Temperature
10 – Humidity measurements, Mixed Layers in the Atmosphere
11 – Atmospheric Stability
12 – CAPE/CIN, Stability Indices
13 – NO CLASS THANKSGIVING WEEK
14 – Aerosols, Droplet Growth, Cloud and Precipitation Processes
15 – Weather Modification, Electrification, Cloud and Precipitation Chemistry