Atmospheric Processes I
ATSC 4010
Fall 2014

MWF, 10:00 to 10:50, EN6060
Prerequisites: PHYS 1320 and either MATH2210 or MATH2310
Jeff Snider, EN6019, jsnider@uwyo.edu, x2637
Class Web Site: http://www-das.uwyo.edu/~jsnider/atsc4010/
Text Book: http://acmg.seas.harvard.edu/publications/jacobbook/index.html
Grading: Quizzes, 20%; Homework, 20%; Midterm 30%, Final 30%

Description - Physical processes occurring in the troposphere and stratosphere are investigated. The course emphasizes key aspects of atmospheric science: air parcel physics, hydrostatics, stability, compartment models, radiation transfer in the cloud-free atmosphere and climate change. Rudiments needed for physical-science problem solving are emphasized, including dimensional analysis, integral and differential calculus.

Introduction
- Integral and differential calculus applications in ATSC4010

Ideal Gas Equation
- The concept of the air parcel
- Single component gas systems and gas mixtures
- Mole fraction composition
- H_2O Saturation vapor pressure, relative humidity, and H_2O partial pressure
- Molecular weight of air

Temperature, Pressure and Humidity Profiles
- The temperature profile
- Temperature lapse rates
- Troposphere, tropopause and stratosphere regions
- Vertical-component equation of motion
- Hydrostatics
- The pressure profile
- The atmospheric scale height
- The sea level pressure chart
- Mass of the atmosphere
- Mass of a well-mixed atmospheric component
- Layer temperature and layer thickness
- Thermal circulations (Hadley cell and mountain breeze)

Midterm

Mass Conservation Modeling
- The reservoir concept
- Sink-specific lifetimes
- Sink and source processes
- Troposphere/stratosphere exchange (the “two-box” problem)
- Lagrangian mass balance problems

Thermodynamics and Vertical Stability
- Air density and specific volume
- Motivation for thermodynamics
- Intensive and extensive properties
- Gibb’s phase rule (why we measure P, T and RH)
- First law of thermodynamics
- Dry adiabatic lapse rate
- Stability assessment
- Stability and plume dispersion
- The buoyant force

Radiation in the Cloud-free Atmosphere

- Climate forcing
- Climate feedback
- 200,000 years of proxy climate record
- The blackbody flux distribution function
- Kirchhoff's radiation law
- The Solar Constant
- The (planetary) effective temperature
- Models of Earth's radiation budget
- Humidity scale height
- One- and two-layer radiant flux models
- Optical depth
- The greenhouse gas effect

Final

……..

Notes:

1) I will use a plus/minus scale when assigning grades for this class (UW Regulation 6-722).

2) Disability Statement:

If you have a physical, learning, or psychological disability and require accommodations, please me know as soon as possible. You must register with, and provide documentation of your disability to University Disability Support Services (UDSS) in Student Educational Opportunity office, room 330 Knight Hall. More information can be found at: http://www.uwyo.edu/udss/

3) Academic Honesty:

UW Bulletin: "The University of Wyoming is built upon a strong foundation of integrity, respect and trust. All members of the university community have a responsibility to be honest and the right to expect honesty from others. Any form of academic dishonesty is unacceptable to our community and will not be tolerated." Students should report suspected violations of standards of academic honesty to the instructor, department head, or dean. Other University regulations can be found at: http://www.uwyo.edu/generalcounsel/new-regulatory-structure/academic-policy.html