Syllabus: ATMS 317 Intermediate Meteorology and Weather Forecasting

Course Administration: http://www.patarnott.com/atms317 and webcampus

Time and Place: MWF 3:00 pm to 3:50 pm, Room 300 Leifson Physics

Main Textbook: Applied Atmospheric Dynamics, First Edition. Authors are Lynch and Cassano. ISBN-10: 0470861738. ISBN-13: 978-0470861738.

This course will be taught by Pat Arnott. Office hours 1 pm to 3 pm Thursday, or by appointment (often best).

Prerequisites:
ATMS 117 or ATMS 121 or GEOG 121; Physics 181; Math 285.

Topics:

- Overview of atmospheric thermodynamics, structure, and balloon sonde measurements.
- Air Pressure and Winds.
- Wind: Small Scale and Local Systems.
- Wind: Global Systems.
- Air Masses and Fronts.
- Middle-Latitude Cyclones.
- Weather Forecasting. Anatomy of Weather Models and Limitations.
- Thunderstorms, Tornados, Hurricanes.
- Mountain Meteorology.
- Boundary Layer Meteorology

Each topic will involve one week of lecture and one class of practical, hands on experience with measurements and models to reinforce understanding of the topic.

Learning Outcomes:
1. Demonstrate an understanding of how winds are generated in the atmosphere.

2. Recognize wind circulation patterns on local, regional, and global scales.

3. Understand how jet streams are formed.

4. Understand warm and cold fronts at the surface.

5. Understand cyclogenesis.

6. Understand divergence and convergence and their mechanisms both at the surface and aloft.

7. Understand vorticity.

8. Be able to identify short wave disturbances on long waves and how they affect weather.

9. Understand how the flow at the 300 mb level can provide upper level support for the formation of storms.

10. Be able to construct a weather forecast from all available scientific evidence, and how to diagnose its success after the fact.

11. Become familiar with the most useful weather model output for forecast and understanding weather.

12. Be aware of the types of equations used in weather models.

13. Learn about ensemble forecasting as a means of improving and qualifying the accuracy of forecasts.

14. Learn about the limitations placed on weather models due to finite accuracy and precision for specifying initial conditions, and because of the nonlinearity and chaos inherent in the equations used to simulate the atmosphere.

15. Learn how to diagnose weather radar images and weather maps that indicate the atmosphere is ripe for tornado formation.

16. Learn how to use Skew T Log P thermodynamic diagrams for balloon soundings to assist in making a forecast.

17. Learn the meaning and uses of weather maps drawn at 1000 mb, 850 mb, 700 mb, 500 mb, and 300 mb.

18. Understand what is meant by quasi-geostrophic theory for synoptic scale flows.

19. Understand how hurricanes form; their structure, lack of electrification, and their typical movement.

20. Be prepared to enter the 400 level meteorology courses where the concepts developed in this course will be used along with advanced mathematical methods and models to develop more understanding of meteorology commensurate with the training requirements for meteorologists working at the National Weather Service, or for students wishing to pursue graduate studies in Atmospheric Science.

Optional Introductory Textbook as a Reference: Meteorology Today: An Introduction to Weather, Climate, and the Environment, 9th edition. The author is by C. Donald Ahrens. ISBN-13: 978-0-495-55573-5.

Optional Midlevel Textbook as a Reference: Atmosphere, Ocean, and Climate Dynamics by John Marchall and R. Alan Plumb

Brief Description:
This course provides a firm foundation for understanding small scale and global winds and their connections with weather. Local circulations have direct impacts on atmospheric boundary layer development and turbulent exchange of heat and mass between the atmosphere and the surface.

The clash of cold air from the north with warm air from the south along the polar front often erupts into small disturbances with surface winds organized into patterns of counter clockwise (cyclonic) flow when a surface low pressure region forms. When upper level support from the exit region of a jet stream coincides with the surface low a major mid latitude cyclone is the outcome. A cold front sweeps down from the northwest raising warmer air up its sides where condensation and intense precipitation often forms. A warm front sweeps to the north with warmer, often moist air over rides colder air, resulting in large-scale clouds and light precipitation. These fronts eventually occlude and merge as the storm ends.

The dynamics of fronts, jet streaks, baroclinic and barotropic conditions, and vorticity are brought together to build a deep understanding of mid latitude cyclones. The long wave (Rossby waves) and short wave structure of the disturbances in jet streams are discussed. Propagation of storms and weather-steering by upper level winds are discussed in relation to weather forecasting development.

Tropical meteorology is introduced as a bridge to understanding hurricane formation and dynamics. Similarities and differences between hurricanes and mid latitude cyclones are presented.

Thunderstorms and tornadoes are discussed as well. Typical conditions ripe for strong thunderstorm development are presented.

Tools for this class:
Students will access extensive atmospheric measurements and model output for winds and the thermodynamics of the atmosphere. Atmospheric soundings made by weather balloons will be discussed for both local weather forecasting and understanding applications. These soundings are also used to interpolate atmospheric wind and thermodynamic structure to form ‘weather maps’ of the mandatory pressure levels used by the National Weather Service.

Advanced topics and homework will involve use of Matlab programs to produce maps of vorticity and divergence for understanding jet stream dynamics.

GRADING:
40% on homework. 20% on exam 1. 20% on exam 2. 20% on comprehensive final exam.

GRADING SCALE:
92% >= Score <= 100% = A
90% >= Score < 92% = A-
88% >= Score < 90% = B+
82% >= Score < 88% = B
80% >= Score < 82% = B-
78% >= Score < 80% = C+
72% >= Score < 78% = C
70% >= Score < 72% = C-
68% >= Score < 70% = D+
62% >= Score < 68% = D
60% >= Score < 62% = D-
0% >= Score < 60% = F

POLICY ON LATE HOMEWORK: 0% possible. Contact instructor for circumstances.

ONLINE CONTENT: Grades are posted on webct as we go, http://webct.unr.edu.

Final Exam:
17 December 2014 10:15 am to 12:15 pm.

GUIDE TO DOING WELL:
(My observations of students that get the most out of their course work during this brief time in life when you get to be a student)

1. Attend class, every class. Ask questions in class. I benefit greatly from questions students ask in class as it helps me refine my understanding of the subject matter, and it helps me convey topics more effectively. Other students benefit as well. I am very open to questions in class, and find that when we have a discussion rather than a monologue, we all get a lot more out of our time together, and we can make interesting discoveries as we go along.

2. Do the homework every time, on time.

3. Work with others on the homework so that you learn to work in a group, and you gain the insights of others as they gain from you.

4. Be sure you thoroughly understand the homework and course material.

5. Arrange your daily schedule so that you have time for sleep at night, and can digest the course material daily. Work on each course a little each day.

6. Get started early on everything. It helps cement your knowledge.

7. Eat well, and get some exercise. Some diversions help refresh your enthusiasm and skill.

8. Attend office hours to ask questions and refine your understanding of the subject matter.

9. Seek connections with the subjects of this course and others you are taking or will take later on.

10. Pay close attention to subjects that are of great interest to you, and you may be able to link your future employment in some way to the concepts of this course.

UNR Policies:
Student Absences: NSHE and University policy state that there are no official absences from any university class:

It is the personal responsibility of the student to consult with the instructor regarding absence from class. It is the expectation of the instructor to accommodate absences of students participating in official University functions and to be sensitive to the needs of students who face serious personal issues. In the event that a student misses a class because of a serious personal issue, the Office of the Vice President for Student Services may, at its discretion, send an explanation to affected faculty. The instructor shall make the final determination on whether the missed work can be done at a time other than during the regularly scheduled class period. It is the policy of the NSHE to be sensitive to the religious obligations of its students. Any student missing class, quizzes, examinations or any other class or lab work because of observance of religious holidays shall, whenever possible, be given an opportunity during that semester to make up the missed work. The make-up will apply to the religious holiday absence only. It shall be the responsibility of the student to notify the instructor in advance in writing, according to the policy of the institution offering the class, if the student intends to participate in a religious holiday that does not fall on state holidays or periods of class recess. This policy shall not apply in the event that administering the assignment at an alternate time would impose an undue hardship on the instructor or the institution that could not reasonably have been avoided.

Absence due to university approved extracurricular activity: The University of Nevada, Reno deeply values and supports the participation of undergraduate students in university-approved extracurricular activities. It is the spirit and intent of this policy to offer fair and equitable opportunities to all students, including those who must miss class due to participation in university approved extracurricular activities. University-

approved extracurricular activities are defined as those sanctioned by the college dean and/or the provost, and may include, but are not limited to, intercollegiate athletics, band, drama, forensics and recruitment. Students who represent the University at such events shall be provided with alternate, timely accommodations for exams, quizzes, or other course assignments missed as a result of their participation. The alternate accommodations should in no way penalize or disadvantage the student. It is the responsibility of the student to provide written notice to their instructor of their participation in official University activities as soon as the student is aware of the potential need to miss class.

Medical Excuse Policy: Effective Fall 2014, the Student Health Center will no longer provide medical excuses for missed classes, exams, or assignments. This policy is based on their limited resources, which are better dedicated to providing health care; the inability for us to make valid determinations about illnesses or injuries students may have effectively managed through self care; and our commitment to student privacy. Exceptions to this policy may occur if, in the judgment of a health care provider at the Student Health Center, the student will be out of class for an extended period of time due to a serious illness or medical condition. Examples of serious illnesses or medical conditions may include but are not limited to:

Mononucleosis, which may require bed rest and/or removal from campus
Hospitalization and/or surgery
Severe injury or illness requiring prolonged bed rest
Highly contagious diseases (chicken pox, measles)

This policy is consistent with the recommendations of the American College Health Association and is similar to other colleges and universities. Reference: Policy adapted from Nazareth College and Drexel University
Disability Statement: Any student with a disability needing academic adjustments or accommodations is requested to contact the instructor as well as the Disability Resource Center in Thompson Student Services 107 as soon as possible to allow for appropriate arrangements.

Academic Success Services
Your student fees cover use of:

- Math Center (784-443 or www.unr.edu/mathcenter/)
- Tutoring Center (784-6801 or www.unr.edu/tutoring/)
- University Writing Center (784-6030 or www.unr.edu/writing_center)

These centers support your classroom learning; it is your responsibility to take advantage of their services. Seeking help outside of class helps you develop as a responsible and successful student.

Recording
Surreptitious or covert videotaping of class or unauthorized audio recording of class is prohibited by law and by Board of Regents policy. This class may be videotaped or audio recorded only with the written permission of the instructor. In order to accommodate students with disabilities, some students may have been given permission to record class lectures and discussions. In those cases, students should understand that their comments during class might be recorded.