

# Syllabus

## Physics of Weather

### (Physics 240)

### Spring Semester 2011

#### Instructor

Prof. Jens Oberheide, 102B Kinard Lab, Dept. of Physics and Astronomy, Clemson University, Tel. 864-656-5163, Email: joberhe@clemson.edu.

#### Class Hours

Monday, Wednesday, Friday: 10:10 am – 11:00 am, 216 Long Hall. You may leave class after 15 minutes if Prof. Oberheide has not arrived.

#### Office Hours

Monday and Wednesday: 4:00 pm – 5:30 pm

#### Course Objective

The objective of the course is two-fold, namely to give the students an appreciation of the broad variety of phenomena that occur in the atmosphere and to use the atmospheric phenomena as an illustration of the principles of physics. The course has relatively little mass, but you are expected to be able to apply physical principles and scientific reasoning to explain various phenomena and effects.

The atmosphere represents an extremely important physical system that strongly influences everything from our daily activities to the long-term future of our society. It creates effects that range from minor inconveniences, in the form of inclement weather, to hazards, in the form of severe weather. Some of the most beautiful phenomena in nature also occur in the atmosphere and are related to atmospheric optics effects and other fields of physics.

The course will cover the structure of the atmosphere, the processes responsible for the planetary circulation, weather systems, including the high and low pressure systems that constitute what is known as synoptic meteorology, mesoscale weather systems, including thunderstorms, atmospheric optics, atmospheric electrification, and seasons and climate. The goal is not to teach weather forecasting, but the course will cover the techniques used in forecasting, primarily as a means of improving our understanding of how the atmosphere works.

#### General Education Competencies

For the area Mathematical, Scientific, and Technological Literacy, students must demonstrate key competencies as listed in the General Education curriculum. Applicable for this course are:

M2. Develop an understanding of the principles and theories of a natural science and its applications: Students will work inquiry-based thematic exercises. Any of these labs are suitable for inclusion in the student's ePortfolio.

M4. Apply information technologies to intellectual and professional development: Assignments require the use of current weather information websites and the combination of multiple observations (satellite, radar, upper-air, surface, forecast maps) to understand how the atmosphere works. The assembly of such maps and data and their discussion is an example of scientific data visualization as part of the student's ePortfolio.

M5. Understand the role of science and technology in society: The course covers extensively atmospheric disturbances that influence human lives on a daily basis. Student essays that discuss the benefits of accurate weather forecasting or the costs and impacts of severe weather events will address this key competency in their ePortfolio.

#### Text:

There are two required texts:

1. *Understanding Weather & Climate* (Fifth Edition) by Aguado and Burt, ISBN 0-321-59550-5.
2. *Excercises for Weather and Climate* (Seventh Edition) by Carbone, ISBN 0-321-59625-0. Make sure that you have a clean, unmarked version (see academic integrity policy below) of the latest printing.

#### Web site:

In addition to the texts, we will use the American Meteorological Society web site, accessible at <http://www.ametsoc.org/amsedu/login.cfm>. The site has information about current weather, links to current meteorological data in the format used by meteorologists and forecasters, and links to other web sites with resource material that may be useful or of general interest. The site also has online quizzes that the students can take for practice or for help in learning terminology and course-related information. Access to the site requires a username and login that is specific to Clemson and the course. The login information will be provided separately by the instructor.

#### Course Outline

1. Composition and Structure of the Atmosphere
2. Solar Radiation and the Seasons
3. Energy Balance and Temperature
4. Atmospheric Pressure and Wind
5. Atmospheric Moisture
6. Cloud Development and Forms
7. Precipitation Processes
8. Atmospheric Circulation
9. Fronts and Midlatitude Cyclones
10. Lightning, Thunder, and Tornados
11. Tropical Storms and Hurricanes
12. Weather Forecasting and Analysis
13. Climate
14. Atmospheric Optics

### Course Grade Weights

40%: Weekly homework assignments.

40%: Three or more tests/quizzes during class hours. The lowest of the test/quiz scores will be dropped, and the remaining scores will constitute the same percentage of the course grade, i.e., 40% / (number of quizzes -1) each.

20%: Final examination (comprehensive).

Regular participation in classroom activities and discussions can add up to 5% to the final course grade, at the discretion of the instructor.

A: 90-100%; B: 80-89%; C: 70-79%; D: 60-69%; F: <60%.

### Homework

Homework is due on the date assigned. Late homework will be accepted only with a very good excuse. Students are welcome to discuss the homework assignments with the instructor or with other students, but they are expected to complete the assignments on their own.

### Attendance Policy

The Clemson University attendance policy as stated in the “Undergraduate Announcements 2010 – 2011” applies.

### Academic Integrity Policy

The Clemson University statement on academic integrity applies. It reads:

“As members of the Clemson University community, we have inherited Thomas Green Clemson’s vision of this institution as a ‘high seminary of learning.’ Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form.”

“When, in the opinion of a faculty member, there is evidence that a student has committed an act of academic dishonesty, the faculty member shall make a formal written charge of academic dishonesty, including a description of the misconduct, to the Associate Dean for Curriculum in the Office of Undergraduate Studies. At the same time, the faculty member may, but is not required to, inform each involved student privately of the nature of the alleged charge.”

Submission of work that has been turned in for credit for a previous and/or current course is not allowed.

### Disability Access Statement

It is University policy to provide, on a flexible and individualized basis, reasonable accommodations to students who have disabilities. Students are encouraged to contact Student Disability Services to discuss their individual needs for accommodation.