Atmospheric Sciences 5951 (Dynamic Meteorology I) Course Syllabus

Class Meetings: WF 3:55 - 5:15 pm
Classroom: Derby Hall 0070
Instructor: Dr. Rachel Mauk
            Office: Room 1055 Derby Hall
            Office phone: 614-688-9296
            Office hours: By appointment
            Email: mauk.20@osu.edu

Course Prerequisites: Atmospheric Sciences 5950, Math 2153

Course Objectives

The basic objective of this course is to provide students with knowledge of the fundamentals of atmospheric dynamics. The knowledge will facilitate students' comprehension of meteorological processes that determine the weather. This increased comprehension of important physical processes will improve students' ability to analyze and to forecast the state of the atmosphere.

Course Structure

The class will meet two days per week for 80 minutes each day. Lectures present material on dynamic processes and their application to atmospheric situations. Important equations are derived and the implications of assumptions discussed. Examples of meteorological problems are discussed.

The textbook for this course is:

Holton, J. R., 2004: *An Introduction to Dynamic Meteorology,* 4th ed., Elsevier Academic Press.

Note: The 3rd and 5th editions are also acceptable, although page and figure numbers may differ. Users of other editions are responsible for identifying the corresponding pages.

Course Requirements

The grade for this course will be determined using the following weighted components:

1. The **midterm examination** will occur in lecture on **Wednesday March 1, 2017 [**25%**]**

2. The **final examination** will occur at 4:00-5:45 pm on **Thursday April 27, 2017** [30%]

3. **Sets of problems** assigned in class. [45%]

4. **Pre- and post-tests** at the beginning and end of the semester. [up to 2% bonus]

The OSU standard scheme will be used:

	A $\geq$ 93.00%	A- 90.00 – 92.99%
B+ 87.00 - 89.99%	B 83.00 – 86.99%	B- 80.00 – 82.99%
C+ 77.00 - 79.99%	C 73.00 – 76.99%	C- 70.00 – 72.99%
D+ 67.00 - 69.99%	D 60.00 – 66.99%	E < 60.00%

Detailed Requirements

Examination format: Each examination will begin with a series of terms to define in one or two sentences. You will have a choice of which terms you choose to define. The remainder of the examination will consist of short essay questions and problems like the problems that will be assigned as homework. The examinations are designed to test your comprehension and understanding of the material, as well as your ability to recall basic dynamic principles. You may use a scientific or graphing calculator on the exams. Cell phone calculators are not permitted during exams. *Complete responses to short answer questions include explanations of relevant dynamic principles.*

Homework assignments: Homework assignments will be due in class every 1-2 weeks. The homework assignments are designed to accomplish two goals. The first goal is to give students some experience solving basic dynamic problems using concepts introduced in class. A second goal is to make students think about the dynamic processes that occur in certain atmospheric phenomena. More challenging problems may require students to combine dynamic principles in order to arrive at the solution to the problem. Some problems will be similar to the tasks require of operational meteorologists. Other problems will deal with fundamental principles and calculations that are used to develop meteorological models and software.

The homework grade component is divided into two parts. The initial assignment submission (first deadline/entry) constitutes 30% of the final grade. Students may then submit corrections to homework assignments following a specified format (second deadline/entry) for the remaining 15% of the final grade. If a student chooses not to submit corrections, then the grade (percentage) on the first entry will be repeated for the second entry.

Pre- and Post-tests: As part of the university's upcoming accreditation, the Department of Geography and the College of Arts and Sciences have requested that pre- and post-tests be given to assess students' understanding of relevant concepts at the beginning and end of the semester. They will constitute up to a 2% bonus (1% per test) on the final grade. *If you complete both tests with evidence of effort, you get the full 2%.*

Other Policies

Units: Numerical answers are incomplete unless they are accompanied by the correct simplified units. Points will be deducted on examinations and homework assignments if units are incorrect, unsimplified, or missing.

Late policy: Assignments and corrections are due on the stated date. Assignments and corrections will be accepted for grading until the time at which they are returned to the rest of the class.

Academic Misconduct: All examination and homework answers are expected to be the work of the student whose name appears on them. Copying another student's work is *plagiarism* and is considered to be *academic misconduct.*

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the Committee (Faculty Rule 3335-5-847). For additional information, see the Code of Student Conduct (http://studentaffairs.osu.edu/info_for_students/csc.asp).

Disability Services: The University strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability (including mental health, chronic or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion.

SLDS contact information: slds@osu.edu; 614-292-3307; slds.osu.edu;
098 Baker Hall, 113 W. 12th Avenue.

List of Topics

In lieu of lecture on Friday March 24, please attend the Severe Weather Symposium!

Part I: Introduction to atmospheric dynamics (3 weeks)
       a. Wind vectors
       b. Basic vector operations
       c. Newton's Second Law of Motion
       d. Fundamental forces
       e. Apparent forces

Part II: Basic conservation laws and equations (3 weeks)
       a. Equations of motion in Cartesian coordinates
       b. Scale analysis
       c. Geostrophic wind
       d. Continuity equation
       e. Thermal energy equation
       f. Mechanical energy equation
       g. Thermodynamic energy equation

Part III: Some applications of the basic equations (4 weeks)
       a. Converting equations to a global coordinate system
       b. Types of balanced flow
       c. Trajectories and streamlines
       d. Pressure as a vertical coordinate
       e. Vertical motion
       f. Thermal wind

Part IV: Circulation and vorticity (4 weeks)
       a. The circulation theorem
       b. Vorticity
       c. Potential vorticity
       d. The vorticity theorem
       e. Helicity