Course Syllabus

Atmospheric Sciences 5951: Dynamic Meteorology I
Class Meetings: MWF 3:00-3:55 p.m.
Classroom: Derby Hall 0030

Instructor: Rachel Mauk
Office: Room 1131 Derby Hall
Office phone: 292-1357
Office hours: M 1:30-2:30 pm, W 4:00-5:00 pm, or by appointment
Email: mauk.20@osu.edu

Course Prerequisites: Atmospheric Sciences 631 or 5950, Math 254 or 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 three days per week for 55 minutes each day. Lectures during the classes will present material on dynamic processes and their application to atmospheric situations. Important equations will be derived and the implications of assumptions will be discussed. Examples of meteorological problems will be discussed. Homework problems that involve the application of material introduced in class will also be assigned and discussed in class.

Textbook: Holton, J. R., 2004: *An Introduction to Dynamic Meteorology*, fourth edition, Elsevier Academic Press.

Course requirements:

1. The **first examination** will occur on **Wednesday February 10, 2016** and will constitute 25% of the course grade.

2. The **second examination** will occur on **Wednesday March 9, 2016** and will constitute 25% of the course grade.

3. The **final examination** will occur at 4:00-5:45 pm on **Friday April 29, 2016** and will constitute 30% of the course grade.

4. Sets of problems will be assigned in class and will constitute 20% of the final grade.

In lieu of lecture on Friday March 4, please attend the Severe Weather Symposium!

Units: Numerical answers are incomplete unless they are accompanied by the correct units. Students will lose points on examinations and homework assignments if the units are incorrect or missing.

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.

Homework assignments: Homework assignments will be due in class every 1-2 weeks. The homework assignments are designed to accomplish several 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. Homework assignments 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.*

Late policy: Assignments are due on the stated date. Assignments will be accepted for grading until they have been returned to the rest of the class.

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: Students with disabilities that have been certified by the Office for Disability Services will be appropriately accommodated, and should inform the instructor as soon as possible of their needs. The Office for Disability Services is located in 150 Pomerene Hall, 1760 Neil Avenue; telephone 292-3307, TDD292-0901; http://www.ods.ohio-state.edu/.

List of Topics

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

Part II: The basic conservation laws (3 weeks)
- a. The equations of motion in Cartesian coordinates
- b. Scale analysis
- c. The geostrophic wind
- d. The continuity equation
- e. The thermal energy equation
- f. The mechanical energy equation
- g. The 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. The use of pressure as a vertical coordinate
- e. Vertical motion
- f. The thermal wind

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