Dynamics of the Atmosphere (11:670:324)

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Prerequisites
Thermodynamics of the Atmosphere (11:670:323), Multivariable Calculus (01:640:251)

Course Description
Hydrodynamics of the atmosphere. equations of motion on rotating earth. Vorticity, potential vorticity, and divergence.

Learning Goals
1) Develop a conceptual understanding of atmospheric dynamical processes;
2) Master the foundational mathematical and physical principles of atmospheric dynamics;
3) Apply the conceptual understanding and mathematical and physical principles to solve problems;
4) Use specialized software to analyze real-time and historical meteorological data.

Week 1	Course overview; review of basic mathematics; review of vector analysis
Week 2	In-class problems; **Quiz**
Week 3	Scale analysis; basic kinematics of fluids; advection; fundamental forces
Week 4	Fixed vs. rotating frames of reference; apparent forces; momentum equation in rotating coordinates; momentum equation in spherical coordinates
Week 5	Continuity equation; "Weather in a Tank"
Week 6	Thermodynamic energy equation; summary of primitive equations; **Hourly exam #1**
Week 7	Hypsometric equation and thickness: pressure coordinates; using GEMPAK to visualize meteorological data
Week 8	Balanced flow; natural coordinates; types of balanced flow; thermal wind
Week 9	In-class problems; barotropic and baroclinic atmospheres; trajectories and streamlines
Week 10	Application of continuity eq. to vertical motion; Dines compensation; using GEMPAK to visualize meteorological data
Week 11	Chaos and numerical weather prediction; **Hourly exam #2**
Week 12	"Weather in a Tank"; vorticity and its physical interpretation; potential vorticity
Week 13	Vorticity equation; using GEMPAK to visualize meteorological data
Week 14	Vorticity equation in p-coordinates; scale analysis of vorticity equation; "Weather in a Tank"
Week 15	**Final exam**

Textbook
Martin, Jonathan E., Mid-Latitude Atmospheric Dynamics, John Wiley and Sons, 324 pp.

Supplemental Reading:
Holton, *An Introduction to Dynamic Meteorology*, 4th Edition, Elsevier Academic Press, Amsterdam, 535 pp.
Wallace and Hobbs, *Atmospheric Science*, 2nd Edition, Elsevier Academic Press, Amsterdam, 483 pp.

Grading
Quiz (mathematical methods, including vector analysis): 5%
Homework and in-class problems: 15%
GEMPAK exercises: 15%
First hourly exam: 20%
Second hourly exam: 20%
Final exam: 25%

Homework
All homework problems will be posted on the Sakai site. ***Homework assignments are due at the beginning of class exactly one week after they are assigned.*** We will accept late homework assignments through the beginning of the next class after the due date, but your score will be reduced by 50%. Do not unnecessarily reduce your final grade by turning in your homework assignments late. If you have not turned in your homework by the next class after the due date, you will receive a score of zero for that assignment.

Exams
In cases of serious emergencies or University-sanctioned schedule conflicts, make-up exams will be given if we are notified in advance. ***Only in cases of serious medical or personal emergencies will a make-up exam be given if we are not notified in advance, and a note from a physician or the Dean's office will be required.***
Message: Show up and take your exams at their scheduled time!

Academic Integrity
You are required to adhere to the Rutgers University policies on academic integrity, which are available from the Rutgers Academic Integrity website. ***During exams and quizzes, cell phones, iPods, PDAs, programmable calculators, and other electronic devices are not to be used under any circumstances.***

Attendance
Attendance is not taken in this class, although the size of the class makes it very easy for us to notice whether or not you attend. We do not grade on the basis of attendance, but in borderline cases we will be more sympathetic to students who demonstrate that they are trying their best by attending class regularly.