Syllabus for Introduction to Atmospheric Dynamics (ATMO 303)

Time: Fall 2020 (August 24, 2020 - December 17, 2020), TR, 10:30-11:45 am
Location: HIG 309

Instructor: Dr. Jingxia (Grace) Zhao, HIG 365, 956-3736, Cell 225-2726, jingxiaz@hawaii.edu

Office Hours: WF 10:30-11:45 am or by appointment

Prerequisites: MET302, MATH242 and PHYS272

Text: ***An Introduction to Dynamics Meteorology***, by James R. Holton and Gregory J. Hakim, Academic Press, 5nd Edition, 2012, 553pp, ISBN 978-0-12-384866-6 (hardback)

Course description: This course is a quantitative introduction to the fundamentals for modern dynamic meteorology. The emphasis is focus on the physical principle rather than mathematical elegance. It provides an elementary description and interpretation of the large-scale atmospheric motions that are associated with weather and climate. Topics to be studied include: the basic conservation laws and its applications of the basic equations, spherical and Cartesian coordinates, pressure (p) and potential temperature (θ) vertical coordinates, thermal and gradient winds, circulation and vorticity in the atmosphere.

Grading:

Problems	30%
Midterm Test	30%
Final Exam	40%
Total	100%

Grading Scale	
100-90	A
89-80	B
79-70	C
69-60	D
Below 60	F

A focused effort is essential to understanding the material and completing the problems successfully. You are encouraged to work together, but you are not allowed to copy each other. Claiming someone else's work or ideas as your own will be considered as dishonesty. It will not be tolerated with consequence of a bad outcome. Format of the exams will be short essay, draw and label a sketch, and problems like ones in the homework. Homework and exams will contribute to grades as indicated in the table above on the left.

Weather information web sites:
University of Hawaii Meteorology weather Server
http://weather.hawaii.edu
The Marshall Spaceflight Center's GOES Satellite viewer:
http://weather.msfc.nasa.gov/GOES/
And the NCEP web-based surface weather analysis:
http://www.wpc.ncep.noaa.gov/html/sfc2.shtml

The Student Learning Outcomes listed in this syllabus are those required actions that a student who successfully completes the course must be able to perform. The educational experience, however, is a two-way, interactive process involving both the student and the instructor. The student must play an active role in the learning process in order to be successful. Instructors will provide an Instructor's Course Requirements document at the first class meeting explaining how they measure each of the Student Learning Outcomes. A student who is unable to accomplish the outcomes will not receive a passing grade in the course.

The information in this Syllabus may not be accurate beyond the current semester. Textbooks and other course materials are subject to change. Students should verify the textbooks at the first class meeting with their instructor prior to purchasing.

- **Student Learning Outcomes:**
  By the end of the course, students will be able to
  - *Apply* physical laws and forces in initial and non-initial frame coordinates to explain the circular motions in the atmosphere of the rotating earth.
  - *Describe* the balanced winds (such as geostrophic wind, thermal wind, and gradient wind), circulation and vorticity in the earth's atmosphere

Schedule for ATMO 303

Fall 2020

	Tuesday	Thursday	Homework Assignments
Week 1	August 25 Introduction	August 27 Basic Notions & Physical Laws	
Week 2	September 1 Atmos. Forces	September 3 Atmos. Forces	HW #1
Week 3	September 8 Non-inertial Frame and Apparent Forces	September 10 Non-inertial Frame and Apparent Forces	
Week 4	September 15 Hydrostatic Equation	September 17 Different vertical coordinates	HW #2
Week 5	September 22 Equations in Rotating Coordinate	September 24 Equations in Spherical Coordinate	
Week 6	September 29 Scale Analysis of Equations	October 1 Continuity Equation	HW #3
Week 7	October 6 Dry Thermodynamics	October 8 Moist Thermodynamics	
Week 8	October 13 Review	**October 15** **Test**	
Week 9	October 20 Basic Equation in P Coordinates	October 22 Balanced Flows	HW #4
Week 10	October 27 Balanced Flows	October 29 Trajectories & Streamline	
Week 11	**November 3** **Election Day**	November 5 Thermal Wind	HW #5
Week 12	November 10 Vertical Motion	November 12 Circulation Theorem	
Week 13	November 17 Vorticity in Natural Coordinates	November 19 Vorticity Equation	HW #6
Week 14	November 24 Vorticity Equation	**November 26** **Holiday: Thanksgiving**	
Week 15	December 1 Potential Vorticity	December 3 Shallow Water Equation	HW #7
Week 16	December 8 Potential Vorticity in θ-Coordinate	December 10 Review	
Week 17	December 15 **Final** **9:45-11:45am, HIG 309**	December 17	