GEORGE MASON UNIVERSITY

Course Approval Form

For approval of new courses and deletions or modifications to an existing course.

registrar.gmu.edu/facultystaff/curriculum

Action Requested:

[X] Create new course
[ ] Delete existing course
[ ] Modify existing course (check all that apply)
- [ ] Title
- [ ] Prereq/coreq
- [ ] Credits
- [ ] Schedule Type
- [ ] Repeat Status
- [ ] Restrictions
- [ ] Grade Type
- [ ] Other: ____

Course Level:

[X] Undergraduate
[ ] Graduate

College/School: College of Sciences
Department: Atmospheric, Oceanic, and Earth Sciences
Submitted by: Barry Klinger
Ext:
Email: bklinger@gmu.edu

Subject Code: CLIM **Number:** 311
(Do not list multiple codes or numbers. Each course proposal must have a separate form.)

Effective Term: [X] Fall [ ] Spring [ ] Summer *Year* 2014

Title: Current: Introduction to Atmospheric Dynamics
Banner (30 characters max including spaces):
New:

Credits: (check one) [X] Fixed 3 [ ] Variable

Repeat Status: (check one) [X] Not Repeatable (NR) [ ] Repeatable within degree (RD) [ ] Repeatable within term (RT)
Maximum credits allowed:

Grade Mode: (check one) [X] Regular (A, B, C, etc.) [ ] Satisfactory/No Credit [ ] Special (A, B C, etc. +IP)

Schedule Type Code(s): (check all that apply)
[X] Lecture (LEC)
[ ] Lab (LAB)
[ ] Recitation (RCT)
[ ] Internship (INT)
[ ] Independent Study (IND)
[ ] Seminar (SEM)
[ ] Studio (STU)

Prerequisite(s): CLIM 111 and MATH 213; Or permission of instructor

Corequisite(s):

Instructional Mode:
[X] 100% face-to-face
[ ] Hybrid: ≤ 50% electronically delivered
[ ] 100% electronically delivered

Special Instructions: (list restrictions for major, college, or degree;hard-coding; etc.)

Are there equivalent course(s)? [ ] Yes [X] No
If yes, please list ____

Catalog Copy for NEW Courses Only (Consult University Catalog for models)

Description (No more than 60 words, use verb phrases and present tense)
Observational bases and fundamentals of fluid dynamic principles for understanding atmospheric motions across multiple spatial and temporal scales; covers basic conservation laws of mass, momentum, and energy; concepts of circulation and vorticity; balanced atmospheric flows, e.g. geostrophic wind and shear, thermal wind; quasi-geostrophic and isentropic potential vorticity analysis for mid-latitude cyclones and fronts

Notes (List additional information for the course)
This course replaces CLIM 411

Indicate number of contact hours: Hours of Lecture or Seminar per week: 3 Hours of Lab or Studio:
When Offered: (check all that apply) [X] Fall [ ] Summer [ ] Spring

Approval Signatures

Department Approval ____ Date ____
College/School Approval ____ Date ____

If this course includes subject matter currently dealt with by any other units, the originating department must circulate this proposal for review by those units and obtain the necessary signatures prior to submission. Failure to do so will delay action on this proposal.

Unit Name	Unit Approval Name	Unit Approver's Signature	Date

For Graduate Courses Only

Graduate Council Member ____
Provost Office ____
Graduate Council Approval Date ____

Course Proposal Submitted to the Curriculum Committee of the College of Science

1. COURSE NUMBER AND TITLE: CLIM 311 Introduction to Atmospheric Dynamics

Course Prerequisites: CLIM 111 and MATH 213; or permission of instructor

Catalog Description:
Observational bases and fundamentals of fluid dynamic principles for understanding atmospheric motions across multiple spatial and temporal scales; covers basic conservation laws of mass, momentum, and energy; concepts of circulation and vorticity; balanced atmospheric flows, e.g. geostrophic wind and shear, thermal wind; quasi-geostrophic and isentropic potential vorticity analysis for mid-latitude cyclones and fronts

2. COURSE JUSTIFICATION:
Dynamic meteorology offers the core principles for understanding atmospheric motions across multiple temporal and spatial scales. The course introduces the basic concepts and dynamics framework for describing the motions in the atmosphere, including the global large-scale circulation and the weather related transients, provides theoretical principles and guidance for interpreting weather map and weather forecasting. It also provides the framework for understanding atmospheric circulations and their internal variability as well as their response to climate change.

Course Objectives:
Students will become familiar with the basic concepts of dynamic meteorology, develop an appreciation of meteorological phenomena across multiple spatio-temporal scales, and be able to apply these concepts to understanding weather and climate phenomena. The course will focus on the following topics:

- Major dynamical balances (e.g., geostrophic, hydrostatic, and/or thermal wind) for atmospheric motions
- Approximations enabling solution to specific atmospheric phenomenon (e.g., quasigeostrophic equations)
- Conservation laws such as energy, mass, momentum, vorticity (potential vorticity), and entropy
- Key structures and development of the mid-latitude weather systems and the related dynamical interpretation.

Course Necessity:
Introductory course provides students the fundamentals of dynamic meteorology, which form the basics for understanding atmospheric motions.

Course Relationship to Existing Programs:

It is a core requirement for BS in Atmospheric Science and serves as an elective for BS students with an Atmospheric Science concentration.

Course Relationship to Existing Courses:
This course is developed from the existing graduate level course CLIM711. This course replaces CLIM 411 in the GMU catalog.

3. APPROVAL HISTORY:

4. SCHEDULING AND PROPOSED INSTRUCTORS:

Semester of Initial Offering: Fall 2014

Proposed Instructors: TBD

5. TENTATIVE SYLLABUS: see following page

CLIM 311 Introduction to Atmospheric Dynamics

Instructor: TBD

Catalog Description:
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- Key structures and development of the mid-latitude weather systems and the related dynamical interpretation.

Prerequisites: CLIM 111 and MATH 213; or permission of instructor

Grading: Home work: 30%**,** Mid-term: 30%, Final: 40%
There are 6 HW problem sets. Each set carries 5% of total grade. HW problems are due the week after they are assigned.

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

Supplementary Texts:
Holton, J., 2004: An Introduction to Dynamic Meteorology; 4th edition, Elservier, 535 pp.
Wallace J. M. and Hobbs, P. V., 2006: Atmospheric Science—An Introductory Survey, *Chapter 7 Atmospheric Dynamics.*

Course Resources:
AMS glossary of meteorology http://glossary.ametsoc.org/wiki/Main_Page
Amazon site for text book: http://www.amazon.com/Mid-Latitude-Atmospheric-Dynamics-First-Course/dp/0470864656
Brian Doty's website for contemporary weather map archive: http://wx.gmu.edu/pix/forecast.html

Tentative Syllabus and Schedule

Week (Monday of week)	Topics	Reading	HW assignment
1 (Aug 25)	Nature of fluids and useful mathematical tools	1.1-1.5	
2 (Sept 1)	Fundamental forces and apparent forces	2.1-2.2	
3 (Sept 8)	Conservation of momentum, mass, and energy;	3.1-3.3	HW#1

4 (Sept 15)	Equations of motion and applications	4.1-4.3	
5 (Sept 22)	Circulation; vorticity; potential vorticity	5.1-5.2	HW#2
6 (Sept 29)	Quasi-Geostrophic system	5.3-5.4	HW#3
7 (Oct 6)	Review and Mid-term exam		Mid-term
8 (Oct 13)	Ageostrophic wind and Sutcliffe development theorem	6.1-6.2	
9 (Oct 20)	QG Omega equation and **Q** vector	6.3-6.4	HW#4
10 (Oct 27)	Midlatitude fronts and frontogenesis	7.1-7.2	
11 (Nov 3)	Semi-geostrophic equations and application to fronts	7.3-7.5	HW#5
12 (Nov 10)	QG diagnosis for cyclogenesis	8.1-8.4	
13 (Nov 17)	Post-mature stages of cyclone life cycle	8.6-8.8	HW#6
14 (Nov 24)	Break (Thanksgiving)		
15 (Nov 31)	Ertel PV and applications to mid-latitude weather systems	9.1-9.5	
16 (Dec. 7)	Final		