FORMAT 2

Submit originals and one copy and electronic copy to **Governance/Faculty Senate Office**
See http://www.uaf.edu/uafgov/faculty/cd for a complete description of the rules governing curriculum & course changes.

CHANGE COURSE (MAJOR) and DROP COURSE PROPOSAL

SUBMITTED BY:

Department	**Physics**	**College/School**	**CNSM**
Prepared by	Barbara May x 7368	**Phone**	
Email Contact		**Faculty Contact**	**John Olson, x6793/7559 (jvo@gi.alaska.edu)**

Received
JUN 18 2010
Dean's Office
College of Natural Science & Mathematics

1. *COURSE IDENTIFICATION:*

Dept **PHYS** Course # **F645** No. of Credits **3**

COURSE TITLE **Fundamentals of Geophysical Fluid Dynamics**

2. *ACTION DESIRED:*

Change Course [X] If Change, indicate below what change. Drop Course [ ]

NUMBER	[X]	**TITLE** [ ]	**DESCRIPTION** [ ]
PREQUISITES	[ ]		***FREQUENCY OF OFFERING*** [ ]
CREDITS (including credit distribution)	[ ]		***COURSE CLASSIFICATION*** [ ]
CROSS-LISTED Creates ATM F647	[X] Dept.	ATM	(Requires approval of both departments and deans involved. Add lines at end of form for such signatures.)
STACKED (400/600) *Include syllabi.*	[ ] Dept.	[ ]	Course # F645 ~~F645~~ 647
OTHER (please specify)	Change course number to F647 for PHYS.		

3. *COURSE FORMAT*

NOTE: Course hours may not be compressed into fewer than three days per credit. Any course compressed into fewer than six weeks must be approved by the college or school's curriculum council. Furthermore, any core course compressed to less than six weeks must be approved by the core review committee.

COURSE FORMAT: (check all that apply) [ ] *1* [ ] *2* [ ] *3* [ ] *4* [ ] *5* [x] *6 weeks to full semester*

OTHER FORMAT (specify all that apply)

Mode of delivery (specify lecture, field trips, labs, etc) **lecture**

4. COURSE CLASSIFICATIONS: (undergraduate courses only. Use approved criteria found on Page 10 & 17 of the manual. If justification is needed, attach on separate sheet.)

H = Humanities [ ] S = Social Sciences [ ]

Will this course be used to fulfill a requirement for the baccalaureate core? **YES** [ ] **NO** [ ]

IF YES, check which core requirements it could be used to fulfill:

O = Oral Intensive, Format 6 also submitted [ ] W = Writing Intensive, Format 7 submitted [ ] Natural Science, Format 8 submitted [ ]

5. COURSE REPEATABILITY:

Is this course repeatable for credit? **YES** [ ] **NO** [X]

Justification: Indicate why the course can be repeated (for example, the course follows a different theme each time).

How many times may the course be repeated for credit? [ ] **TIMES**

If the course can be repeated with variable credit, what is the maximum number of credit hours that may be earned for this course? [ ] **CREDITS**

6. ***CURRENT CATALOG DESCRIPTION AS IT APPEARS IN THE CATALOG: including dept., number, title and credits***

PHYS F645 Fundamentals of Geophysical Fluid Dynamics
3 Credits
Offered Fall Odd-numbered Years
Introduction to the mechanics of fluid systems, the fundamental processes, Navier-Stokes' equations in rotating and stratified fluids, kinematics, conservation laws, vortex motion, irrotational flow, laminar flow, boundary layer phenomena, waves, instabilities, turbulent flows and mixing. Prerequisites: Graduate standing or permission of instructor. (3+0)

7. ***COMPLETE CATALOG DESCRIPTION AS IT WILL APPEAR WITH THESE CHANGES: (Underline new wording ~~strike-through old wording~~ and use complete catalog format including dept., number, title, credits and cross-listed and stacked.) PLEASE SUBMIT NEW COURSE SYLLABUS. For stacked courses the syllabus must clearly indicate differences in required work and evaluation for students at different levels.***

PHYS ~~F645~~ 647 Fundamentals of Geophysical Fluid Dynamics
3 Credits
Offered Fall Odd-numbered Years
Introduction to the mechanics of fluid systems, the fundamental processes, Navier-Stokes' equations in rotating and stratified fluids, kinematics, conservation laws, vortex motion, irrotational flow, laminar flow, boundary layer phenomena, waves, instabilities, turbulent flows and mixing. Prerequisites: Graduate standing or permission of instructor. (Cross-listed with ATM ~~F645~~ 647.) (3+0)

ATM ~~F645~~ 647 Fundamentals of Geophysical Fluid Dynamics
3 Credits
Offered Fall Odd-numbered Years

Introduction to the mechanics of fluid systems, the fundamental processes, Navier-Stokes' equations in rotating and stratified fluids, kinematics, conservation laws, vortex motion, irrotational flow, laminar flow, boundary layer phenomena, waves, instabilities, turbulent flows and mixing. Prerequisites: Graduate standing or permission of instructor. (Cross-listed with PHYS ~~F645~~ 647.) (3+0)

8. ***IS THIS COURSE CURRENTLY CROSS-LISTED?***
YES/NO [No] **If Yes, DEPT** [ ] **NUMBER** [ ]
(Requires written notification of each department and dean involved. Attach a copy of written notification.)

9. ***GRADING SYSTEM:*** ***Specify only one***
LETTER: [X] **PASS/FAIL:** [ ]

10. ***ESTIMATED IMPACT***
WHAT IMPACT, IF ANY, WILL THIS HAVE ON BUDGET, FACILITIES/SPACE, FACULTY, ETC.

No impact. Atmospheric sciences' students already take the class.

11. ***LIBRARY COLLECTIONS***
Have you contacted the library collection development officer (kljensen@alaska.edu, 474-6695) with regard to the adequacy of library/media collections, equipment, and services available for the proposed course? If so, give date of contact and resolution. If not, explain why not.

No [ ] Yes [ ]

Professor has talked to the librarian and all the requested materials will be available at the Keith Mather Library.

12. ***IMPACTS ON PROGRAMS/DEPTS:***
What programs/departments will be affected by this proposed action?

Include information on the Programs/Departments contacted (e.g., email, memo)

None

13. *POSITIVE AND NEGATIVE IMPACTS*

*Please specify **positive and negative** impacts on other courses, programs and departments resulting from the proposed action.*

JUSTIFICATION FOR ACTION REQUESTED

The purpose of the department and campus-wide curriculum committees is to scrutinize course change and new course applications to make sure that the quality of UAF education is not lowered as a result of the proposed change. Please address this in your response. This section needs to be self-explanatory. If you ask for a change in # of credits, explain why; are you increasing the amount of material covered in the class? If you drop a prerequisite, is it because the material is covered elsewhere? If course is changing to stacked (400/600), explain higher level of effort and performance required on part of students earning graduate credit. Use as much space as needed to fully justify the proposed change and explain what has been done to ensure that the quality of the course is not compromised as a result.

In the last few years, several atmospheric sciences' students were advised to take this class through Physics as the ATM fluid dynamics class to bundle resources. For atmospheric sciences' graduates, however, it is advantageous if they take this class under an atmospheric sciences label rather than a physics label. UAF will save money if the two departments cross-list the class rather then both departments teaching a class that basically delivers the same material.

APPROVALS:

John Olson	Date	6/17/2010
Signature, Chair, Program/Department of:	Physics	
	Date	6/28/2010
Signature, Chair, College/School Curriculu Council for:	CNSM	
	Date	6/28/10
Signature, Dean, College/School of:	CNSM	
	Date	
Signature of Provost (if applicable)		

Offerings above the level of approved programs must be approved in advance by the Provost.

ALL SIGNATURES MUST BE OBTAINED PRIOR TO SUBMISSION TO THE GOVERNANCE OFFICE.

	Date	
Signature, Chair, UAF Faculty Senate Curriculum Review Committee		

ADDITIONAL SIGNATURES: ***(As needed for cross-listing and/or stacking)***

Nicole Mölders Nicole Mölders		Date	6-17-20P
Signature, Chair, Program/Department of:	**Atmospheric Sciences**		
		Date	
Signature, Chair, College/School Curriculu Council for:	**CNSM**		
		Date	
Signature, Dean, College/School of:	**CNSM**		

Fundamentals of Geophysical Fluid Dynamics

PHYS F~~645~~647; ATM F~~645~~647 F01 Fundamentals of Geophysical Fluid Dynamics

Instructor: David Newman
Office: 112 REIC
Office Phone: 474-7858
Home Phone: 458-8576 (if all else fails!! But please not after 11 PM)
Email: denewman@alaska.edu

Office Hours:

Monday 2:00-4:00pm in 112 REIC
Wednesday 2:00-4:00pm in 112 REIC

Course Description: Fundamentals of Geophysical Fluid Dynamics deals with large-scale fluid motion on a rotating body (i.e. a planet). Often, the rotation, stratification and surface curvature place important constraints on the dynamics of the fluid. These "fluids" can be oceans, atmospheres, ionized atmospheres, molten rock and even ice. We will develop the mathematical (and hopefully intuitive) tools to study these dynamical systems. This course will cover the following topics among others: Characteristics of geophysical fluids Basic fluid dynamics Waves and instabilities Rotation and stratification Introduction to Turbulence

Course Syllabus:

Prerequisites: Graduate standing or permission of instructor. Mathematical methods will be used extensively in this course

Materials Needed:

Required Text: *Introduction to Geophysical Fluid Dynamics*, Benoit Cushman-Roisin, 2010, Prentice Hall

Suggested text: *Atmospheric and Oceanic Fluid Dynamics: Fundamentals and Large-scale Circulation*, Geoffrey K. Vallis, 2006, Cambridge University Press

Lectures: Note room: MWF 1-2 in Room 204 Reichardt Building. If you miss the first class, check back here for any changes in schedule. The lectures supplement but do not substitute for the reading. Lectures will cover the major topics, emphasizing and discussing the important points. They are not sessions to regurgitate material already written in the text (though they sometimes may be!). Your personal participation is important, and it is critical that you read the assigned material before lecture. Time permitting several lectures will cover special topics beyond the scope of the text. These will be announced before hand.

Homework: There will be approximately one homework assignment per week. The assignment will be given out (and posted on the web and in the hall in front of my office) on Wednesdays and will be due in class on the following Wednesday. You are encouraged to work with others on the homework, but please make sure the work you turn in is not simply copied from someone else. These assignments help me assess your understanding of the material, and will count toward the bulk of your final grade. **Late problem sets will not in general be accepted**

Project: There will be in the form of a web page and presentation on a topic in geophysical fluids that you find interesting and we agree on together. These topics could include research you

are involved in, as well as general topics of interest and importance in GFD. The topic must be agreed to by Feb 11th and must be competed by April 22nd. They will be graded both for presentation and content. More details will be discussed in class.

Exams: Exams will be take home exams: Check back for more details and dates.

Grading: The course will be graded on a plus/minus grade scale and the grade will consist of the following components:

2 take home exams 30 %
Homework 50 %
Project 20 %

Contacting Me: I have office hours as listed above. You can drop by at other times if I'm not busy, or make an appointment. I am (almost) /never/ available before class.

Special Needs: The Office of Disability Services implements the Americans with Disabilities Act (ADA), and insures that UAF students have equal access to the campus and course materials. We will work with the Office of Disabilities Services (203 WHIT, 474-7043) to provide reasonable accommodation to students with disabilities. *Plagiarism etc:* Plagiarism and cheating are matters of serious concern for students and academic institutions. This is true in this class as well. The UAF Honor Code (or Student Code of Conduct) defines academic standards expected at the University of Alaska Fairbanks which will be followed in this class. (Taken from the UAF plagiarism web site, which has many links with good information about this topic)

Complaints and Concerns: You are always welcome to talk to me about anything, however, if you have a non-subject matter question or concern that cannot be resolved by me contact the department chair, Dr. Olson, Physics Department Office, room 102 REIC

Alternate References: To see the same topics explained differently, try the following:

--*Geophysical Fluid Dynamics*, Joseph Pedlosky, Springer-Verlag
--*Lectures on Geophysical Fluid Dynamics*, Rick Salmon, Oxford University Press
--*Fluid Mechanics*, P. Kundu, Academic Press
--*An Introduction to Dynamic Meteorology*, J. Holton
--*Physical Fluid Dynamics*, D. J. Tritton, Oxford University Press
--*Atmosphere-Ocean Dynamics*, Adrian E. Gill, Academic Press
--*Elementary Fluid Dynamics*, D. J. Acheson, Oxford Press under construction
(Let me know any which you find and like)

General Advice: Physics is not something you read and memorize, rather it is something you learn how to do. Try the following study procedure:

1. Read the material prior to lecture, so that you will know what it's about.
2. Listen carefully to the lecture and take notes, ask questions and participate
3. This is crucial: Do not go back and read and re-read the chapter until you "understand it." Rather, start working problems, going back through the chapter to clarify points as they come up. I suggest read relevant sections in other texts to see alternate ways of presenting the material
4. Think! Physics is, by in large intuitive, so if you think through a problem first you can often figure out the answer before working through to the solution.

Proposed Syllabus:

Lecture 1 – Introduction to GFD
Lecture 2 – Fundamentals of Fluid Dynamics (Hydrostatics)
Lecture 3 & 4 – Fundamentals of Fluid Dynamics (Shallow Water Waves and Rotation)
Lecture 5 – Fundamentals of Fluid Dynamics (Rotating Coordinates, Introduction to Equations of Motion)
Lecture 6 – Fundamentals of Fluid Dynamics (Introduction to Equations of Motion and Vorticity); Homework #1
Lecture 7 – Fundamentals of Fluid Dynamics (Vorticity Equation, Circulation and Scalings in GFD)
Lecture 8 – Vorticity Equation and Circulation
Lecture 9 – Viscosity and Boundary Layers; Homework #2
Lecture 10 & 11 – Approximations and Scalings in GFD
Lecture 12 – Implications of Rotation for Flow Dynamics; Homework #3
Lecture 13 & 14 – Wave in Rotating Flows
Lecture 15 – Barotropic Flows: Kelvin Waves; Homework #4
Lecture 16 – Rossby Waves
Lecture 17 – Topographic Waves
Lecture 18 – Physical Mechanisms of Waves
Lecture 19 – Instabilities and Free Energy; Homework #5; Exam I Distributed
Lecture 20 – Analysis of Instabilities
Lecture 21 – Barotropic Instabilities
Lecture 22 – Tropical Dynamics
Lecture 23, 24, 7 25 – Exam I Due
Lecture 26 – Viscosity and Ekman layers

Lecture 27 – Ekman Layers and Ekman Pumping
Lecture 28 & 29 – Ekman Pumping
Lecture 30, 31, 32, & 33 – Stratification; Homework #5
Lecture 34, 35, 36 – Stratification: Exam II Distributed
Lecture 37 & 38 – Solitons and Introduction to Turbulence
Lecture 39 & 40 – Introduction to Turbulence; Exam II Due; Project Presentations
Lecture 41 –Project Presentations