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PROGRAM/DEGREE REQUIREMENT CHANGE (MAJOR/MINOR)

SUBMITTED BY:

Department	Geology & Geophysics	College/School	College of Natural Sciences and Mathematics
Prepared by	Carl Tape and Erin Pettit	Phone	907-474-5456
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See <http://www.uaf.edu/uafgov/faculty/cd> for a complete description of the rules governing curriculum & course changes.

PROGRAM IDENTIFICATION:

DEGREE PROGRAM	Geophysics
Degree Level: (i.e., Certificate, A.A., A.A.S., B.A., B.S., M.A., M.S., Ph.D.)	M.S. and Ph.D.

A. CHANGE IN DEGREE REQUIREMENTS: (Brief statement of program/degree changes and objectives)

Our goal is to modify the graduate geophysics program to provide students with a better education at UAF and with the best preparation for futures in academia, industry, or government jobs. Our impetus arises from: (1) a curriculum that has not adapted to reflect developments in the field of geophysics over the last two decades; (2) feedback from a series of discussions among graduate students in geophysics; and (3) the arrival of new faculty (C. Tape, E. Pettit). Our primary objectives, listed in approximate order of importance, are as follows:

1. Unify the program by requiring a single, new, comprehensive course (Foundations of Geophysics; GEOS F631) that all incoming students are required to take.
2. Provide a computational "base" within Foundations of Geophysics, such that subsequent courses can readily incorporate real-world (and often computational) problems. The computational training is enhanced with the new admission requirement of linear algebra, which underlies the most commonly used computer programs (such as Matlab).
3. Implement more stringent admission requirements. Some faculty members perceived some inadequacies in students beginning the MS/PhD program. We have added two classes (Linear Algebra; Computational Physics). Also, we added explicit guidelines for how a student can enter directly into the PhD program.
4. Increase the flexibility of the program to potentially accommodate students in geophysics-related fields such as hydrology and planetary science, which do not have formal programs at UAF. A student is no longer required to select one of three geophysics concentrations, but instead can choose a general geophysics degree.
5. Make the requirements more consistent for all three concentrations.
6. Enhance the curriculum with the addition of two new courses: (1) Inverse Problems and Parameter Estimation and (2) Applied Seismology. Course (1) is aimed at broad audience of graduate and advanced undergraduate students, and it fills an important role within natural sciences and mathematics at UAF. Course (2) targets the solid-earth geophysics students and provides applied training that is not prevalent within the current curriculum.

B. CURRENT REQUIREMENTS AS IT APPEARS IN THE CATALOG:

Geophysics

College of Natural Science and Mathematics
Department of Geology and Geophysics
907-474-7565
www.uaf.edu/geology/

M.S., Ph.D. Degrees

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College of Natural Science & Mathematics

Governance

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Minimum Requirements for Degrees: M.S.: 30 credits; Ph.D.: 18 thesis credits

Graduate Program -- M.S. Degree

Concentrations: Solid-Earth Geophysics; Snow, Ice and Permafrost Geophysics; Remote Sensing Geophysics

1. Complete the following admission requirements:
 1. Submit GRE scores.
 2. Complete a background at least to the level of a B.S. concentration in geology, geophysics or an appropriate physical science or engineering.
 3. Complete MATH F421 and MATH F422; or equivalent.
2. Complete the general university requirements.
3. Complete the master's degree requirements.
 1. Complete 6 - 12 thesis credits.
 2. Complete any deficiencies concurrently with this degree.
4. Submit a written thesis proposal and pass an oral comprehensive examination centered on this proposal.
5. Complete and submit a written thesis and pass an oral defense of thesis.
6. Complete 6 credits of the following geophysics core requirements:
 - GEOS F602--Geophysical Fields--3 credits
 - GEOS F620--Geodynamics--3 credits
 - GEOS F654--Visible and Infrared Remote Sensing--3 credits
 - GEOS F657--Microwave Remote Sensing--3 credits
7. Complete one of the following concentrations:

Solid-Earth Geophysics

1. Complete 6 credits from the following:
 - GEOS F604--Intermediate Seismology--3 credits
 - GEOS F605--Geochronology--3 credits
 - GEOS F613--Global Tectonics--3 credits
 - GEOS F655--Tectonic Geodesy--3 credits
 - GEOS F671--Volcano Seismology--3 credits
2. Minimum credits required--30 credits

Snow, Ice, and Permafrost Geophysics

1. Complete 6 credits from the following:
 - GEOS F614--Ice Physics--3 credits
 - GEOS F615--Sea Ice--3 credits
 - GEOS F616--Permafrost--3 credits
 - GEOS F617--Glaciers--3 credits
2. Minimum credits required--30 credits

Remote Sensing

1. Complete 7 credits from the following list:
 - GEOS F654--Visible and Infrared Remote Sensing--3 credits
 - GEOS F657--Microwave Remote Sensing--3 credits
 - GEOS F622--Digital Image Processing in the Geosciences--3 credits
 - GEOS F434/F634--Remote Sensing of the Cryosphere--4 credits
 - GEOS F484/F684--Remote Sensing Bi-Weekly Seminar--1 credit
 - GEOS F676--Remote Sensing of Volcanic Eruptions--3 credits
 - GEOS F639--InSAR and its Applications--3 credits
 - ATM F413/F613--Atmospheric Radiation--3 credits
2. Complete 6 credits from relevant geology and geophysics courses as agreed by the advisory committee.
3. Minimum credits required--30 credits

Graduate Program -- Ph.D. Degree

1. Complete the following admission requirement:
 1. Submit GRE scores.
2. Complete the general university requirements.
3. Complete the course work requirements for the appropriate M.S. concentration.
4. Complete the Ph.D. requirements.
5. As part of the Ph.D. degree requirements, complete the following:
 1. Complete and pass a written and oral comprehensive examination.
 2. Complete and submit a written thesis proposal for approval.
 3. Complete a research program as arranged with the graduate advisory committee.
 4. Complete 18 credits of thesis, write a thesis and pass an oral defense of thesis.
6. Minimum credits required--18 credits.

C. PROPOSED REQUIREMENTS AS IT WILL APPEAR IN THE CATALOG WITH THESE CHANGES: (Underline new wording strike through old wording and use complete catalog format)

Geophysics

College of Natural Science and Mathematics
Department of Geology and Geophysics
907-474-7565
www.uaf.edu/geology/

M.S., Ph.D. Degrees

Downloadable PDF

Minimum Requirements for Degrees: M.S.: 30 credits; Ph.D.: 18 thesis credits

UAF Geophysics specializes in several broad areas of research and is closely connected with the Geophysical Institute. Although much of the research conducted by Geophysics faculty takes advantage of the geographic location of the university, the faculty have research projects on all continents. Students have the option to obtain a general geophysics degree or to choose one of three concentrations to focus their studies.

Graduate Program -- M.S. Degree

Concentrations: Solid-Earth Geophysics; Snow, Ice and Permafrost Geophysics; Remote Sensing Geophysics

1. Complete the following admission requirements:
 1. Submit GRE scores.
 2. Complete a background at least to the level of a B.S. concentration in geology, geophysics or an appropriate physical science or engineering.
 3. Complete MATH F302, MATH F314, MATH F421, and PHYS F220 MATH F422; or equivalent.
2. Complete the general university requirements.
3. Complete the master's degree requirements.
 1. Complete 6 - 12 thesis credits.
 2. Complete any deficiencies concurrently with this degree.
4. Submit a written thesis proposal and pass an oral comprehensive examination centered on this proposal.
5. Complete and submit a written thesis and pass an oral defense of thesis.
6. Complete the following geophysics core requirements:
 1. GEOS F631—Foundations of Geophysics—4 credits
 2. GEOS F482—Geological Sciences Seminar—1 credit
- ~~6. Complete 6 credits of the following geophysics core requirements:~~

- ~~—GEOS F602—Geophysical Fields—3 credits~~
- ~~—GEOS F620—Geodynamics—3 credits~~
- ~~—GEOS F654—Visible and Infrared Remote Sensing—3 credits~~
- ~~—GEOS F657—Microwave Remote Sensing—3 credits~~

7. Complete 6 credits from relevant graduate-level courses agreed by the advisory committee, or choose one of the following concentrations:

Solid-Earth Geophysics

1. Complete 6 credits from the following:
 - GEOS F604--Intermediate Seismology--3 credits
 - GEOS F607—Applied Seismology—3 credits
 - GEOS F671--Volcano Seismology--3 credits
 - GEOS F655--Tectonic Geodesy--3 credits
 - GEOS F605--Geochronology--3 credits
 - GEOS F613--Global Tectonics--3 credits
- ~~2. Minimum credits required—30 credits~~
2. Minimum of 30 credits required, including thesis/research credits

Snow, Ice, and Permafrost Geophysics

1. Complete 6 credits from the following:
 - GEOS F614--Ice Physics--3 credits
 - GEOS F615--Sea Ice--3 credits
 - GEOS F616--Permafrost--3 credits
 - GEOS F617--Glaciers--3 credits
- ~~2. Minimum credits required—30 credits~~
2. Minimum of 30 credits required, including thesis/research credits

Remote Sensing

1. Complete 6 7 credits from the following list:
 - GEOS F654--Visible and Infrared Remote Sensing--3 credits
 - GEOS F657--Microwave Remote Sensing--3 credits
 - GEOS F622--Digital Image Processing in the Geosciences--3 credits
 - GEOS F434/F634--Remote Sensing of the Cryosphere--4 credits
 - GEOS F484/F684--Remote Sensing Bi-Weekly Seminar--1 credit
 - GEOS F676--Remote Sensing of Volcanic Eruptions--3 credits
 - GEOS F639--InSAR and its Applications--3 credits
 - ATM F413/F613--Atmospheric Radiation--3 credits
- ~~2. Complete 6 credits from relevant geology and geophysics courses as agreed by the advisory committee.~~
- ~~2. Minimum credits required—30 credits~~
2. Minimum of 30 credits required, including thesis/research credits

Graduate Program -- Ph.D. Degree

1. Complete the following admission requirements:
 1. Submit GRE scores.
 2. Complete a Master's Degree in geology, geophysics or an appropriate field of physical science or engineering.
2. Complete the general university requirements.
3. Complete the course work requirements for the appropriate M.S. concentration.
4. Complete the geophysics core requirements:
 1. GEOS F631—Foundations of Geophysics—4 credits
 2. GEOS F482—Geological Sciences Seminar—1 credit
5. Complete 3 credits each in two of the following advanced skills categories (total 6 credits):
 1. Digital signal analysis and remote sensing
 - GEOS F654—Visible and Infrared Remote Sensing—3 credits

- GEOS F657—Microwave Remote Sensing—3 credits
- GEOS F622—Digital Image Processing in the Geosciences—3 credits
- PHYS F628—Digital Time Series Analysis—3 credits
- 2. Statistics and parameter estimation
 - GEOS F609—Inverse Problems and Parameter Estimation—3 credits
 - ATM F693—Analysis Methods in Meteorology and Climate—3 credits
 - STAT F401—Regression and Analysis of Variance—3 credits
 - STAT F461—Applied Multivariate Statistics—3 credits
- 3. Numerical methods
 - MATH F615—Applied Numerical Analysis—3 credits
 - MATH F694—Numerical Linear Algebra—3 credits
 - MATH F661—Optimization—3 credits
 - ME F601—Finite Element Analysis in Engineering—3 credits
- 4. One graduate-level advanced skills course approved by the student's advisory committee.
- 6. ~~4.~~ Complete the UAF Ph.D. requirements.
- 7. ~~5.~~ As part of the Ph.D. degree requirements, complete the following:
 1. Complete and pass a written and oral comprehensive examination.
 2. Complete and submit a written thesis proposal for approval.
 3. Complete a research program as arranged with the graduate advisory committee.
 4. Complete 18 credits of thesis, write a thesis and pass an oral defense of thesis.
- 8. ~~6.~~ Minimum credits required--18 credits.

Admission to Ph.D. geophysics program directly from bachelor's program:

Entering graduate students whose highest earned degree is the baccalaureate are normally admitted as master of science candidates. However, exceptionally able and accomplished students in this category are eligible for direct admission to the Ph.D. program. For direct admission from the baccalaureate to the Ph.D. program, a student must receive approval from the graduate admission committee and also meet one of three criteria:

1. At least one first-authored manuscript published, accepted, or submitted for publication in a peer-reviewed scientific journal
2. Receipt of an NSF, NIH, or similar prestigious pre-doctoral fellowship
3. Demonstrated research proficiency AND either (1) attained a GPA of at least 3.5 in mathematics and science courses at the undergraduate level, or (2) scored at or above the 80% percentile in two of three categories in the GRE. The requirement of demonstrated research proficiency can be waived for exceptionally promising students. In this case the student is required to complete a research or review paper focusing on a thesis related topic approved by the graduate advising committee. The paper should be roughly 4000-5000 words and must be submitted and approved by the advising committee within the first three semesters to maintain Ph.D. status. Failure will result in changing the student's status to M.S. candidate.

After admission, M.S. candidates may in exceptional cases petition for conversion to the Ph.D. program if they satisfy one of the above criteria. Such petitions must be approved both by the student's current (M.S.) and proposed (Ph.D.) advisory committee and the department director or designee.

D. ESTIMATED IMPACT

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

Individual faculty workloads will not change appreciably.

E. 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)

Geophysics is an interdisciplinary field of science and therefore relies on expertise in other fields to provide comprehensive training. Several non-GEOS courses are listed as part of the curriculum, either as "advanced skills course" or as elective courses: MATH, STAT, ATM, PHYS. We have been in contact with all the professors who teach these courses and have notified them of our proposed changes. We have asked them to forward the information to their respective department chairs.

F. IF MAJOR CHANGE - ASSESSMENT OF THE PROGRAM:

Description of the student learning outcomes assessment process.)

Current and former student feedback helped form the proposed changes in the curriculum. Current geophysics graduate students assembled multiple times in 2010 to evaluate the current curriculum and to suggest changes. Their assessments were documented in several emails that were signed by all participants. We will solicit feedback from graduate students every other year to obtain a semi-continuous record of student satisfaction with the program. Furthermore, we will ask faculty to "track" their own graduate students after they leave UAF, so that we can build an informal database of student occupations.




Our hope is that we see a moderate increase in the number of geophysics graduate students, and that a higher percentage remain in professions (academia, industry, government) where they are using skills and expertise acquired within their geophysics tenure at UAF.

JUSTIFICATION FOR ACTION REQUESTED

The purpose of the department and campus-wide curriculum committees is to scrutinize program/degree change 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 drop a course, is it because the material is covered elsewhere? 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 program is not compromised as a result.

For an overview of our objectives, please refer to the Section A. We provide some additional details here. The new course, Foundations of Geophysics, will contain material from two formerly "core geophysics" courses: Geophysical Fields and Geodynamics. These courses are expected to be removed from the curriculum within the next couple years, after the graduate students who have taken them have graduated. The other two "core geophysics" courses are now listed among the "advanced skills" category "Digital Signal Analysis and Remote Sensing." Introduction to Complex Analysis (MATH 422) is no longer a requirement for admission; instead, we require both Linear Algebra and Introduction to Computational Physics.

APPROVALS:

	Date	9/28/11
Signature, Chair, Program/Department of: <u>Geology + Geophysics</u>		
	Date	10/5/11
Signature, Chair, College/School Curriculum Council for: <u>CNSM</u>		
	Date	Oct 7, 2011
Signature, Dean, College/School of: <u>CNSM</u>		

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

Date

Signature, Chair, UAF Faculty Senate Curriculum Review Committee