

FORMAT 5

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PROGRAM/DEGREE REQUIREMENT CHANGE (MAJOR/MINOR)

SUBMITTED BY:

Department	Geology and Geophysics	College/School	
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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., PhD)	MS and PhD

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

The catalog for 2012-2013 contained major changes to the MS and PhD program. We continue to make relatively minor revisions to the new curriculum presented in the 2013-2014 catalog. The primary change is regarding the admission requirement courses, three of which are now proposed to be recommended. This reflects the fact that some admission courses were only essential for certain options within geophysics.

We also wanted to clarify the number of coursework credits that are needed. The current language of "30 credits maximum" is misleading for the MS geophysics (and geology), since the reader (say, a new student) must know in advance that a maximum of 12 thesis/research credits are allowed; therefore 18 credits of coursework are needed, which is not stated. This ambiguity has led to many questions from both students and faculty. We are hoping that the improved language will clarify the curriculum and will eliminate most of these questions.

Finally we decided to rewrite the degree description, which was more vague than we wanted. Our proposed text contains learning outcomes for the degree. These items should be helpful to prospective students, current students, and advising faculty alike.

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/

MS, PhD Degrees

Minimum Requirements for Degrees: MS: 30 credits; PhD: 18 thesis credits

The geophysics program at UAF 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.

MS Degree

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

1. Complete the following admission requirements:
 - a. Submit GRE scores.
 - b. Complete a background at least to the level of a BS concentration in geology, geophysics or an appropriate physical science or engineering.
 - c. Complete MATH F302, MATH F314, MATH F421 and PHYS F220 or equivalent.
2. Complete the general university requirements (page 202).
3. Complete the master's degree requirements (page 206).

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College of Natural Science & Mathematics

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- a. Complete 6 – 12 thesis credits.
- b. 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:
 - GEOS F631—Foundations of Geophysics.....4
 - GEOS F682—Geoscience Seminar (fall semester).....1
7. Complete 6 credits from relevant graduate-level courses agreed by the advisory committee, or choose one of the following concentrations:

Solid-Earth Geophysics

Complete 6 credits from the following:

GEOS F604—Seismology.....	3
GEOS F605—Geochronology.....	3
GEOS F626—Applied Seismology.....	3
GEOS F613—Global Tectonics.....	3
GEOS F655—Tectonic Geodesy.....	3
GEOS F671—Volcano Seismology.....	3

Snow, Ice and Permafrost Geophysics

Complete 6 credits from the following:

GEOS F614—Ice Physics.....	3
GEOS F615—Sea Ice.....	3
GEOS F616—Permafrost.....	3
GEOS F617—Glaciers.....	3

Remote Sensing

Complete 6 credits from the following:

GEOS F654—Visible and Infrared Remote Sensing.....	3
GEOS F657—Microwave Remote Sensing.....	3
GEOS F622—Digital Image Processing in the Geosciences.....	3
GEOS F434/F634—Remote Sensing of the Cryosphere.....	4
GEOS F484/F684—Remote Sensing Bi-Weekly Seminar.....	1
GEOS F676—Remote Sensing of Volcanic Eruptions.....	3
GEOS F639—InSAR and its Applications.....	3
ATM F413/F613—Atmospheric Radiation.....	3
8. Minimum credits required, including thesis/research credits.....	30

PhD Degree

1. Complete the following admission requirement:
 - a. Submit GRE scores.
2. Complete a master's degree in geology, geophysics or an appropriate field of physical science or engineering.
3. Complete the general university requirements (page 202).
4. Complete the requirements for the MS (see requirements 6 and 7 listed above).
5. Complete 3 credits each in two of the following advanced skills categories (total 6 credits):
 - a. Digital signal analysis and remote sensing
 - GEOS F654—Visible and Infrared Remote Sensing.....3
 - GEOS F657—Microwave Remote Sensing.....3
 - GEOS F622—Digital Image Processing in the Geosciences.....3
 - PHYS F628—Digital Time Series Analysis.....3
 - b. Statistics and parameter estimation
 - ATM F693—Analysis Methods in Meteorology and Climate.....3
 - GEOS F627—Inverse Problems and Parameter Estimation.....3
 - STAT F401—Regression and Analysis of Variance.....3
 - STAT F461—Applied Multivariate Statistics.....3
 - c. Numerical methods
 - MATH F615—Applied Numerical Analysis.....3
 - MATH F661—Optimization.....3
 - MATH F694—Numerical Linear Algebra.....3
 - ME F601—Finite Element Analysis in Engineering.....3
 - d. One graduate-level advanced skills course approved by the student's advisory committee
6. Complete the PhD degree requirements (page 207).
7. As part of the PhD degree requirements, complete the following:
 - a. Complete and pass a written and oral comprehensive examination.
 - b. Complete and submit a written thesis proposal for approval.

- c. Complete a research program as arranged with the graduate advisory committee.
- d. Complete 18 credits of thesis, write a thesis and pass an oral defense of thesis.
- 8. Minimum credits required.....18

Admission to PhD geophysics program directly from a 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 PhD program. For direct admission from the baccalaureate to the PhD program, a student must receive approval from the graduate admission committee and also meet one of three criteria:

- a. At least one first-authored manuscript published, accepted, or submitted for publication in a peer-reviewed scientific journal
- b. Receipt of an NSF, NIH or similar prestigious pre-doctoral fellowship.
- c. 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 80th 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 4,000 – 5,000 words and must be submitted and approved by the advising committee within the first three semesters to maintain PhD status. Failure will result in changing the student's status to MS candidate.

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

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/

MS, PhD Degrees

Minimum Requirements for Degrees: MS: 30 credits; PhD: 18 thesis credits

~~The geophysics program at UAF 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.~~

The geophysics program at UAF is closely connected with the Geophysical Institute and is optimally positioned to investigate a wide array of geophysical phenomena. Students have the option to obtain a general geophysics degree or to choose one of three concentrations to focus their studies.

Upon graduation, a student is expected to be able to

1. address geophysical problems using the principles of conservation of energy, mass, and momentum using both physical and mathematical concepts, particularly with respect to mathematical techniques such as linear algebra, vector calculus, and partial differential equations;
2. explain physical processes underlying the Earth's global scale features, including plate tectonics and the gravitational and magnetic fields;
3. describe common geophysical problems and assess the advantages and disadvantages of various theoretical, modeling, or observational approaches to solving them, including identifying key assumptions underlying each approach;
4. frame well-defined scientific research questions and apply modern computational methods and observational techniques necessary to conduct the research;
5. publish and present results in peer-reviewed articles, scientific reports, and at national and international scientific meetings using oral and written skills developed through regular faculty feedback.

MS Degree

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

1. Complete the following admission requirements:

- a. Submit GRE scores.
- b. Complete a background at least to the level of a BS concentration in geology, geophysics or an appropriate physical science or engineering.
- c. ~~Complete MATH F302, MATH F314, MATH F421 and PHYS F220 or equivalent.~~
- d. Complete MATH 302 (Differential Equations).
- e. Recommended: MATH F314 (Linear Algebra), MATH F421 (Applied Analysis), PHYS 220 (Introduction to Computational Physics)

2. Complete the general university requirements (page 202).

3. Complete the master's degree requirements (page 206).

- a. Complete 6 – 12 thesis credits.
- b. 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:

GEOS F631—Foundations of Geophysics.....	4
GEOS F682—Geoscience Seminar (fall semester).....	1

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

Solid-Earth Geophysics

Complete 6 credits from the following:

GEOS F604—Seismology.....	3
GEOS F605—Geochronology.....	3
GEOS F626—Applied Seismology.....	3
GEOS F613—Global Tectonics.....	3
GEOS F655—Tectonic Geodesy.....	3
GEOS F671—Volcano Seismology.....	3

Snow, Ice and Permafrost Geophysics

Complete 6 credits from the following:

GEOS F614—Ice Physics.....	3
GEOS F615—Sea Ice.....	3
GEOS F616—Permafrost.....	3
GEOS F617—Glaciers.....	3

Remote Sensing

Complete 6 credits from the following:

GEOS F654—Visible and Infrared Remote Sensing.....	3
GEOS F657—Microwave Remote Sensing.....	3
GEOS F622—Digital Image Processing in the Geosciences.....	3
GEOS F434/F634—Remote Sensing of the Cryosphere.....	4
GEOS F484/F684—Remote Sensing Bi-Weekly Seminar.....	1
GEOS F676—Remote Sensing of Volcanic Eruptions.....	3
GEOS F639—InSAR and its Applications.....	3
ATM F413/F613—Atmospheric Radiation.....	3

8. Complete 7 credits of courses approved by the advisory committee.

8. ~~Minimum credits required, including thesis/research credits.....~~30

9. The minimum credits required is 30. The required MS coursework above represents 18 credits. The minimum number of thesis credits (GEOS 699) required is 6. The remaining 6 credits can either be thesis credits or credits from courses that are 400-level or higher.

PhD Degree

1. Complete the following admission requirement:
 - a. Submit GRE scores.
2. Complete a master's degree in geology, geophysics or an appropriate field of physical science or engineering.
3. Complete the general university requirements (page 202).
4. Complete the MS requirements 6 and 7 above (11 credits), the requirements for the MS (see requirements 6 and 7 listed above).
5. Complete 3 credits each in two of the following advanced skills categories (total 6 credits):
 - a. Digital signal analysis and remote sensing
GEOS F654—Visible and Infrared Remote Sensing.....3
GEOS F657—Microwave Remote Sensing.....3
GEOS F622—Digital Image Processing in the Geosciences.....3
PHYS F628—Digital Time Series Analysis.....3
 - b. Statistics and parameter estimation
~~ATM F693—Analysis Methods in Meteorology and Climate.....3~~
GEOS F627—Inverse Problems and Parameter Estimation.....3
STAT F401—Regression and Analysis of Variance.....3
STAT F461—Applied Multivariate Statistics.....3
ATM F693—Analysis Methods in Meteorology and Climate.....3
 - c. ~~Numerical Mathematical~~ methods
MATH F421—Applied Analysis.....4
~~MATH F694F614—Numerical Linear Algebra.....3~~
MATH F615—Applied Numerical Analysis of Differential Equations3
~~MATH F661—Optimization.....3~~
~~ME F601—Finite Element Analysis in Engineering.....3~~
 - d. One graduate-level advanced skills course approved by the student's advisory committee
6. Complete the PhD degree requirements (page 207).
7. As part of the PhD degree requirements, complete the following:
 - a. Complete and pass a written and oral comprehensive examination.
 - b. Complete and submit a written thesis proposal for approval.
 - c. Complete a research program as arranged with the graduate advisory committee.
 - d. Complete 18 credits of thesis, write a thesis and pass an oral defense of thesis.
- ~~8. Minimum credits required.....18~~
8. The minimum credits required is 35. This includes 18 thesis credits and 17 credits from coursework (11 from MS, 6 from PhD).

Admission to PhD geophysics program directly from a 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 PhD program. For direct admission from the baccalaureate to the PhD program, a student must receive approval from the graduate admission committee and also meet one of three criteria:

- a. At least one first-authored manuscript published, accepted, or submitted for publication in a peer-reviewed scientific journal
- b. Receipt of an NSF, NIH or similar prestigious pre-doctoral fellowship.
- c. 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 80th 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 4,000 – 5,000 words and must be submitted and approved by the advising committee within the first three semesters to maintain PhD status. Failure will result in changing the student's status to MS candidate.

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

D. ESTIMATED IMPACT

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

The changes will not affect budget, space, or faculty workloads. But they will clarify the curriculum for the MS/PhD program.

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)

These changes will clarify the curriculum for the MS/PhD program in Geophysics, thereby affecting students and faculty in the Department of Geology and Geophysics.

F. IF MAJOR CHANGE - ASSESSMENT OF THE PROGRAM:

Description of the student learning outcomes assessment process.)

The student learning outcomes are now listed explicitly in the description of the degree. There it lists several mathematical topics, such as linear algebra, vector calculus, and partial differential equations. These topics will continue to be used within the capstone course, Foundations of Geophysics, which is required for all graduates of the MS and PhD program.

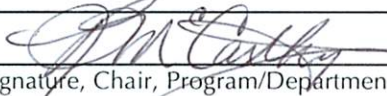
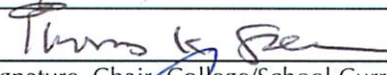
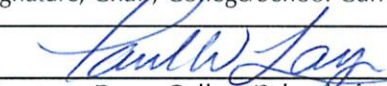
JUSTIFICATION FOR ACTION REQUESTED

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.

We shifted three admission requirement courses from "required" to "recommended". In practice we have been admitting students who had not taken these courses. In several cases these deficiencies were waived by the thesis committees, either because the students had learned the key material (partial differential equations and scientific computing) from other courses or from their own research, or the students did not need the courses for their thesis research. The new admission requirements better reflect how the curriculum is actually applied, and it also implicitly acknowledges the diversity of sub-disciplines in geophysics. We see no lowering of the quality of the geophysics education program as a result of these changes. Finally we note that two of the recommended courses (PHYS 220 and MATH 302) were not listed at all prior to 2012-2013; therefore the main course in question was MATH 421.

Following student feedback to this paperwork in Nov 2013, the faculty re-engaged discussion on the proposed changes. Ultimately they/we decided to keep the proposed changes within the paperwork, but also agreed to add the degree learning outcomes, which help to clarify the expectations of the students and faculty.

APPROVALS:

	Date	2/7/14
Signature, Chair, Program/Department of: GEOLOGY & GEOPHYSICS		
	Date	2-27-14
Signature, Chair, College/School Curriculum Council for: CSM		
	Date	2/28/14
Signature, Dean, College/School of: CSM		

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

Date

Signature, Chair, UAF Faculty Senate Curriculum Review Committee

2/27/14

From CNSM Curriculum Committee:

The only reservation that the committee had was concerning the wisdom of putting Student Learning Outcomes into a catalogue description of MS and PhD program. We believe such should exist, but we feel it better to convey these outcomes in a different format, perhaps from a departmental website or part of a SLOA document.

Tom Green

Chair, CNSM Committee