

Status: PENDING

**PROGRAM REQUEST**  
Geodetic Science

Last Updated: Myers, Dena Elizabeth  
07/26/2011

<b>Fiscal Unit/Academic Org</b>	School of Earth Sciences - D0656
<b>Administering College/Academic Group</b>	Arts And Sciences
<b>Co-administering College/Academic Group</b>	
<b>Semester Conversion Designation</b>	Re-envisioned with significant changes to program goals and/or curricular requirements (e.g., degree/major name changes, changes in program goals, changes in core requirements, structural changes to tracks/options/courses)
<b>Current Program/Plan Name</b>	Geodetic Science
<b>Proposed Program/Plan Name</b>	Geodetic Science
<b>Program/Plan Code Abbreviation</b>	GEODSCM-MS
<b>Current Degree Title</b>	Master of Science

### Credit Hour Explanation

Program credit hour requirements		A) Number of credit hours in current program (Quarter credit hours)	B) Calculated result for 2/3rds of current (Semester credit hours)	C) Number of credit hours required for proposed program (Semester credit hours)	D) Change in credit hours
Total minimum credit hours required for completion of program		52	34.7	30	4.7
Required credit hours offered by the unit	Minimum	38	25.3	26	0.7
	Maximum	55	36.7	30	6.7
Required credit hours offered outside of the unit	Minimum	6	4.0	0	4.0
	Maximum	20	13.3	4	9.3
Required prerequisite credit hours not included above	Minimum	0	0.0	0	0.0
	Maximum	0	0.0	0	0.0

**Explain any change in credit hours if the difference is more than 4 semester credit hours between the values listed in columns B and C for any row in the above table**

The overall credit hour requirement has been reduced to match the present Graduate School requirement. In addition, the specializations available, the courses required within the remaining specializations, and the requirements for elective courses outside Geodetic Science have all been changed -- and generally have been reduced -- because fewer faculty members are available to support the program in Geodetic Science since it has moved to SES.

### Program Learning Goals

Note: these are required for all undergraduate degree programs and majors now, and will be required for all graduate and professional degree programs in 2012. Nonetheless, all programs are encouraged to complete these now.

**Program Learning Goals**                      •

### Assessment

Assessment plan includes student learning goals, how those goals are evaluated, and how the information collected is used to improve student learning. An assessment plan is required for undergraduate majors and degrees. Graduate and professional degree programs are encouraged to complete this now, but will not be required to do so until 2012.

**Is this a degree program (undergraduate, graduate, or professional) or major proposal?** No

### Program Specializations/Sub-Plans

If you do not specify a program specialization/sub-plan it will be assumed you are submitting this program for all program specializations/sub-plans.

**Program Specialization/Sub-Plan Name**                      Thesis Option ("Plan A") (Existing)

**Program Specialization/Sub-Plan Goals**                      •

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**Program Specialization/Sub-Plan Name** Non-Thesis Option ("Plan B") (Existing)  
**Program Specialization/Sub-Plan Goals** •

**Pre-Major**

Does this Program have a Pre-Major? No

**Attachments**

- Geodetic Science MS conversion attachment 2 revised 22 July.doc: Geodetic Sci M.S. program proposal  
*(Program Proposal. Owner: Krissek, Lawrence Alan)*
- Geodetic Science MS cover letter.doc: NMS Division of Arts and Sciences cover letter  
*(Letter from the College to OAA. Owner: Andereck, Claude David)*

**Comments**

**Workflow Information**

Status	User(s)	Date/Time	Step
Submitted	Krissek, Lawrence Alan	07/06/2011 10:37 PM	Submitted for Approval
Approved	Krissek, Lawrence Alan	07/06/2011 10:46 PM	Unit Approval
Revision Requested	Andereck, Claude David	07/22/2011 03:25 PM	College Approval
Submitted	Krissek, Lawrence Alan	07/24/2011 04:01 PM	Submitted for Approval
Approved	Krissek, Lawrence Alan	07/24/2011 04:05 PM	Unit Approval
Approved	Andereck, Claude David	07/26/2011 02:53 PM	College Approval
Approved	Myers, Dena Elizabeth	07/26/2011 03:08 PM	GradSchool Approval
Pending Approval	Cameron, Erin Marie Soave, Melissa A	07/26/2011 03:08 PM	CAA Approval



College of Arts and Sciences

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July 26, 2011

Dena Myers  
Graduate School  
250 University Hall  
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Campus

Dear Dena:

It is a pleasure to forward to you for your consideration the proposal for the Masters program in Geodetic Science. The program has been revised from its quarter version mainly through a reduction in credit hours to the minimum required by the Graduate School, an increase in flexibility in the core areas, and a change in the tracks offered to better match the interests and size of the faculty available to staff the courses.

Beyond my own review of the documents, the proposal has been discussed by colleagues from other NMS units at meetings on July 22, 2011. Feedback from these discussions has been incorporated in the proposal.

If you have any questions, I would be happy to address them.

Sincerely,

David Andereck  
Professor of Physics  
Associate Dean of Natural and Mathematical Sciences, College of Arts and Sciences

## LETTER FROM PROGRAM-OFFERING UNIT

DATE: 9 June 2011 (modified 6 July 2011)

TO: NMS, Graduate School, and OAA Reviewers

FROM: Lawrence Krissek, Associate Director for Administration, School of Earth Sciences  
and  
W. Berry Lyons, Director, School of Earth Sciences

SUBJECT: Conversion of graduate programs (M.S. and Ph.D.) in the School of Earth Sciences from quarters to semesters

At the graduate level, the School of Earth Sciences presently offers an M.S. in Geological Sciences (with both a thesis option and a non-thesis option), and a Ph.D. in Geological Sciences. During the conversion to semesters, we request that the names of these programs be changed from Geological Sciences to Earth Sciences, so that the names of these degree programs match the name of our School. This detail was not included at the time the School of Earth Sciences was established, so the quarter-to-semester conversion provides an opportunity to establish uniformity between the name of our unit and the names of our graduate programs.

The School of Earth Sciences also offers an M.S. in Geodetic Science (with both a thesis option and a non-thesis option) and a Ph.D. in Geodetic Science; both the M.S. and the Ph.D. programs will be converted to the semester format. These programs will retain their present names, because of the long history and distinct identity of Geodetic Science at Ohio State.

### Graduate Programs in Earth Sciences (presently Geological Sciences)

In addition to changing the names of our existing graduate programs in Geological Sciences, the extent of change during the quarter-to-semester conversion ranges from minimal (for the conversion of the M.S. in Geological Sciences to the M.S. in Earth Sciences) to slightly more significant (for the conversion of the Ph.D. in Geological Sciences to the Ph.D. in Earth Sciences, which includes a reduction in credit hour requirements beyond the standard 2/3rds ratio).

The process that developed the conversions proposed here was led by Prof. William Ausich, Associate Director for Graduate Studies in SES. The requirements of the existing graduate programs in Geological Sciences were discussed within the SES Graduate Studies Committee, with input from both faculty and graduate student members. Each member of the Graduate Studies Committee consulted with his/her constituency within SES (i.e., the Earth History Division, the Earth and Planetary Dynamics Division, the Water, Environment, and Climate Division, and the graduate students), so that all faculty and graduate students had the opportunity to provide input to the proposed conversions. In addition, Prof. Ausich held an open forum with all interested graduate students in Autumn 2010, and the plans for program conversion were discussed, as they developed, at several faculty meetings in Autumn 2010.

For the M.S. thesis option, consensus quickly developed that: 1) the quarter credit hour requirements should be reduced by the standard 2/3rds ratio, thereby keeping the semester requirements consistent with the minimum requirements established by the Graduate School; and 2) no new requirements should be added. The motion to convert the M.S. thesis option in this way was approved at a faculty meeting on 17 November 2010, with a vote of 21 in favor, 0 opposed, and 0 abstentions.

For the M.S. non-thesis option, consensus quickly developed to: 1) reduce the quarter credit hour requirements by the standard 2/3rds ratio; and 2) clearly define the courses that satisfy the core requirements and the capstone project. The Earth History Division, the Earth and Planetary Dynamics Division, and the Water, Environment, and Climate Division each identified a set of courses that will serve as core courses for their non-thesis M.S. students, and a new course (Earth Sci 8570) was created to satisfy the capstone requirement. The motion to convert the M.S. non-thesis option in this way was approved at a faculty meeting on 5 May 2011, with a vote of 16 in favor, 0 opposed, and 1 abstention.

For the Ph.D. program in Earth Sciences, discussion primarily focused on the number of graded credit hours to require under semesters. The Geological Sciences Ph.D. requirements for both graded quarter credit hours and total quarter credit hours were not changed several years ago, when the Graduate School reduced its minimum credit hour requirements; as a result, the standard 2/3rds reduction moving to semesters would have kept our requirements well above the minimum set by the Graduate School. Our Ph.D. students are – and will continue to be -- encouraged to take their candidacy exam during their 2<sup>nd</sup> year, in order to maintain “normal progress” toward their degree. However, an increasing number of them have encountered difficulty meeting our existing requirements for graded and total credit hours because of the combination of: 1) our continued requirement above the minimum established by the Graduate School; 2) the relatively early time when the Ph.D. candidacy exam is taken; and 3) the 3 credit limit for post-candidacy enrollment recently established by the Graduate School. This difficulty has been even more severe for our increasing number of students who enter the Ph.D. program without completing an M.S. first, because these students do not transfer credits – either graded or ungraded -- from their M.S. program.

Because we anticipate that Ph.D. students will continue to face this situation under semesters, it was proposed that the total credit hour requirement be reduced to 80 semester credit hours, in order to match the minimum requirements set by the Graduate School. This motion was approved by unanimous faculty vote on 17 November 2010. The remaining vote considered whether to set the minimum graded credit hour requirement at 30 semester credit hours or at 34 semester credit hours; at the faculty meeting of 17 November 2010, the vote was 12 in favor of 30 semester credit hours, 8 in favor of 34 semester credit hours, and 1 abstention. As a result, the semester version of our Ph.D. program requires a minimum of 30 graded semester credit hours, and a minimum of 80 semester credit hours.

### Graduate Programs in Geodetic Science

The graduate programs in Geodetic Science are being re-envisioned during conversion, both in terms of their credit hour requirements and in terms of the structure and course offerings within each program. This re-envisioning reduces somewhat the credit hour requirements for the various Geodetic Science graduate programs while adhering to existing Graduate School guidelines. Primarily, this re-envisioning is necessary because the move of the Geodetic Science program from Engineering to SES has significantly reduced the number of faculty and courses available to support all options within the programs. As a result, the re-envisioned programs have been simplified and focused on the strengths of the existing Geodetic Science faculty within SES.

Conversion of the graduate programs in Geodetic Science was led by Prof. Christopher Jekeli, head of the Geodetic Science Division within SES. Conversion plans were developed through discussions and direct consultations within that Division. The final conversion plans were then distributed via e-mail to all SES faculty, and were discussed at an SES faculty meeting in February 2011. The proposed conversions were approved by an e-vote, with 20 in favor, 1 opposed, and no abstentions.

For the M.S. thesis option, the credit hour requirements are reduced by more than the standard factor of 2/3rds, from a range of 52-57 quarter credit hours (depending on the area of concentration and the specific courses chosen) to a minimum of 30 semester credit hours. In the semester format, “core courses” are selected in 4 categories from lists of options, whereas “core courses” were more completely prescribed in the quarter format. Three pre-approved tracks of “core courses” are available under semesters, in the areas of Geodesy, GIS, and Geodynamics, whereas pre-approved tracks in Geodesy, Photogrammetry, and Mapping & GIS were available under quarters. This change in subject area of the tracks reflects the change in composition of the Geodetic Science faculty as they moved from Engineering to SES, and the reduction in the minimum credit hour requirement reflects the reduced faculty numbers in the Geodetic Science program. The M.S. thesis option maintains the requirement for independent research and the completion and defense of a written research thesis.

For the M.S. non-thesis option, credit hour requirements also are reduced by more than the standard factor of 2/3rds, from a range of 58-67 quarter credit hours (with the range depending on the specific courses chosen) to a minimum of 30 semester credit hours. As with the other Geodetic Science graduate programs, the reduction in the minimum credit hour requirement reflects the reduced number of faculty and course offerings in the Geodetic Science program. The M.S. non-thesis option maintains the requirements for a written technical paper and a written comprehensive examination.

For the Ph.D., credit hour requirements are reduced by more than the standard factor of 2/3rds, in order to align the minimum credit hour requirement (i.e., 80 semester credit hours) with the minimum now set by the Graduate School. A credit hour requirement higher than this value has become increasingly difficult for students to achieve, given the 3 credit-hour limit on enrollment after a student passes the Ph.D. candidacy exam. In addition, specific track options within the semester-version of the Ph.D. program have been reduced from those in the quarter-version because the decreased number of faculty supporting the Geodetic Science program cannot regularly offer all of the courses that were required with the previous larger number of options. In addition, the number of core courses for the PhD has been reduced so that, in concert with the evolving interdisciplinary nature of geodetic science, students may be encouraged to include appropriate courses offered by other Divisions within SES.

The details of these conversions are included in the appropriate program templates and proposals. Please contact us if you have any questions.

Thank you for your attention to these proposals.

W. Berry Lyons  
Professor and Director  
School of Earth Sciences

Lawrence Krissek  
Professor and Associate Director for Administration  
School of Earth Sciences

## **Geodetic Science M.S. Program Rationale Statement**

The overall goal of the Graduate Degree Program in Geodetic Science is to provide students the opportunity to develop advanced professional training in Geodetic Science. Specific objectives of the program include providing opportunities for students to participate in advanced classes and seminars and – for the M.S. thesis option -- to conduct independent research on fundamental issues in Geodetic Science. The products of M.S. research projects are expected to be suitable for publication in the refereed scientific literature.

The M.S. program in Geodetic Science traditionally has focused on the thesis-based M.S. degree, and we expect that focus to continue in the future. However, the Geodetic Science M.S. program does have an approved non-thesis (Plan B) option, which we are also converting to semesters. The Non-Thesis Option is intended for geodetic scientists in government or industry who do not plan to continue for a Ph.D., and therefore do not require significant training in independent research, but whose career paths will benefit from additional educational and practical experience.

Most of our graduate-level semester-version courses in Geodetic Science are relatively direct conversions of existing quarter-version courses, although many have converted to semester-credit-hour values by greater than the standard ratio of 2/3. For example, some 5 quarter-credit-hour courses have converted to 4 semester-credit-hour courses, some 4 quarter-credit-hour courses have converted to 4 semester-credit-hour courses, and some 3 quarter-credit-hour courses have converted to 3- or 4-semester-credit-hour courses. In all cases, these conversions by greater than the standard ratio of 2/3 are justified by increased content and student contact, either as lectures or as laboratories. The increased course content arises from the need to incorporate information into these courses that used to be distributed through other courses, which are no longer available to support the graduate program in Geodetic Science.

### **Details of the Proposed Conversion**

The date of the last significant revision of the Geodetic Science M.S. – both thesis option and non-thesis option -- was in the 1990s.

The proposed changes to the M.S. in Geodetic Science can be categorized overall as a significant re-envisioning, both in terms of a reduction in credit hours required and in terms of the structure of, and courses available within, the degree program. This re-envisioning brings the credit hour requirements for the Geodetic Science M.S. program into alignment with existing Graduate School guidelines. In addition, this re-envisioning is necessary because the move of the Geodetic Science program from Engineering to SES has significantly reduced the number of faculty and courses available to support the Geodetic Science program. As a result, the re-envisioned M.S. program has been simplified and focused on the strengths of the existing Geodetic Science faculty within SES.

For the M.S. thesis option, the minimum credit hour requirements are reduced by more than the standard factor of 2/3rds, from a range of 52-57 quarter credit hours (depending on the area of concentration and the specific courses chosen) to a minimum of 30 semester credit hours. In the semester format, “core courses” are selected in 4 categories from lists of options, whereas “core courses” were more completely prescribed in the quarter format. Three pre-approved tracks of “core courses” are available under semesters, in the areas of Geodesy, GIS, and Geodynamics, whereas pre-approved tracks in Geodesy, Photogrammetry, and Mapping & GIS were available under quarters. This change in subject area of the tracks reflects the change in composition of the Geodetic Science faculty as they moved from Engineering to SES, and the reduction in the minimum credit hour requirement reflects the reduced faculty numbers in

the Geodetic Science program. The M.S. thesis option maintains the requirement for independent research and the completion and defense of a written research thesis.

For the M.S. non-thesis option, credit hour requirements also are reduced by more than the standard factor of  $2/3$ ds, from a range of 58-67 quarter credit hours (with the range depending on the specific courses chosen) to a minimum of 30 semester credit hours. As with the other Geodetic Science graduate programs, the reduction in the minimum credit hour requirement reflects the reduced number of faculty and course offerings in the Geodetic Science program. The M.S. non-thesis option maintains the requirements for a written technical paper and a written comprehensive examination.



## **Master's Program in Geodetic Science**

### **Semester Version**

#### **1) Expected Background**

All Master's degree aspirants are expected to have a Bachelor's degree, and they normally will have a degree in the sciences or engineering. The basic entrance requirements to the program include courses in advanced calculus, linear algebra, and introductory physics, and some knowledge of and experience with scientific computer programming using a high-level language. Matlab, C++, Java, and FORTRAN are some of the most commonly used computer programming languages in geodetic science.

#### **2) Program of Study**

In consultation with the student's advisor, and with approval of the Graduate Studies Committee (GSC), a student will design a course of study appropriate to the field of specialization. If needed, in consultation with the advisor, and with approval of the GSC, students will design a course of study to remedy program deficiencies, to bring the student to the level required to do work in the field of specialization. Students should plan on completing all deficient course work with a grade of "B" or better within one year of entry into the program.

#### **3) Thesis Option ("Plan A")**

##### **a) Credit Hours/Coursework**

For the M.S. in Geodetic Science – Thesis Option, a minimum of 30 graduate semester credit hours is required. Of those 30 graduate semester credit hours, approximately 16-24 semester credit hours are earned by completing 4 to 6 courses from 4 core areas; these courses cover basic knowledge and skills required of all M.S. students in the Geodetic Science program. The remaining credit hours are fulfilled with elective courses, including research courses, in one or more areas within Geodetic Science or in related disciplines. Three standard sets of courses are pre-approved to meet requirements within the core areas, as described below. If a student chooses one of these standard sets of courses, then his/her selection of core and elective courses only requires approval by his/her advisor. Any selection of "core courses" that deviates from these 3 pre-approved sets of courses must be approved by the student's advisor and the GSC.

##### **b) Core Coursework in Geodetic Science**

In general, a student must complete core coursework consisting of the 2 foundational courses and 1 course chosen from each of the following 3 categories: Geodetic Science, Geomathematics/GIS, and Sensor Systems and Applications. A student specializing in Geomathematics/GIS who completes the pre-approved set of core courses listed below, however, is not required to complete a core course in Sensor Systems and Applications.

##### **1. Foundational Courses**

- a) Geod Sci 5660, Geometric Reference Systems (4 semester credit hours)
- b) Geod Sci 5636, Geovisualization Geometry (4 semester credit hours)

## 2. Geodetic Science

- a) Geod Sci 6776, Physical Geodesy (4 semester credit hours)
- b) Geod Sci 6777, Satellite Geodesy (3 semester credit hours)
- c) Geod Sci 5781, Geodesy and Geodynamics (3 semester credit hours)
- d) Geod Sci 6786, Geospatial Data Structures for Computer Mapping and GIS (3 semester credit hours)
- d) Earth Sci 5646, Geodynamics (3 semester credit hours)

## 3. Geomathematics/GIS

- a) Geod Sci 5652, Adjustment Computations (5 semester credit hours)
- b) Earth Sci 5642, Geomathematical Analysis (3 semester credit hours)
- c) Math 5601, Essentials of Numerical Methods (3 semester credit hours)
- d) Physics 5300, Theoretical Physics (4 semester credit hours)
- e) Stat 6450, Applied Regression Analysis (4 semester credit hours)

## 4. Sensor Systems and Applications

- a) CE 7442, Fundamentals of GPS and Reference Systems (4 semester credit hours)
- b) Earth Sci 5781, Gravity Exploration (3 semester credit hours)
- c) Earth Sci 5782, Magnetic Exploration (3 semester credit hours)
- d) Geod Sci 7745, Inertial Navigation/Positioning Analysis (4 semester credit hours)
- e) Earth Sci 5650, Glaciology (4 semester credit hours)
- f) Earth Sci 5655, Land Surface Hydrology (3 semester credit hours)

The 3 pre-approved sets of core courses are as follows:

For a student specializing in Geodesy:

Geod Sci 5636 (4), 5660 (4), 5652 (5), 6776 (4), 6777 (3), and CE 7442 (4)

Total = 24 semester credits

For a student specializing in Geomathematics (GIS):

Geod Sci 5636 (4), 5660 (4), 5652 (5), and 6786 (3)

Total = 16 semester credits

For a student specializing in Geodynamics:

Geod Sci 5636 (4), 5660 (4), 5652 (5), 5781 (3), and CE 7442 (4)

Total = 20 semester credits

The following are suggested 2-year coursework plans for students specializing in Geodesy, Geomathematics/GIS, and Geodynamics:

	Geodesy	Geomathematics (GIS)	Geodynamics
Autumn Semester, Year 1	GS5636 (4 credits), GS5652 (5 credits), GS5660 (4 credits) Total = 13 credits	GS5636 (4 credits), GS5652 (5 credits), GS5660 (4 credits) Total = 13 credits	GS5636 (4 credits), GS5652 (5 credits), GS5660 (4 credits) Total = 13 credits
Spring Semester, Year 1	CE7442 (4 credits), GS6776 (4 credits), GS6777 (3 credits) Total = 11 credits	GS6786 (3 credits) Research or other courses ( $\geq 5$ credits) Total = $\geq 8$ credits	GS5781 (3 credits), CE7442 (4 credits) Research or other courses ( $\geq 1$ credit) Total = $\geq 8$ credits
Summer, Year 1	Research (4 credits)	Research (4 credits)	Research (4 credits)
Subsequent Semesters	Geod Sci or other electives + research credits	Geod Sci or other electives + research credits	Geod Sci or other electives + research credits

### c) Thesis and Completion of Degree

The *Application to Graduate* form must be submitted to the Graduate School for the semester in which the student wishes to graduate, according to the rules of the Graduate School. The final Master's Examination cannot be scheduled until the Advisory Committee has given preliminary approval of the thesis document.

Each student must complete a Master's thesis, which describes the results of an original research project. The thesis document must be prepared according to the guidelines described in the Graduate School handbook.

Upon completion of the Master's thesis, candidates for the M.S. degree must complete a final oral examination, which may include questions on both the thesis research and aspects of the M.S. training not necessarily related to the thesis. The Master's Examination Committee consists of the Advisory Committee as originally constituted, although substitutions can be approved by the GSC in situations where a member cannot be present at the time of the examination. The advisor serves as chairperson of the examination. The final oral examination will be scheduled and conducted according to the rules of the Graduate School.

### i) Masters Degree Research -- Choice of Research Area

If necessary, the Chair of the Graduate Studies Committee will provide advice on coursework and help in the selection of a research area and an advisor. By the end of the first semester in the program every student is strongly encouraged to have identified a research area and to have obtained the consent of a faculty member to serve as an advisor. Until the student has an advisor, the chair of the GSC will act in that capacity.

Once a faculty advisor has been identified, the graduate student, in consultation with his/her advisor, will define a research topic of appropriate level and scope. Two additional faculty members will be identified to serve on the student's Advisory Committee and Master's Examination Committee, subject to approval by the Geodetic Science GSC.

#### **d) Financial Support for Graduate Students**

Opportunities for GTA support are limited, because the Geodetic Science program offers no undergraduate courses. As a result, graduate student support primarily is arranged between an individual faculty member and a graduate student. Continuation of that support is conditional on maintaining normal progress, on maintaining good standing in the Graduate School, and on satisfactory performance of GTA or GRA duties. Support is also conditional on availability of funds.

Registration requirements for GTAs, GRAs, fellowships, etc. are those set by the Graduate School.

#### **4) Non-Thesis Option ("Plan B")**

Note: the non-thesis option may not be used as an exit strategy for students in the M.S. thesis option who are having difficulty completing the thesis requirement.

##### **a) Credit Hours/Coursework**

A minimum of 30 graduate semester credit hours is required for the Master's degree non-thesis option, including completion of the following 2 requirements:

- 1) complete one of the sets of core courses outlined above for the Thesis option, selected in consultation with a Geodetic Science advisor (16-24 semester credit hours);
- 2) complete a minimum of 6 additional semester credits of graduate-level coursework in Geodetic Science or other approved areas, chosen in consultation with your advisor, in order to complete a minimum of 30 graduate semester credit hours.

##### **b) Technical Paper, Comprehensive Examination, and Completion of Degree**

The student must write a 3000–5000 word technical paper on an approved topic, chosen in consultation with his/her advisor, and must orally defend it satisfactorily prior to the Master's Examination. This oral defense will be conducted by the student's advisor and one other faculty member, selected by the Geodetic Science Graduate Studies Committee.

The Master's Examination for the non-thesis option (Plan B) is a written, comprehensive examination covering material presented in the required courses. Questions will be written and evaluated by the student's advisor and one other faculty member, selected by the Geodetic Science GSC. The student must successfully complete the Master's Examination to receive the M.S. degree.

##### **c) Financial Support for M.S. Non-Thesis Option Students**

M.S. non-thesis option students generally will not be considered for GTA or GRA support.

**5) Awarding of the M.S. Degree upon Completing the Ph.D. Candidacy Examination**

In general, the M.S. degree is also awarded (if it has not been earned through a formal curriculum as described above) upon the successful completion of the Ph.D. Candidacy Examination.

**Master’s Program in Geodetic Science**

**Quarter Version**

**1) Expected Background** -- same as for semester version

**2) Program of Study** – same as for semester version

**3) Thesis Option (“Plan A”)**

**a) Credit Hours/Coursework**

A minimum of 52-57 graduate quarter credit hours is required for the Master’s degree with thesis option. Suggested coursework for the M.S. Thesis Option is shown in the following table, in the columns labeled “A”:

Qtr/ Year	Course No.	Lec Hr + Labs	Course Name	OPTIONS					
				Geodesy		Photogrammetry		Mapping & GIS	
				A	B	A	B	A	B
Au 1st <sup>1</sup>	GS 601	(4+1)	Intro to Mapping & Photogrammetry	5	5	5	5	5	5
	GS 630	(3+1)	Fund of Computer Assist Cartography	4	4	4	4	4	4
	GS 650	(4+1)	Adjustment Computations I Seminar <sup>2</sup>	5	5	5	5	5	5
				<u>14</u>	<u>14</u>	<u>14</u>	<u>14</u>	<u>14</u>	<u>14</u>
Wi 1st	GS 607	(3+1)	Intro to GIS					4	4
	GS 628	(3+1)	Analytical Photogrammetry I			4	4		
	GS 632	(3+1)	Large Scale Topo Mapping					4	4
	GS 636	(3+1)	Map Projections	4	4	4	4	4	4
	GS 651	(3+1)	Adjustment Computations II	4	4	4	4		
	GS 660	(4+1)	Geometric Reference Systems	5	5				
	GS 609	(2+1)	Surveying with Satellites Elective <sup>3</sup> Seminar <sup>2</sup>	3	3			3-5	3-5
			<u>16</u>	<u>16</u>	<u>15-17</u>	<u>15-17</u>	<u>15-17</u>	<u>15-17</u>	
Sp 1st	GS 625	(3+1)	Cadastral Information Systems					4	4
	GS 623	(3+1)	Topics in Photogrammetry	4	4			4	4
	GS 629	(3+1)	Digital Photogrammetry I			4	4		
	GS 637	(3+1)	Topics in Mapping	4	4	4	4		
	GS 786	(3+1)	Data Structures in GIS					4	4
	GS 776	(4+1)	Gravimetric Geodesy Elective <sup>3</sup> Seminar <sup>2</sup>	5	5	3-5	3-5	3-5	3-5
			<u>16-18</u>	<u>16-18</u>	<u>11-13</u>	<u>11-13</u>	<u>15-17</u>	<u>15-17</u>	
Su 1st	GS 998 <sup>4</sup>		Two electives <sup>3</sup> Research for Thesis	x	6-10	x	6-10	x	6-10
	GS 693 <sup>4</sup>		Scientific paper		<u>x</u> 6-10		<u>x</u> 6-10		<u>x</u> 6-10
Au 2nd	GS 612	(3+1)	Topics in Geodesy			4	4	4	4
	GS 732	(3+1)	Generalization of Topo Maps					4	4
	GS 725	(2+1)	Analytical Photogrammetry II			4	4		

GS 728	(3+1)	Digital Photogrammetry II			4	4		
GS 777	(3+1)	Satellite Geodesy	4	4				
		Elective <sup>3</sup>	3-5	3-5				
GS 998 <sup>4</sup>		Research for thesis	x		x		x	
GS 693 <sup>4</sup>		Scientific paper Seminar <sup>2</sup>		x		x		x
			—	—	—	—	—	—
			7-9	7-9	12	12	8	8

<sup>1</sup> A student in any of the Master's programs planning to pursue a PhD degree is advised to consult his/her adviser before Winter Qtr. to plan a special program in which the courses GS 612, 623, and 637 may be replaced by other equivalent courses required for the PhD.

<sup>2</sup> It is the responsibility of the student to attend departmental seminars when offered (no credit given).

<sup>3</sup> Chosen in consultation with your advisor. Electives may be taken during any quarter. Plan A students are encouraged to take additional electives.

<sup>4</sup> Number of credits determined with approval of adviser.

**b) Thesis and Completion of Degree** – same as for semester version.

**c) Financial Support for Graduate Students** – same as for semester version.

#### 4) Non-Thesis Option (“Plan B”)

**a) Credit Hours/Coursework**

A minimum of 58-67 graduate quarter credit hours is required for the Master's degree non-thesis option. Suggested coursework is shown in the table above, in the columns labeled “B”

**b) Final Examinations and Completion of Degree** -- same as semester version

**c) Financial Support for M.S. Non-Thesis Option Students** -- same as semester version.

**5) Awarding of the M.S. Degree upon Completing the Ph.D. Candidacy Examination** -- same as semester version.

## **Transition Plan**

Students who began their degree under quarters will not be penalized as we move to semesters, either in terms of progress towards their degree or their expected date of graduation. Arrangements will be made for individual students on a case-by-case basis by their advisors and the Graduate Studies Committee within Geodetic Science, but we anticipate few complications because few of our courses are contained in sequences and because the total graduate student population in Geodetic Science is small (~ 30 students, including both M.S. and Ph.D.).

Because our M.S. degree requirements are specified in terms of a required number of credit hours, rather than a required number of courses, credit hours will serve as the “currency” during the transition. Students who have completed graded coursework under quarters will be allowed to count the equivalent number of semester credit hours toward their degree requirements. Students who have completed the quarter equivalent of a pre-approved semester “core course” will be considered to have fulfilled that semester-course requirement; students who have completed quarter courses that are not included in the new pre-approved “core courses” will apply the semester-equivalent credit hours toward their electives.

There presently are no students in the M.S. non-thesis-option -- and none have applied for the 2011-12 academic year – so we do not anticipate having to transition a non-thesis option student into the semester format. If any such cases do arise during 2011-12, the student will be advised to complete the quarter-version of the appropriate core courses, which then can be converted as described above.



**GEODETIC SCIENCE SEMESTER COURSES AVAILABLE IN GEODETIC SCIENCES M.S.**

Semester Course	Semester Course Title	Semester Credit Hours	Quarter Course	Quarter Course Title	Quarter Credit Hours	Comments
Geod Sci 5194	Group Studies	1-6	Geod Sci 694	Group Studies	1-9	Direct conversion
Geod Sci 5612	Introduction to Geodesy	3	Geod Sci 612	Topics in Geodesy	4	Direct conversion
Geod Sci 5636	Geovisualization Geometry	4	Geod Sci 636	Map Projections	4	Increased content on computer methods
Geod Sci 5637	Topics in Mapping	3	Geod Sci 637	Topics in Mapping	4	Direct conversion
Geod Sci 5652	Adjustment Computations	5	Geod Sci 651 + 652	Adjustment Computations I & II	5 + 4	Direct conversion of combined courses
Geod Sci 5660	Geometric Reference Systems	4	Geod Sci 660	Geometric Reference Systems	5	Increased lab content
Geod Sci 5781	Geodesy and Geodynamics	3	Geod Sci 781	Topics in Geodynamics	3	Increased lecture content
Geod Sci 6193	Individual Studies	2-6	Geod Sci 693	Individual Studies	2-9	Direct conversion
Geod Sci 6776	Physical Geodesy	4	Geod Sci 776	Gravimetric Geodesy	4	Increased lecture and lab components
Geod Sci 6777	Satellite Geodesy	3	Geod Sci 777	Satellite Geodesy	4	Direct conversion
Geod Sci 6786	Geospatial Data Structures for Computer Mapping and GIS	3	Geod Sci 786	Managing Spatial Data Structures for Computer Mapping	4	Direct conversion
Geod Sci 7745	Inertial Navigation/Positioning Analysis	4	Geod Sci 745	Inertial Navigation/Positioning Analysis	4	Increased lab content
Geod Sci 7763	Advanced Adjustment Computations	4	Geod Sci 762	Advanced Adjustment Computations	4	Increased lecture

						content
Geod Sci 7765	Analysis and Design of Geodetic Networks	2	Geod Sci 765	Analysis and Design of Geodetic Networks	3	Direct conversion
Geod Sci 7837	Computational Cartography	4	Geod Sci 837	Computational Cartography	4	Increased lab content
Geod Sci 7875	Spectral Methods in Geodesy	3	Geod Sci 875	Spectral Methods in Gravimetric Geodesy	3	Increased lab content
Geod Sci 7998	Research in Geodetic Science	1-12	Geod Sci 998	Research in Geodetic Science: Thesis	1-18	Direct conversion
Geod Sci 7999	Research for M.S. Thesis in Geodetic Science	1-12	Geod Sci 998	Research in Geodetic Science: Thesis	1-18	Direct conversion
Geod Sci 8862	Adjustment Computations for Random Processes	2	Geod Sci 862	Adjustment Computations for Random Processes	3	Direct conversion
Geod Sci 8871	Advanced Physical Geodesy	3	Geod Sci 871	Advanced Gravimetric Geodesy	4	Direct conversion
Geod Sci 8873	Advanced Satellite Geodesy	3	Geod Sci 873	Advanced Satellite Geodesy	4	Direct conversion
Geod Sci 8785	Research Principles and Techniques	2-6	Geod Sci 885	Research Principles and Techniques	2-9	Direct conversion
Geod Sci 8998	Research in Geodetic Science	1-12	Geod Sci 999	Research in Geodetic Science: Dissertation	1-18	Direct conversion
Geod Sci 8999	Research for Ph.D. Dissertation in Geodetic Science	1-12	Geod Sci 999	Research in Geodetic Science: Dissertation	1-18	Direct conversion

Note: Other Geodetic Science courses included in the quarter-version of the M.S. program are not being converted to the semester-format.

**SEMESTER COURSES FROM OTHER BOOK 3 LISTINGS**  
**SPECIFICALLY LISTED IN GEODETIC SCIENCES M.S.**

CE 7442	Fundamentals of GPS and Reference Systems	4	CE 609	Surveying with Satellites	3	Increased lecture and lab content
Earth Sci 5642	Geomathematical Analysis	3	Earth Sci 642	Geomathematical Analysis	5	Direct conversion
Earth Sci 5646	Geodynamics	3	Earth Sci 646	Geodynamics	5	Direct conversion
Earth Sci 5650	Glaciology	4	Earth Sci 650	Glaciology	5	Increased lecture and lab content
Earth Sci 5655	Land Surface Hydrology	3	New course			
Earth Sci 5781	Gravity Exploration	3	Earth Sci 781	Gravimetry	3	Increased lecture content
Earth Sci 5782	Magnetic Exploration	3	Earth Sci 782	Magnetometry	3	Increased lecture content
Math 5601	Essentials of Numerical Methods	3	Math 606	Introduction to Numerical Analysis of Partial Differential Equations	3	Increased lecture content
Physics 5300	Theoretical Physics	4	Physics 664	Theoretical Physics	4	Increased lecture content
Stat 6450	Applied Regression Analysis	4	Stat 645	Applied Regression Analysis	5	Increased lecture content