

3240 Geosciences

Programs Offered:

- **Master of Science in Geosciences**
- **Doctor of Philosophy in Chemistry with Concentration in Geology (see section 3190)**
- **Professional Certificate in Geographic Information Science**
- **Dual Degree, B.A./M.S. or B.S. / M.S., Program in Geosciences**

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Applicants may obtain additional information about the Department of Geosciences by contacting the Director of Graduate Studies at the addresses above.

The Department of Geosciences offers the Master of Science (M.S.) in Geosciences in two tracks: Thesis or Capstone option. The thesis track offers a research-intensive experience for students seeking additional advanced degrees or research-based employment. The track culminates in a thesis project. The thesis track affords the experience of writing for publication and is suited for students with a project requiring more time to pursue. The capstone track is experiential in nature and is the appropriate choice for working professionals or students seeking a more structured, time-confined project. The track culminates in a capstone project that covers a variety of options such as case studies, surveys, or extensive literature reviews. The M.S. track is normally selected at the application by the first year of study at the latest.

Master of Science in Geosciences - Geography Concentration

Students seeking this degree and concentration are offered a broad range of courses that prepare students for research and professionals careers. Areas of specialization include: urban studies, geospatial technologies, physical geography/environmental studies, or human geography. Further information concerning specific courses applicable to each of these specializations is available in the departmental publication, *Guide to Graduate Studies in Geosciences*, which may be obtained from the department.

Students with professional goals are encouraged to enroll in the departmental internship course. This program is coordinated by the geoscience faculty members who assist students in selecting an appropriate sponsor. Our students have interned with a diverse group of sponsors, including local and regional planning agencies, federal and state governments, and numerous private corporations. Graduate credit earned in the internship course may be applied toward minimum credit requirements. Applications and internship qualifications can be obtained from the department. Thirty-six hours are required for completion of this degree. Further information is provided at geosciences.gsu.edu.

Master of Science in Geosciences - Geology Concentration

The M.S. degree program with a Geology concentration offers a broad range of courses that prepare students for research and professionals careers. Research efforts are in the following broad areas: geochemistry (analytical,

aqueous, environmental, igneous, metamorphic, and sedimentary), mineralogy, hydrogeology, petrology, sedimentology, structural geology, and geoinformatics. Thirty-six hours are required for completion of this degree. Further information is provided at geosciences.gsu.edu.

Master of Science in Geosciences - Water Sciences Concentration

A strong demand exists in the public sector and private industry for understanding of aquatic systems. The M.S. degree program with a Water Sciences concentration is designed to provide students with a working knowledge of both the quality and quantity of water in the environment, and modern techniques to assess, model, and remediate aquatic environmental problems, and understand the social context and implications of water resources. Thesis research and capstone projects with faculty are carried out in the following broad areas: aqueous geochemistry, hydrogeology, watershed hydrology, water resources, ecohydrology, urban hydrology, meteorology, and applied climatology. Thirty-six hours are required for completion of this degree. Further information is provided at geosciences.gsu.edu.

Doctor of Philosophy in Chemistry - Geology Concentration

The Doctor of Philosophy (Ph. D) degree in Chemistry with a concentration in Geology is offered in collaboration with the Department of Chemistry. This program culminates in a dissertation containing the results of distinctive and original research scholarship carried out by the candidate. The dissertation must be defended publicly and judged to be a significant contribution in the advancement of science.

Graduate assistantships are available for qualified M.S. and Ph.D. students. Masters students in the capstone track must participate in an internship or equivalent limited research project as a directed study and submit a report to the graduate faculty on the findings of this project. The capstone M.S. degree students must also pass the departmental comprehensive exam.

Applications for admission are accepted for all three semesters. International students and students requesting graduate assistantships must have submitted their complete application by April 15 to be considered for admission for the fall semester and by November 15 for the spring semester.

Additional Admission Requirements for the Geography Concentration

In addition to the general requirements of the College of Arts and Sciences, the Department of Geosciences has the following admission requirements for the Geography Concentration:

1. Applicants to the M.S. degree program in Geosciences with Geography concentration must submit three letters of recommendation from professional sources.
2. A statement of educational, research, and/or career goals.

Additional Admission Requirements for the Geology Concentration

In addition to the general requirements of the College of Arts and Sciences, the Department of Geosciences has the following admission requirements for the Geology Concentration:

1. Three letters of recommendation from individuals who can evaluate the applicant's potential for graduate work in Geology.
2. A statement of educational, research, and/or career goals.
3. A bachelor's degree in Geology or other physical science or engineering. Students with a B.S. degree in other fields other than Geology are also welcome but are expected to take the Foundational courses listed below.
4. Foundation coursework (0-46 hours)

These courses are assigned as part of the admission process. They can be exempted if equivalent work has been completed with grades of C or higher. Note: Field Geology requirement may be satisfied by presenting evidence of supervised field work in Geology performed at the upper-division undergraduate level. Graduate

students who are required to take the Geology Foundation courses should take them at the graduate level (i.e., 6000 and higher) if available.

- a. Geology (0-32 hours)
 - [GEOS 1121K](#) Introductory Geosciences I (4)
 - [GEOS 1222K](#) Introductory Geosciences II (4)
 - [GEOS 4006](#) Sedimentary Environments and Stratigraphy (4)
 - [GEOS 4013](#) Structural Geology (4)
 - GEOL 4015 Crystallography & Mineralogy (4)
 - GEOL 4016 Igneous & Metamorphic Petrology (4)
 - [GEOS 4120](#) Basic Field Geology (4) and
 - [GEOS 4121](#) Advanced Field Geology (4)
- b. Allied Disciplines (0-20 hours)
 - Calculus: [MATH 2211](#) (4) and [MATH 2212](#) (4)
 - Physics: [PHYS 1111K](#) (4) or [PHYS 2211K](#) (4)
 - Chemistry: [CHEM 1211K](#) (4) and [CHEM 1212K](#) (4)

Additional Admission Requirements for the Water Sciences Concentration

In addition to the general requirements for the College of Arts and Sciences, the Department of Geosciences has the following admission requirements for the Water Sciences Concentration:

1. Three letters of recommendation from individuals who can evaluate the applicant's potential for graduate work in Water Sciences.
2. A statement of educational, research, and/or career goals.
3. A bachelor's degree in geography, geology, or related field.
4. Foundational coursework for students who wish to specialize in physical-chemical aspects of water science. These courses are normally expected to have been completed as part of the applicant's undergraduate education and completed with grades C or higher. However, students who are otherwise qualified may be accepted under Special Status, with the condition that this coursework is completed as part of their graduate study:
 - a. Minimum 1 semester of calculus
 - b. Minimum 1 semester of physics
 - c. Minimum 1 semester of chemistry
 - d. 2 semesters of introductory physical geography or geology

Degree Requirements

Master of Science in Geosciences, Geography Concentration

Thesis option (36 hours)

Early in their coursework, students must select advisers to direct their programs of study and to appoint their general examination and thesis committees. A timeline is provided in the *Guide to Graduate Studies*.

1. [GEOS 8002](#) (Geoscience Research Methods) to be taken the first time offered after the student's admission to the program.
2. Techniques training equivalent by completion of one of the following courses: [GEOS 6518](#) (Digital Cartography); ([GEOS 6530](#) (Introduction to Remote Sensing); [GEOS 6532](#) (Introduction to Geographic Information Systems); [GEOS 6534](#) (Advanced Geographic Information Systems). This course may count toward the departmental minimum credit hour requirements.
3. [GEOS 6515](#) (Qualitative Methods in Geography) or [GEOS 6520](#) (Quantitative Spatial Analysis). This requirement may be waived if student has equivalent training.
4. Six semester hours of coursework at the 8000 level in addition to [GEOS 8002](#).
5. Seminar (1-2 hours) [GEOS 6095](#) Seminar in Geosciences.
6. Remaining hours in student's area of specialization chosen from graduate level courses.
7. Six semester hours of [GEOS 8999](#) (Thesis Research) for thesis option or three semester hours of [GEOS 8990](#) (Research Practicum) for capstone option.
8. Proficiency in a foreign language or in an approved research skill. Courses taken to fulfill this requirement may not count towards the departmental minimum credit hour requirements.
9. Completion of Thesis and pass oral examination of Thesis.

Capstone Option (36 hours)

In addition to the requirements 1-7 above for the thesis option, students choosing the capstone track must take three additional semester hours of graduate level coursework in lieu of [GEOS 8999](#) and complete a capstone research project ([GEOS 8990](#) Research Practicum). Students may attempt to fulfill the practicum requirement twice, but only three semester hours of [GEOS 8990](#) can be counted toward their degree requirements. Students must pass a written comprehensive examination and pass an oral examination of the capstone project.

Degree Requirements

Master of Science in Geosciences, Geology Concentration

Thesis Track (36 hours)

1. [GEOS 8002](#) (Geoscience Research Methods) to be taken the first time offered after the student's admission to the program.
2. Techniques training equivalent by completion of one of the following courses: [GEOS 6518](#) (Digital Cartography); ([GEOS 6530](#) (Introduction to Remote Sensing); [GEOS 6532](#) (Introduction to Geographic Information Systems); [GEOS 6534](#) (Advanced Geographic Information Systems). This course may count toward the departmental minimum credit hour requirements.
3. Geology courses (14-20 hours)
 - o [GEOS 6000](#) Advanced Topics in Physical and Historical Geology (3)
 - o [GEOS 6003](#) Aqueous Geochemistry (3)
 - o [GEOS 6005](#) Geology of Georgia (3)
 - o [GEOS 6006](#) Sedimentary Environments and Stratigraphy (4)
 - o [GEOS 6007](#) Groundwater Hydrology (3)
 - o [GEOS 6009](#) Applications of Chemical Tracers (3)

- [GEOS 6011](#) Principles of Paleontology (4)
 - [GEOS 6013](#) Structural Geology (4)
 - [GEOS 6097](#) Topics in Geological Sciences (1-3)
 - [GEOS 6120](#) Basic Field Geology (3)
 - [GEOS 6121](#) Advanced Field Geology (3)
 - [GEOS 8001](#) Soils, Clays, and Weathering (3)
 - [GEOS 8097](#) Directed Study in Geology (1-3)
4. Seminar (1-2 hours) [GEOS 6095](#) Seminar in Geosciences
 5. Extra departmental courses (3-6 hours): An approved list of courses is available from the Department of Geosciences.
 6. Foreign language: Proficiency in a foreign language or in an approved research skill. This requirement can be fulfilled by taking an approved course or by taking an examination.
 7. Thesis Research ([GEOS 8999](#)) (9 hours).
 8. Completion of Thesis and pass oral examination of Thesis.

Capstone Track (36 hours)

1. [GEOS 8002](#) (Geoscience Research Methods) to be taken the first time offered after the student's admission to the program.
2. Techniques training equivalent by completion of one of the following courses: [GEOS 6518](#) (Digital Cartography); ([GEOS 6530](#) (Introduction to Remote Sensing); [GEOS 6532](#) (Introduction to Geographic Information Systems); [GEOS 6534](#) (Advanced Geographic Information Systems). This course may count toward the departmental minimum credit hour requirements.
3. Geology Courses (14-20 hours)
 - [GEOS 6000](#) Advanced Topics in Physical and Historical Geology (4)
 - [GEOS 6003](#) Aqueous Geochemistry (3)
 - [GEOS 6005](#) Geology of Georgia (3)
 - [GEOS 6006](#) Sedimentary Environments and Stratigraphy (4)
 - [GEOS 6007](#) Groundwater Hydrology (3)
 - [GEOS 6011](#) Principles of Paleontology (4)
 - [GEOS 6013](#) Structural Geology (4)
 - [GEOS 6097](#) Topics in Geological Sciences (1-3)
 - [GEOS 6120](#) Basic Field Geology (3)
 - [GEOS 6121](#) Advanced Field Geology (3)
 - [GEOS 8001](#) Soils, Clays, and Weathering (4)
 - [GEOS 8097](#) Directed Study in Geology (1-3)
4. Seminar (1-2 hours) [GEOS 6095](#) Seminar in Geosciences
5. Extra departmental Courses (6-9 hours). An approved list of courses is available from the department
6. Directed Study (3 hours) [GEOS 8097](#) Directed Study in Geology

7. Comprehensive Examination: Pass a general written examination
8. Foreign language: Proficiency in a foreign language or in an approved research skill. This can be fulfilled by taking a course or taking an examination.
9. Submission and approval of a capstone project and pass oral examination of the project.

Degree Requirements

Master of Science in Geosciences, Water Sciences Concentration

Thesis Option (36 credit hours)

Early in their graduate studies, students must select a faculty advisor to direct their programs of study and to appoint their committee. A timeline is provided in the Guide to Graduate Studies. Students should consult with faculty members to align their course of study with desired professional licensure and certification appropriate to their desired career trajectory – for example, either the American Institute of Hydrology's Professional Hydrologist Certification, or the Association of State Boards of Geology's Professional Geologist Licensure Examination.

1. Take all from Group I: Department Requirements (13 credit hours):
 - a. [GEOS 8002](#) Geoscience Research Methods (3)
 - b. [GEOS 6095](#) Seminar (1)
 - c. [GEOS 8999](#) Thesis Research (9)
 - d. [GEOS 6646](#) Water Resources (3)
 - e. Successfully defend thesis in public presentation
2. Select one from Group II: Core Required Water Sciences Courses (3 credit hours):
 - a. [GEOS 6650](#) Surface Water Hydrology (3)
 - b. [GEOS 6007](#) Groundwater Hydrogeology (3)
 - c. [GEOS 6009](#) Applications of Chemical Tracers (3)
3. Elective Water Sciences Courses (Minimum 6 hours):
 - a. Either course from Group II not already taken
 - b. [GEOS 6003](#) Aqueous Geochemistry (3)
 - c. [GEOS 6642](#) Advanced Weather and Climate (3)
 - d. [GEOS 8040](#) Seminar in Hydrology and Geomorphology (3)
 - e. [BIOL 6451](#) Aquatic Pollution and Toxicology (4)
 - f. [PH 7297](#) Global Water, Sanitation and Hygiene (4)
4. Related Geoscience Skills Courses (Minimum 6 hours):
 - a. [GEOS 6520](#) Quantitative Spatial Analysis (OR APPROVED statistics substitute) (3-4)
 - b. [GEOG 6515](#) Qualitative Methods in Geography (3)
 - c. [GEOS 6532](#) GIS (4)
 - d. [GEOS 6534](#) Advanced Geographic Information Systems (4)
 - e. [GEOS 6536](#) GIS Programming (OR APPROVED Comp Sci substitute) (4)
 - f. [GEOS 6538](#) Urban GIS (4)
 - g. [GEOS 6123](#) Geoinformatics (3)
 - h. [GEOS 6042](#) Environmental Instrumentations (4)

- i. [PH 7299](#) Sampling of the Environment (3)
- j. Remaining courses taken in consultation with the student's advisor.

Capstone Track

1. All above requirements, except 1-C and 1-D.
2. An additional 6 (or more) credits of GEOS graduate courses.
3. Pass a written comprehensive examination.
4. GEOS 8990 (3) – Research Practicum (in consultation with a faculty member)
5. Pass an oral examination of the capstone project carried out in GEOS 8990.

Doctor of Philosophy

The Doctor of Philosophy (Ph.D.) degree in Chemistry with a concentration in Geology is offered in collaboration with the Department of Chemistry. At least 80 hours of graduate credit are required for the Ph.D. degree. In order to satisfy the minimum requirements for the degree, students must complete successfully:

1. Thirty hours of approved graduate core coursework.
2. Forty hours of research, at least 20 hours of which must be Dissertation Research.
3. Ten additional hours of graduate course electives.
4. Satisfaction of the foreign language (research skill) requirement.
5. A written and oral qualifying general examination.
6. A dissertation.
7. A final oral examination directed primarily to the defense of the dissertation.

Specific requirements: In the list of requirements that follows, the minimum number of credit hours required in each category is indicated and the courses that can be taken to fulfill these requirements are listed in parentheses. Credit will be given only for those Geology courses in which the student receives a grade of B or higher. Category C may be used as the minor area of specialization if approved by the examination committee. Substitutions may be made by the graduate director in Category C with written approval of the Department of Geosciences.

- A. Core courses: Geology (11 hours). To be selected from GEOS 6003, 8001, 8010, or other approved substitutes;
- B. Minor Area electives: (13 hours). To be selected from: GEOS 6004, 6006, 6009; Analytical Chemistry: CHEM 6850, 6860, 6800, 8900; Biophysical Chemistry: CHEM 6000, 6010, 6190, 6110, 6580; Organic Chemistry: CHEM 6400, 6410, 6450, 8900; or other approved substitutes;
- C. Interdisciplinary elective: (6 hours). To be selected from Chemistry or Biology or approved substitutes;
- D. Special Topics, Electives and Seminar: (10 hours). To be selected from GEOS 6008, 6095, 6097, 6640, 6650; BIOL 6439, 6458; CHEM 6600, 6610, 6490; or other approved substitutes; and
- E. Research: (40 hours). To be selected from [GEOS 8097](#) or [GEOS 9999](#) (a minimum of 20 hours are selected from [GEOS 9999](#)).

Foreign language/research skill requirement: A reading proficiency in one foreign language is required. An equivalent research skill such as computer language, technical writing, advanced statistics, electronics, etc. may be substituted for the foreign language (departmental approval required). Students with M.S. degrees which had a foreign language

requirement satisfy the foreign language requirement. Note: credit hours used to fulfill the language requirement do not count in the 80 hours.

Professional Certificate in Geographic Information Science

Geographic Information Science (GIS) is a rapidly growing discipline, with applications in many fields. A strong demand exists for proficient users of geospatial technology. The graduate-level Professional Certificate Program in GIS is designed to facilitate those students working toward graduate degrees in a variety of disciplines, as well as those who use GIS in the workplace and would like to obtain systematic training in the technology without having to complete a graduate degree. The Certificate Program consists of five courses with a total of 18-19 credit hours, including elective courses from a variety of departments/programs. Please contact the Department of Geosciences for more information.

GIS Certificate Requirements (18-19)

1. Admission to the program: B.A. or B.S. in a related field. A statement of intent, GRE scores, and transcripts must be provided to the Graduate School as part of the application. Students lacking appropriate background may be required to take prerequisite courses:
2. Required Courses (15) The student must take the following courses:
 - [GEOS 6518](#) Digital Cartography (3)
 - [GEOS 6530](#) Introduction to Remote Sensing (4)
 - [GEOS 6532](#) Introduction to Geographic Information Systems (4)
 - [GEOS 6534](#) Advanced Geographic Information Systems (4)
3. Elective Courses (3-4) The student must take one of the following courses:
 - [GEOS 6520](#) Quantitative Spatial Analysis (3)
 - [GEOS 6536](#) GIS Programming (4)
 - [GEOS 6538](#) Urban GIS (4)
 - [GEOS 6834](#) Applied Research in GIS (3)
 - [GEOS 8001](#) Methods of Geographic Research (3)
 - [GEOS 8030](#) Seminar in Cartography (3)
 - [GEOS 8035](#) Seminar in Geographic Information Systems (3)
 - [GEOS 6123](#) Geoinformatics (3)
4. Examination
5. The student must pass an examination of GIS knowledge and applications. The certificate will be issued to students who complete the above requirements, including graduate students enrolled in the non-degree program.

Dual B.A./M.S. and Dual B.S./M.S. Programs in Geosciences

The department offers a dual Bachelor of Arts or Bachelor of Sciences and Master of Science in Geosciences. The Dual Degree Program is designed for high-achieving GSU undergraduate students majoring in Geosciences and allows students to complete both their Bachelors and Masters degrees in just five years. Students are able to take graduate-level courses as they complete their undergraduate degree.

Students must be formally accepted into the dual degree program by the department and College of Arts and Sciences to be able to take graduate courses as an undergraduate. Additionally, acceptance into the dual program does not constitute admission to the master's program. Students must fulfill regular graduate admissions requirements and apply for the master's program following college processes.

Information about the dual program, including application instructions and program requirements, can be found at cas.gsu.edu/dual-degrees/.

Applicants may obtain additional information about the program by contacting the Director of the Geosciences Dual Degree Program Richard Milligan (rmilligan@gsu.edu).