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 B.A. or B.S. / M.S. in Geosciences**

Department of Geosciences
38 Peachtree Center Ave.
730 Langdale Hall
P.O. Box 3965
Atlanta, Georgia 30303
Phone: 404-413-5750
Fax: 404-413-5768
geosciences.gsu.edu

Katherine Hankins, Chair, khankins@gsu.edu
Nadine Kabengi, Director of Graduate Studies for Geosciences, geosgraddirector@gsu.edu
Richard Milligan, Dual Degree Coordinator, rmilligan@gsu.edu

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 non-academic 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, internships, surveys, or extensive literature reviews. The M.S. track is normally selected on the application. A switch between tracks is possible pending approval from the Director of Graduate Studies and as long as it is completed by the end of the first year of study at the latest. Applicants may obtain additional information about the Department of Geosciences by contacting the Director of Graduate Studies at the addresses above.

Program Overviews

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 professional careers that employ geographic methods, perspectives, and expertise. A wide range of areas of specialization in geography include: urban geography, geospatial science, physical geography, environmental studies, and human geography

Our Geography students find internship and employment opportunities in a diverse range of sectors including local and regional planning agencies; federal, state, and municipal governments; non-governmental organizations and community-based advocacy groups; as well as private industry and corporations. 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 professional careers. Research efforts in either thesis or capstone projects are in the following broad areas: geochemistry (analytical, aqueous, environmental, igneous, metamorphic, and sedimentary), mineralogy, hydrogeology, petrology, sedimentology, structural geology, and geoinformatics. Students that pursue the Geology concentration find employment in environmental consulting, mining and energy resource industries, state and federal agencies, non-governmental organizations, and related opportunities that utilize foundational skills and knowledge in geology. 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 public and private sectors for understanding of aquatic systems, hydrological processes, and water resources. The M.S. degree program with a Water Sciences concentration is designed to provide students with expertise in the quality, quantity, storage, and flow of water in diverse environments; techniques to assess, model, and remediate aquatic environmental problems; and paradigms for understanding the social contexts and implications of water governance. 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, water governance, 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. PhD students are supported by external funding from competitive grants awarded to faculty in the Geosciences Department. This degree represents a collaborative agreement with the Chemistry Department at GSU, and is therefore primarily conceived as a program from students with a strong interest in chemistry-centric sub-disciplines of Geology (e.g. biogeochemistry or inorganic geochemistry).

Professional Certificate in Geographic Information Science (GIS)

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 field 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.

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

The department offers a dual Bachelor of Arts (B.A.) or Bachelor of Sciences (B.S.) and Master of Science in Geosciences. The dual degree program is designed for high-achieving Georgia State undergraduate students majoring in Geosciences and allows students to complete both their bachelor's and master's degrees in just five years. Students are able to take up to four graduate-

level courses as they complete their undergraduate degree, which would then apply to both the undergraduate and graduate degree programs.

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/. Interested students may contact the dual-degree director at the address above.

Further information concerning specific courses applicable to each program, concentration and its disciplinary specializations is available in the departmental publication, *Guide to Graduate Studies in Geosciences*, which may be obtained from the department.

Admission Information

Deadlines

Applications for admission are accepted for all three semesters. The regular deadlines are April 1 admission to the fall semester and November 1 for the spring and summer semesters. *International students and students requesting graduate assistantships are encouraged to apply by the priority deadlines* of February 15 for fall admissions and October 1 for spring and summer admissions. The late deadline for application for fall admissions is June 1. There is no late deadline for spring and summer applications. Late applications may not be considered for graduate assistantships. Online applications must be submitted and all materials received to be reviewed for admission.

Graduate assistantships are available for qualified M.S. and Ph.D. students.

Application Requirements

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

1. Three letters of recommendation on official letterheads from individuals who can evaluate the applicant's potential for graduate work.
2. A statement (approximately 500 to 1500 words) of educational, research, and career goals, where the applicants indicate their desired area of specialization, faculty members they would be interested in working with, and if they have made preliminary contact with that faculty member.
3. Brief (not more than 250 words) rationale explaining preference for thesis or capstone track.

In addition to the above departmental requirements that apply to all applicants, concentration-specific requirements are outlined below.

Additional Admission Requirements – Geology Concentration

1. A bachelor's degree in geology, earth sciences, engineering or a related field.

2. Foundational coursework: These courses are normally expected to have been completed as part of the applicant's undergraduate education and completed with a grade of 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:
    - Minimum one semesters of calculus
    - Minimum one semester of physics
    - Minimum one semesters of chemistry
    - Minimum of two semesters of introductory geology or equivalent training
3. For students seeking traditional disciplinary training in the field of Geology, who have aspirations of seeking Professional Geologist certification to work for a state or federal government, or for certain career pathways in industry, supplemental foundational coursework should include that listed below. Note that these courses are in addition to the foundational courses outlined above in Section 2, and are also expected to have been completed as part of the applicant's undergraduate education with a grade of 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. During the application process the prospective student can indicate their primary interests in their statement of goals and interests. The graduate-admissions committee can then evaluate the students' undergraduate coursework in light of their stated interests:
    - Minimum of one additional semester of calculus and/or statistics (2 semesters total)
    - Minimum of one additional semester of chemistry (2 semesters total)
    - Minimum of four additional courses of upper-level geology or equivalent training
    - Minimum of one semester of a field course in geology or equivalent training

Additional Admission Requirements – Water Sciences Concentration

1. A bachelor's degree in geography, geology, engineering, physics, or related field.
2. Foundational coursework for students who wish to specialize in physical-chemical aspects of water science are listed below. These courses are normally expected to have been completed as part of the applicant's undergraduate education and completed with a grade of 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:
    - Minimum one semester of calculus
    - Minimum one semester of physics
    - Minimum one semester of chemistry
    - Two semesters of introductory physical geography or geology

3. The Water Sciences Concentration is designed to support the educational and research goals of students with interests in social, political, and economic aspects of water resources as well. Students with these primary interests would not be required to have completed the courses noted above in section 2.a-d. During the application process the prospective student can indicate their primary interests in their statement of goals and interests. The graduate-admissions committee can then evaluate the student's undergraduate coursework in light of their stated interests.

Degree Requirements

Early in their coursework, all students must select a thesis advisor or project director to direct their programs of study and help with course selections. Additionally, 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.

Below is an overview of the degree requirements for specific program, concentration and track.

Master of Science in Geosciences – Geography Concentration

Thesis Track (Minimum of 36 hours)

Satisfactory completion of:

1. Take all courses from Group I: Department Requirements (16):
    - GEOS 8002 Geoscience Research Methods (3)
    - GEOS 6095 Colloquium in Geosciences (1)
    - GEOS 8999 Thesis Research (9) (only 9 hours can count towards the 36 hour program of study)
    - Three additional semester hours coursework at the 8000 level (3)
    - Proficiency in a world language or an approved research skill – requirement can be fulfilled by taking an approved course or by taking an examination.
    - Successfully defend thesis in public presentation
2. Select one course from Group 2: Methods (3)
   This requirement may be waived if student has equivalent training
    - GEOS 6515 Qualitative Methods in Geography (3)
    - GEOS 6520 Quantitative Spatial Analysis (3)
3. Select one course from Group 3: Techniques (3)
    - 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)

4. Remaining hours in student's area of specialization chosen from graduate level courses (14)

Capstone Track

1. All above requirements, except GEOS 8999 and thesis defense under section 1.
2. An additional 6 (or more) credits of GEOS graduate courses
3. Pass a written comprehensive examination
4. GEOS 8990 Research Practicum (3) (in consultation with a faculty member)
5. Successfully present the capstone project carried out in GEOS 8990

Master of Science in Geosciences – Geology Concentration

Thesis Track (Minimum of 36 hours)

1. Take all courses from Group I: Department Requirements (16):
   - GEOS 8002 Geoscience Research Methods (3)
   - GEOS 6095 Colloquium in Geosciences (1)
   - GEOS 8999 Thesis Research (9) (only 9 hours can count towards the 36 hour program of study)
   - Three additional semester hours coursework at the 8000 level (3)
   - Proficiency in a world language or an approved research skill – requirement can be fulfilled by taking an approved course or by taking an examination
   - Successfully defend thesis in public presentation
2. Group II: Core Required Geology Courses. Take one course from geochemistry sequence and one from either instrumentation or water sequence (6):
   - GEOS 6003 Principles and Applications of Environmental Geochemistry (3) or GEOS 6004 Advanced Environmental Geochemistry (3)
   - GEOS 6042 Environmental Instrumentations I: Aqueous Media (4) or GEOS 6043 Environmental Instrumentations II: Solid Media (4)
   - GEOS 6010 Groundwater hydrology (3) or GEOS 6002 Hydrogeology (4)
3. Elective Geology Courses (Minimum 9 hours)
   - Any course from Group II above not already taken
   - GEOS 6000 Advanced Topics in Physical and Historical Geology (3)
   - GEOS 6005 Geology of Georgia (3)
   - GEOS 6006 Sedimentary Environments and Stratigraphy (4)
   - GEOS 6008 Fractured Rock and Fluid Flow (3)
   - 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 8002 Nanominerals in Geochemical Environments (3)
- GEOS 8097 Directed Study in Geology (1-3)
- Other Geology-related elective courses in consultation with the student's advisor.

4. Related Geosciences Skills Courses (Minimum 6 hours):
   - 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)
   - GEOS 6123 Geoinformatics (3)
   - GEOS 6520 Quantitative Spatial Analysis (Or approved statistics substitute) (3-4)
5. Remaining courses taken in consultation with the student's advisor.

Capstone Track

1. All above requirements, except GEOS 8999 and thesis defense under section 1.
2. An additional 6 (or more) credits of GEOS graduate courses
3. Pass a written comprehensive examination
4. GEOS 8990 Research Practicum (3) (in consultation with a faculty member)
5. Successfully present the capstone project carried out in GEOS 8990

Master of Science in Geosciences – Water Sciences Concentration

Thesis Track (Minimum of 36 credit hours)

1. Take all courses from Group I: Department Requirements (16):
   - GEOS 8002 Geoscience Research Methods (3)
   - GEOS 6095] Colloquium in Geosciences (1)
   - GEOS 8999 Thesis Research (9) (only 9 hours can count towards the 36 hour program of study)
   - Three additional semester hours coursework at the 8000 level (3)
   - Proficiency in a world language or an approved research skill requirement can be fulfilled by taking an approved course or by taking an examination

- Successfully defend thesis in public presentation

2. Select two courses from Group II: Core Required Water Sciences Courses (6):
   - GEOS 6010 Groundwater Hydrology (3)
   - GEOS 6646 Water Resources (3)
   - GEOS 6650 Surface Water Hydrology (3)
3. Elective Water Sciences Courses (Minimum 6 hours):
   - Any course from Group II above not already taken
   - GEOS 6003 Principles and Applications of Environmental Geochemistry (3)
   - GEOS 6002 Hydrogeology (3)
   - GEOS 6008 Fractured Rock and Fluid Flow (3)
   - GEOS 6009 Applications of Chemical Tracers (3)
   - GEOS 6230 Global Water Policy and Governance (3)
   - GEOS 6235 Water, Wastewater, and the Environment (3)
   - GEOS 6640 Geomorphology (3)
   - GEOS 6642 Advanced Weather and Climate (3)
   - GEOS 6644 Environmental Conservation (3)
   - GEOS 8040 Seminar in Hydrology and Geomorphology (3)
   - BIOL 6451 Aquatic Pollution and Toxicology (4)
   - [PH 7297] Global Water, Sanitation and Hygiene (4)
4. Related Geoscience Skills Courses (Minimum 6 hours):
   - GEOS 6042 Environmental Instrumentations I: Aqueous Media (4)
   - GEOS 6123 Geoinformatics (3)
   - [GEOG 6515] Qualitative Methods in Geography (3)
   - GEOS 6520 Quantitative Spatial Analysis (Or approved statistics substitute) (3-4)
   - GEOS 6532 GIS (4)
   - GEOS 6534 Advanced GIS (4)
   - GEOS 6536 GIS Programming (or approved Comp Sci substitute) (4)
   - GEOS 6538 Urban GIS (4)
   - [PH 7299] Sampling of the Environment (3)
   - [PH 7150] Introduction to Environmental Health (3)
   - [PH 3800] Special topics: Environmental Justice (3)
5. Remaining courses taken in consultation with the student's advisor

Capstone Track

1. All above requirements, except GEOS 8999 and thesis defense under section 1.

2. An additional 6 (or more) credits of GEOS graduate courses
3. Pass a written comprehensive examination
4. GEOS 8990 Research Practicum (3) (in consultation with a faculty member)
5. Successfully present the capstone project carried out in GEOS 8990

Graduate Assistants

Graduate assistants are required to enroll for a minimum of 18 credit hours each semester. These credit hours will consist of courses required for the prescribed program of study, as well as additional hours of GEOS 8999, 8065 and 8060.

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. A minimum of 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 world language (or 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.

1. Core courses: Geology (11 hours). To be selected from GEOS 6003, GEOS 8001, GEOS 8010, or other approved substitutes;
2. Minor Area electives: (13 hours). To be selected from: GEOS 6004, GEOS 6006, GEOS 6009; Analytical Chemistry: CHEM 6850, CHEM 6860, CHEM 6800, CHEM 8900; Biophysical Chemistry: CHEM 6000, CHEM 6010, CHEM 6190, CHEM 6110, CHEM 6580; Organic Chemistry: [CHEM [6400], CHEM 6410, CHEM 6450, CHEM 8900; or other approved substitutes;
3. Interdisciplinary elective: (6 hours). To be selected from Chemistry or Biology or approved substitutes;

4. Special Topics, Electives and Seminar: (10 hours). To be selected from GEOS 6008, GEOS 6095, GEOS 6097, GEOS 6640, GEOS 6650; BIOL 6439, BIOL 6458; [CHEM 6600, [CHEM 6610, CHEM 6490; or other approved substitutes; and
5. Research: (at least 40 hours). To be selected from GEOS 8097 or GEOS 9999 (a minimum of 20 hours are selected from GEOS 9999).

World language/research skill requirement: A reading proficiency in one world language is required. An equivalent research skill such as computer language, technical writing, advanced statistics, electronics, etc. may be substituted for the world language (departmental approval required). The world language requirement satisfied for a student's M.S. degree can satisfy the PhD world language requirement. Note: credit hours used to fulfill the language requirement do not count in the 80 hours.

Graduate Assistants

Graduate assistants are required to enroll for a minimum of 18 credit hours each semester. These credit hours will consist of courses required for the prescribed program of study, as well as additional hours of GEOS 8097, GEOS 8060, and CHEM/GEOS 9999.

GIS Certificate Requirements

Satisfactory completion of:

1. Admission to the program: B.A. or B.S. in a related field. A statement of intent 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 Nanominerals in Geochemical Environments (3)
    - GEOS 8030 Seminar in Cartography (3)
    - GEOS 8035 Seminar in Geographic Information Systems (3)
    - GEOS 6123 Geoinformatics (3)
    - HIST 8770 Intro to Digital History (3)

4. Examination: The student must demonstrate mastery 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.