GEOLOGY, BS

Banner Code: SC-BS-GEOL

Academic Advising

Email: geology@gmu.edu
Website: https://science.gmu.edu/academics/departments-units/atmospheric-oceanic-earth-sciences/geology-bs

This degree is intended for students interested in studying the Earth and its processes. Students receive a broad background in the Earth sciences and select one of five specialty concentrations. The concentrations in Earth Surface Processes, Environmental Geoscience, Geology, and Paleontology are solely offered by the Department of Atmospheric, Oceanic and Earth Sciences (https://catalog.gmu.edu/colleges-schools/science/atmospheric-oceanic-earth-sciences/). The concentration in Oceanography and Estuarine science is offered jointly with the Department of Environmental Science and Policy (https://catalog.gmu.edu/colleges-schools/science/environmental-policy/), where specific advising is also available.

This is a Green Leaf program (https://catalog.gmu.edu/student-services/green-leaf-programs-courses/).

Teacher Licensure

Students who wish to become teachers can pursue either the Geology, BA (https://catalog.gmu.edu/colleges-schools/science/atmospheric-oceanic-earth-sciences/geology-ba/) or the Geology, BS in addition to obtaining teaching credentials. For more information, visit the Secondary Education program's webpage (https://education.gmu.edu/secondary-education/).

Admissions & Policies

Admissions

University-wide admissions policies can be found in the Undergraduate Admissions Policies (https://catalog.gmu.edu/admissions/undergraduate-policies/) section of this catalog.

To apply for this program, please complete the George Mason University Admissions Application (https://www2.gmu.edu/admissions-aid/apply-now).

Policies

Students must fulfill all Requirements for Bachelor's Degrees (https://catalog.gmu.edu/policies/academic/undergraduate-policies/#ap-5-3-2), including the Mason Core (https://catalog.gmu.edu/mason-core/).

For policies governing all undergraduate degrees, see AP.5 Undergraduate Policies (https://catalog.gmu.edu/policies/academic/undergraduate-policies/).

Writing Intensive Requirement

GEOL 317 Geomorphology (Mason Core) (https://catalog.gmu.edu/mason-core/) fulfills the writing intensive requirement for this major, with the exception of:

- The Environmental Geoscience Concentration, whereby GEOL 305 Environmental Geology (Mason Core) (https://catalog.gmu.edu/mason-core/) fulfills the writing intensive requirement.
- The Paleontology Concentration, whereby GEOL 334 Vertebrate Paleontology (Mason Core) (https://catalog.gmu.edu/mason-core/) fulfills the writing intensive requirement.

Requirements

formerly (SC-BS-ESCI)

Degree Requirements

Total credits: minimum 120

This is a Green Leaf program.

Students should refer to the Admissions & Policies tab for specific policies related to this program.

Candidates for a degree in geology must complete allcore courses with a minimum GPA of 2.30.

Core Courses

Code	Title	Credits
Geology & Earth Science		
GEOL 101 & GEOL 103	Physical Geology (Mason Core) (https://catalog.gmu.edu/mason-core/) and Physical Geology Lab (Mason Core) (https://catalog.gmu.edu/mason-core/)	4
GEOL 102 & GEOL 104	Historical Geology (Mason Core) (https://catalog.gmu.edu/mason-core/) and Historical Geology Laboratory (Mason Core) (https://catalog.gmu.edu/mason-core/)	4
GEOL 302	Mineralogy	4
GEOL 420	Earth Science and Policy (Mason Core) (https://catalog.gmu.edu/mason-core/)	3
Chemistry		
CHEM 211 & CHEM 213	General Chemistry I (Mason Core) (https://catalog.gmu.edu/mason-core/) and General Chemistry Laboratory I (Mason Core) (https://catalog.gmu.edu/mason-core/)	4

CHEM 212 & CHEM 214	General Chemistry II (Mason Core) (https://catalog.gmu.edu/mason-core/) and General Chemistry Laboratory II (Mason Core) (https://catalog.gmu.edu/mason-core/)	4
Mathematics		
MATH 113	Analytic Geometry and Calculus I (Mason Core) (https://catalog.gmu.edu/mason-core/)	4-6
or MATH 123 & MATH 124	Calculus with Algebra/Trigonometry, Part A and Calculus with Algebra/Trigonometry, Part B (Mason Core) (https://catalog.gmu.edu/mason-core/)	
MATH 114	Analytic Geometry and Calculus II	4
STAT 250	Introductory Statistics I (Mason Core) (https://catalog.gmu.edu/mason-core/)	3
Physics		
Select one of the following options:		8
Option One		
PHYS 160 & PHYS 161 & PHYS 260 & PHYS 261	University Physics I (Mason Core) (https://catalog.gmu.edu/mason-core/) and University Physics I Laboratory (Mason Core) (https://catalog.gmu.edu/mason-core/) and University Physics II (Mason Core) (https://catalog.gmu.edu/mason-core/) and University Physics II Laboratory (Mason Core) (https://catalog.gmu.edu/mason-core/)	
Option Two		
PHYS 243 & PHYS 244 & PHYS 245 & PHYS 246	College Physics I (Mason Core) (https://catalog.gmu.edu/mason-core/) and College Physics I Lab (Mason Core) (https://catalog.gmu.edu/mason-core/) and College Physics II (Mason Core) (https://catalog.gmu.edu/mason-core/) and College Physics II Lab (Mason Core) (https://catalog.gmu.edu/mason-core/)	
Additional Science		
Select one of the following options:		3-4
Option One		
CLIM 111 & CLIM 112	Introduction to the Fundamentals of Atmospheric Science (Mason Core) (https://catalog.gmu.edu/mason-core/) and Introduction to the Fundamentals of Atmospheric Science Lab (Mason Core) (https://catalog.gmu.edu/mason-core/)	
Option Two		
GGS 309	Introduction to Weather and Climate	
Total Credits		**45-48**

Concentration in Environmental Geoscience (EVGS)

This concentration provides students with a comprehensive knowledge of environmental geoscience. It is designed for students wanting their professional work to focus on understanding, preserving, and protecting the environment. This concentration provides the tools for applying geologic information to contemporary environmental topics. Environmental geologists study natural disasters such as floods, landslides, earthquakes, and tsunamis, and human-caused problems such as climate change.

Students choosing this concnetration must complete the following coursework:

Code	Title	Credits
GEOL 304	Sedimentary Geology	4
GEOL 305	Environmental Geology (Mason Core) (https://catalog.gmu.edu/mason-core/) [1]	3
GEOL 313	Hydrogeology	4
GEOL 403	Geochemistry	4
Select at least 9 credits from the following:		9
GEOL 301	Geological Field Experience	
GEOL 306	Soil Science	
GEOL 317	Geomorphology (Mason Core) (https://catalog.gmu.edu/mason-core/)	
GEOL 320	Resource Geology	
GEOL 407	Geological Field Mapping	
CLIM 312	Physical Climatology	
CLIM 440	Climate Dynamics	
CHEM 427	Aquatic Environmental Chemistry	
EVPP 361	Introduction to Environmental Policy	
GGS 311	Geographic Information Systems [2]	
GGS 379	Remote Sensing [2]	
Total Credits		**24**

1. Fulfills writing intensive requirement for this concentration only.
2. It is recommended that Bachelor's/Accelerated Master's students take the graduate version of these courses: GGS 553 Geographic Information Systems; GGS 379 Remote Sensing.

Concentration in General Geology (GGEO)

This concentration provides students with a comprehensive knowledge of core geologic concepts such as plate tectonics, sedimentary processes, structural geology, paleontology, and more. It allows graduates to be employed as field geologists or to pursue graduate studies in geology.

Students choosing this concentration must complete the following coursework:

Code	Title	Credits
GEOL 304	Sedimentary Geology	4
GEOL 308	Igneous and Metamorphic Petrology	4
GEOL 312	Invertebrate Paleontology	4
GEOL 317	Geomorphology (Mason Core) (https://catalog.gmu.edu/mason-core/) [1]	4
GEOL 401	Structural Geology	4
Field Experience		
Select any combination of the following courses:		6-9
GEOL 301	Geological Field Experience	
GEOL 404	Geological Field Techniques	
GEOL 407	Geological Field Mapping	
Total Credits		**26-29**

[1] Fulfills writing intensive requirement.

Concentration in Oceanography and Marine Science (OMAR)

This concentration provides students with a comprehensive knowledge of oceanography and marine geology. The program will provide students with the education required to allow them to obtain entry level positions in oceanographic career tracks or acceptance into a related graduate degree program.

Students choosing this concentration must complete the following coursework:

Code	Title	Credits
GEOL 309	Oceanography	3
GEOL 364	Marine Geology	3
GEOL 403	Geochemistry	4
GEOL 412	Physical Oceanography	3
or CLIM 412	Physical Oceanography	
Select one sequence from the following:		8
BIOL 102 & BIOL 103 & BIOL 105	Introductory Biology I-Survey of Biodiversity and Ecology (Mason Core) (https://catalog.gmu.edu/mason-core/) and Introductory Biology II-Survey of Cell and Molecular Biology (Mason Core) (https://catalog.gmu.edu/mason-core/) and Introductory Biology II Laboratory (Mason Core) (https://catalog.gmu.edu/mason-core/)	
EVPP 108 & EVPP 109 & EVPP 112 & EVPP 113	Ecosphere - Introduction to Environmental Science I-Lecture (Mason Core) (https://catalog.gmu.edu/mason-core/) and Ecosphere- Introduction to Environmental Science I- Lab (Mason Core) (https://catalog.gmu.edu/mason-core/) and Ecosphere: Introduction to Environmental Science II-Lecture (Mason Core) (https://catalog.gmu.edu/mason-core/) and Ecosphere: Introduction to Environmental Science II–Lab (Mason Core) (https://catalog.gmu.edu/mason-core/)	
Select at least 9 credits from the following:		9
GEOL 301	Geological Field Experience	
GEOL 304	Sedimentary Geology	
GEOL 308	Igneous and Metamorphic Petrology	
GEOL 312	Invertebrate Paleontology	
GEOL 332	Paleoclimatology	
GEOL 340	Modern Methods in Geology	
GEOL 363	Coastal Morphology and Processes	
GEOL 392	Geology and Earth Science Seminar	
GEOL 407	Geological Field Mapping	
Total Credits		**30**

Concentration in Paleontology (PLEO)

This concentration focuses on a broad understanding of Earth's history and the evolution of life on Earth as revealed through the fossil record. Fundamental concepts, methods and techniques of historical geology and paleontological data and analysis are also examined. This concentration may not be taken in conjunction with the Paleontology Minor.

Students choosing this concentration must complete the following coursework:

Code	Title	Credits
GEOL 304	Sedimentary Geology	4
GEOL 312	Invertebrate Paleontology	4
GEOL 334	Vertebrate Paleontology (Mason Core) (https://catalog.gmu.edu/mason-core/) [1]	4
BIOL 213 & BIOL 215	Cell Structure and Function and Cell Structure and Function Laboratory	4
BIOL 300	BioDiversity	4
Select at least 9 credits from the following:		9
GEOL 301	Geological Field Experience	
GEOL 306	Soil Science	
GEOL 317	Geomorphology (Mason Core) (https://catalog.gmu.edu/mason-core/)	
GEOL 332	Paleoclimatology	
GEOL 340	Modern Methods in Geology	

GEOL 364	Marine Geology	
GEOL 392	Geology and Earth Science Seminar	
GEOL 403	Geochemistry	
GEOL 407	Geological Field Mapping	
GEOL 412	Physical Oceanography	
GEOL 441	Great Events in Earth History	
Select 3-4 credits from the following:		3-4
BIOL 320	Comparative Chordate Anatomy	
BIOL 331	Invertebrate Zoology	
BIOL 374	Biogeography: Space, Time, and Life	
or GGS 321	Biogeography	
BIOL 471	Evolution	
Total Credits		**32-33**

[1] Fulfills writing intensive requirement for this concentration only.

Mason Core and Elective Credits

In order to meet a minimum of 120 credits, this degree requires additional credits (specific credit counts by concentration are shown below), which may be applied toward any remaining Mason Core (https://catalog.gmu.edu/mason-core/) requirements, Requirements for Bachelor's Degrees (https://catalog.gmu.edu/policies/academic/undergraduate-policies/#ap-5-3-2), and elective courses. Students are strongly encouraged to consult with their advisors to ensure that they fulfill all requirements.

- EVGS concentration: 48-51 credits
- GGEO concentration: 43-49 credits
- OMAR concentration: 42-45 credits
- PLEO concentration: 39-43 credits

Mason Core

Some Mason Core (https://catalog.gmu.edu/mason-core/) requirements may already be fulfilled by the major requirements listed above. Students are strongly encouraged to consult their advisors to ensure they fulfill all remaining Mason Core (https://catalog.gmu.edu/mason-core/) requirements.

All Integration-level requirements must be completed at George Mason and cannot be satisfied through transfer credit. These courses are integral to the university's educational philosophy and ensure that all graduates demonstrate proficiency in writing, critical thinking, and integrative learning consistent with the university's standards. Rare exceptions to this policy may only be granted by the Provost's Office.

Students who have completed the following credentials are eligible for a waiver of the Foundation and Exploration (lower level) requirement categories with the exception of Written Communication, which must be met by transferring in or taking an approved coruse at George Mason University. The Integration category (upper level) is not waived under this policy. See Admissions (https://catalog.gmu.edu/admissions/undergraduate-policies/#transfertext) for more information.

- VCCS Uniform Certificate of General Studies
- VCCS or Richard Bland Associate of Science (A.S.), Associate of Arts (A.A.), Associate of Arts and Sciences (A.A.&S.), or Associate of Fine Arts (A.F.A.)

Code	Title	Credits
Foundation Requirements		
Written Communication (lower-level) (https://catalog.gmu.edu/mason-core/#written)		3
Oral Communication (https://catalog.gmu.edu/mason-core/#oral)		3
Quantitative Reasoning (https://catalog.gmu.edu/mason-core/#quantitative)		3
Information Technology and Computing (https://catalog.gmu.edu/mason-core/#information-technology)		3
Exploration Requirements		
Arts (https://catalog.gmu.edu/mason-core/#arts)		3
Global Contexts (https://catalog.gmu.edu/mason-core/#global-contexts)		3
Global History (https://catalog.gmu.edu/mason-core/#global-history)		3
Literature (https://catalog.gmu.edu/mason-core/#literature)		3
Natural Science (https://catalog.gmu.edu/mason-core/#natural-science)		7
Social and Behavioral Sciences (https://catalog.gmu.edu/mason-core/#social-behavioral-science)		3
Just Societies (optional) (https://catalog.gmu.edu/mason-core/#justsocieties) [1]		
Integration Requirements		
Written Communication (upper-level) (https://catalog.gmu.edu/mason-core/#written-upper)		3
Writing Intensive (https://catalog.gmu.edu/mason-core/#wi) [2]		3
Mason Apex (https://catalog.gmu.edu/mason-core/#apex) [3]		3
Total Credits		**40**

[1] In addition to covering content related to the designated category, Exploration level courses marked with a Just Societies "flag" are specifically designed to help students learn how to interact effectively with others from all walks of life, including those with backgrounds and beliefs that differ from their own. Students who wish to increase their knowledge and skills in this area may choose to enroll in a Just Societies-flagged course. Students interested in this approach to completing their Mason Core Exploration Requirements should work closely with their advisor to identify the appropriate Just Societies-flagged courses.

[2] Most programs include the writing-intensive course designated for the major as part of the major requirements; this course is therefore not counted towards the total required for Mason Core.

[3] Minimum 3 credits required.

Honors

Honors in the Major

Geology majors who have completed 16 credits of math and science, including GEOL 302 Mineralogy, with a GPA of 3.00 or higher are eligible to enter the departmental honors program. Transfer students who have an incoming GPA of 3.10 or higher in math and science and a grade of 'B' or better in GEOL 302 Mineralogy are also eligible. To graduate with honors in Geology, students are required to maintain a minimum GPA of 3.00 in math and science courses and complete one of the two following sets of courses with an average GPA of 3.50 or better:

Code	Title	Credits
First Set of Courses		
GEOL 410	Research Proposal Preparation	1
GEOL 411	Geological Research	3
GEOL 420	Earth Science and Policy (Mason Core) (https://catalog.gmu.edu/mason-core/)	3
Second Set of Courses		
CLIM 408	Senior Research (Mason Core) (https://catalog.gmu.edu/mason-core/)	3
CLIM 409	Research Internship	3
GEOL 420	Earth Science and Policy (Mason Core) (https://catalog.gmu.edu/mason-core/)	3

Accelerated Master's

Bachelor's Degree (selected)/ Environmental Science and Policy, Accelerated MS

Overview

This bachelor's/accelerated master's degree program allows academically strong undergraduates with a commitment to advance their education to obtain a Green Leaf-designated (https://catalog.gmu.edu/student-services/green-leaf-programs-courses/) bachelor's degree and the Environmental Science and Policy, MS (https://catalog.gmu.edu/colleges-schools/science/environmental-policy/environmental-science-policy-ms/) degrees within an accelerated timeframe. Upon completion of this 141-credit accelerated program, students will be exceptionally well prepared for entry into their careers or into a doctoral program in the field or in a related discipline.

Students are eligible to apply for this accelerated program once they have earned at least 60 undergraduate credits and can enroll in up to 18 credits of graduate coursework after successfully completing 75 undergraduate credits. This flexibility makes it possible for students to complete a bachelor's and a master's in five years.

For more detailed information, see AP.6.7 Bachelor's/Accelerated Master's Degrees (https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7). For policies governing all graduate degrees, see AP.6 Graduate Policies (https://catalog.gmu.edu/policies/academic/graduate-policies/). For more information on undergraduates enrolling in graduate courses, see AP.1.4.4 Graduate Course Enrollment by Undergraduates (https://catalog.gmu.edu/policies/academic/registration-attendance/#text).

Admission Requirements

Applicants to all graduate programs at George Mason University must meet the admission standards and application requirements for graduate study as specified in the Graduate Admission Policies (https://catalog.gmu.edu/admissions/graduate-policies/) section of this catalog.

Important application information and processes for this accelerated master's program can be found here (https://www.gmu.edu/admissions-aid/accelerated-masters).

The GRE exam is not required for this accelerated master's program.

Students should submit three letters of recommendation (at least one from a former professor or someone with a PhD), a recent resume, a statement of interest/research goals and interests (including information on the candidate's proposed MS research), and a letter from their advisor (Prospective Advisor Form (https://science.gmu.edu/media/prospective-advisor-form-dnp-form-revised-mar-2023)) stating that the advisor agrees to take on the candidate as an MS student, how the candidate would be a good fit for them and why candidate's research topic would be suitable.

Students with an overall GPA of at least 3.20 who are pursuing any Green Leaf-designated (https://catalog.gmu.edu/student-services/green-leaf-programs-courses/) major or minor may apply to this accelerated master's program after completing two semesters of chemistry (including CHEM 211 General Chemistry I (Mason Core) (https://catalog.gmu.edu/mason-core/) and CHEM 212 General Chemistry II (Mason Core) (https://catalog.gmu.edu/mason-core/) and three semesters of biology, including a course in ecology, or the equivalent, for example:

Code	Title	Credits
Select one of the following options:		13
Option 1:		
BIOL 213	Cell Structure and Function	
BIOL 214	Biostatistics for Biology Majors	
BIOL 308	Foundations of Ecology and Evolution	
Option 2:		
EVPP 210	Environmental Biology: Molecules and Cells	
EVPP 301	Environmental Science: Biological Diversity and Ecosystems	
EVPP 302	Environmental Science: Biomes and Human Dimensions	
EVPP 305	Environmental Microbiology Essentials	
EVPP 306	Environmental Microbiology Essentials Laboratory	
Option 3:		

CONS 401	Conservation Theory
CONS 402	Applied Conservation
6 credits of BIOL or CONS electives	

Graduate Advisor

By at least the beginning of their senior year, students should seek out a faculty member in the Department of Environmental Science and Policy (https://catalog.gmu.edu/colleges-schools/science/environmental-policy/#facultytext) who is willing to serve as their advisor. This advisor will aid the student in choosing the appropriate graduate courses to take and help to prepare the student for graduate studies. Admission into a research-oriented master's concentration is dependent upon securing the agreement of a faculty advisor. Faculty from a variety of departments and colleges at George Mason University (called "program faculty") can serve as master's advisors. Potential students are encouraged to speak with the graduate program coordinator in the department to obtain guidance on this issue.

Accelerated Option Requirements

After the completion of 75 undergraduate credits, students may complete 3 to 12 credits of graduate coursework that can apply to both the undergraduate and graduate degrees.

In addition to applying to graduate from the undergraduate program, students in the accelerated program must submit a bachelor's/accelerated master's transition form (available from the Office of the University Registrar (https://registrar.gmu.edu/forms/)) to the College of Science's Office of Academic and Student Affairs (https://science.gmu.edu/about/contact) by the last day to add classes of their final undergraduate semester.

Students must maintain an overall GPA of 3.00 or higher in all graduate coursework and should consult with their faculty advisor to coordinate their academic goals.

Reserve Graduate Credits

Accelerated master's students may also take up to 6 graduate credits as reserve graduate credits. These credits do not apply to the undergraduate degree, but will reduce the master's degree by up to 6 credits. With the maximum 12 graduate credits counted toward the undergraduate and graduate degrees plus the maximum 6 reserve graduate credits, the credits necessary for the graduate degree can be reduced by up to 18.

Graduate Course Suggestions

The following list of suggested courses is provided for general reference. To ensure an efficient route to graduation and post-graduation readiness, students are strongly encouraged to meet with an advisor before registering for graduate-level courses.

Code	Title	Credits
EVPP 518	Conservation Biology	3
EVPP 529	Environmental Science Communication	3
EVPP 621	Overview of Biodiversity Conservation	3
EVPP 635	Environment and Society	3

Geology, BS/Earth Systems Science, Accelerated MS

Overview

Geology, and Earth sciences more broadly, are extremely important to society and our economy as they deal with our planet, our oceans, and our climate. Degrees in Earth science are broadly useful in industry, government, conservation, and many other areas of our economy. While there are many positions in the field that only require a bachelor’s degree, many employers either prefer a Master’s degree, or a Master’s degree can be the key to further promotion within a particular organization. This Accelerated Master’s degree is designed to give students the skills and the degrees that they need to be both initially successful, and to ensure long-term advancement in their chosen professions.

Application Requirements

Applicants should be enrolled in the Geology, BS degree at Mason and have earned at least 60 credits. Previous coursework should include two semesters each of calculus, chemistry, and physics, and one semester of statistics. Applicants should have a minimum GPA of 3.00.

Applicants to all graduate programs at Mason must meet the admission standards and application requirements for graduate study as specified in the Graduate Admission Policies (https://catalog.gmu.edu/admissions/graduate-policies/) section of this catalog, excluding the GRE exam requirement (which is not required for those enrolled in the accelerated program). This includes three letters of recommendation (at least one from a former professor or someone with a PhD), a recent resume, a statement of interest/research goals (including information on the applicant's proposed MS research), and a letter from their advisor. This letter should state that the advisor agrees to take on the candidate as an MS student, addresses how the candidate would be a good fit for them, and indicate why the applicant's research topic would be suitable for study.

Accelerated Option Requirements

Students admitted to this program may take graduate courses after completing 75 undergraduate credits, and up to 12 credits of appropriate graduate coursework may be used in partial satisfaction of the requirements for the undergraduate degree. If students earn at least a 3.00 GPA in these classes, they are granted advanced standing in the master's program and must then complete an additional 24 credits to receive the master's degree. All other requirements for the Earth Systems Science, MS, must be met.

To apply these credits to the master's degree, students must request that the credits be moved from the undergraduate degree to the graduate degree using the Bachelor's/Accelerated Master's Transition form found on the Office of the University Registrar's website (https://registrar.gmu.edu/forms/).

For more detailed information, see AP.6.7 Bachelor's/Accelerated Master's Degrees (https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7). For policies governing all graduate programs, see AP.6 Graduate Policies (https://catalog.gmu.edu/policies/academic/graduate-policies).

Reserve Graduate Credit

Undergraduate students may also take up to 6 additional and appropriate graduate credits as reserve graduate credit. These credits do not apply to the undergraduate degree, but will reduce the subsequent master's degree credits accordingly (e.g., with 12 credits counted toward the undergraduate and graduate degrees plus the maximum 6 reserve credits for the master's, an MS could be completed with 12 post-bachelor's credits). The ability to take courses for reserve graduate credit is available to all high achieving undergraduates with the permission of the department.

Graduate Course Suggestions

Students should consult with an advisor before registering for graduate credits.

Code	Title	Credits
GEOL 504	Sedimentary Geology	4
GEOL 506	Soil Science	3
GEOL 510	Advanced Structural Geology	3
GEOL 513	Hydrogeology	3
GEOL 521	Geology of Energy Resources	3
GEOL 532	Paleoclimatology	3
GEOL 534	Vertebrate Paleontology	4
GEOL 536	Paleontology Seminar	1-2
GEOL 541	Great Events in Earth History	3
GEOL 553	Field Mapping Techniques	3

Bachelor's Degree (selected)/Quantum Science and Engineering, Accelerated MS

Overview

Highly-qualified undergraduates may be admitted to the combined bachelor's and accelerated master's degree pathway program (BAM Pathway) and obtain a Bachelor of Science degree in any College of Science major and a Master of Science in Quantum Science and Engineering in an accelerated time-frame after satisfactory completion of a minimum of 138 credits.

This accelerated option is offered jointly by undergraduate Bachelor of Science programs in the College of Science and the Quantum Science and Engineering, MS program, which is jointly offered by the College of Science (https://catalog.gmu.edu/colleges-schools/science/) and the College of Engineering and Computing (https://catalog.gmu.edu/colleges-schools/engineering-computing/).

Students in an accelerated master’s degree program must fulfill all university
requirements for the master's degree. See AP.6.7 Bachelor's/Accelerated Master's Degree (https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7) for policies related to this program. For policies governing all graduate degrees, see AP.6 Graduate Policies (https://catalog.gmu.edu/policies/academic/graduate-policies/).

BAM Pathway Admission Requirements

Applicants to all graduate programs at George Mason University must meet the admission standards and application requirements for graduate study as specified in Graduate Admissions Policies (https://catalog.gmu.edu/admissions/graduate-policies/) and accelerated master's degree policies (https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7).

Students must major in a College of Science Bachelor of Science program and will be considered for admission into the BAM Pathway after completion of a minimum of 60 credits.

Students who are accepted into the BAM Pathway will be allowed to register for graduate level courses after successful completion of a minimum of 75 undergraduate credits.

Accelerated Master's Admission Requirements

Undergraduate students already admitted to the BAM Pathway will be admitted to the intended master’s program if they have met the following criteria that will be verified:

- Submission of BAM Transition Form by stated deadline.
- Sufficient minimum 3.0 cumulative GPA for conferred undergraduate degree (which does not include any earned reserve graduate credits).
- Completion of approved advanced standing courses and any reserve graduate courses; please refer to policy A.P. 6.7 (https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7).
- Successful completion of required minimum of 120 credits needed for undergraduate degree conferral (after exclusion any satisfactory reserve graduate credits earned).
- Successfully meeting George Mason’s requirements for undergraduate degree conferral (graduation) and timely submitting the application for graduation.

Accelerated Pathway Requirements

To maintain the integrity and quality of both the undergraduate and graduate degree programs, undergraduate students interested in taking graduate courses must choose from the following:

Advanced Standing Courses

Students must complete at least 3 credits from the following list of graduate-level courses while in undergraduate status, up to a maximum of 12.

Students are encouraged to consult with both their undergraduate advisor and the Quantum Science and Engineering, MS advisor:

Code	Title	Credits
Select from the following options:		**3-12**
Up to one 500-600 level specialized course from the following:		
ASTR 601	Computer Simulation in Astronomy	
BINF 690	Numerical Methods for Bioinformatics	
CS 583	Analysis of Algorithms	
CS 630	Advanced Algorithms	
CS 635	Foundations of Parallel Computation	
CSI 690	Numerical Methods	
ECE 511	Computer Architecture	
ECE 547	Applied Cryptography	

ECE 633	Error Control Coding
ECE 647	Post-Quantum Cryptography
GGS 579	Remote Sensing
MATH 625	Numerical Linear Algebra
MATH 685	Numerical Analysis
MATH 686	Numerical Solutions of Differential Equations
OR 541	Operations Research: Deterministic Optimization
OR 542	Operations Research: Stochastic Models
OR 646	Stochastic Optimization
PHYS 510	Computational Physics I
PHYS 613	Computational Physics II
Remaining credits are selected from the following:	
QSE 500	Ideas in Quantum Science and Technology
QSE 501	Mathematical Foundations of QSE [1]
QSE 502	Programming Foundations of QSE [1]
QSE 505	Classical and Quantum Information Theory
QSE 511	Quantum Algorithms
QSE 520	Applications of Quantum Technology
QSE 570	Quantum Computing System Design
or ECE 570	Quantum Computing System Design

Reserve Credit Courses

Students may complete up to 6 credits while in undergraduate student status, of graduate-level coursework from the list below that will only count toward the graduate degree program.

Code	Title	Credits
Select up to 6 credits of not previously completed courses from the following:		**6**
QSE 500	Ideas in Quantum Science and Technology	
QSE 501	Mathematical Foundations of QSE [1]	
QSE 502	Programming Foundations of QSE [1]	
QSE 505	Classical and Quantum Information Theory	
QSE 511	Quantum Algorithms	
QSE 520	Applications of Quantum Technology	
QSE 570	Quantum Computing System Design	
or ECE 570	Quantum Computing System Design	

[1] As only one of these courses count for Quantum Science and Engineering, MS, credit, and these courses may not be necessary for all students, consult with an academic advisor prior to enrolling in QSE 501 Mathematical Foundations of QSE or QSE 502 Programming Foundations of QSE.

For more detailed information on coursework and timeline requirements, see AP.6.7 Bachelor's/Accelerated Master's Degree (https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7) and AP.1.4.4 Graduate Course Enrollment by Undergraduates (https://catalog.gmu.edu/policies/academic/registration-attendance/#ap-1-4-4).

Program Outcomes

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1. Comprehend important earth-science concepts that reflect the complexity of the integrated earth-ocean-atmosphere system. These concepts include (but are not limited to) (1) Earth materials, (2) tectonics, (3) basic dynamics of the oceans and atmosphere, (4) surficial processes land-ocean-atmosphere interactions.
2. Demonstrate intellectual and technical ability to observe, develop questions, describe, measure, classify, interpret, assess problems, and critically evaluate hypotheses or plans in field and laboratory settings.
3. Appreciate both team and individual approaches to scientific problem solving, and work effectively, thoroughly, efficiently and competently in either situation.
4. Develop the ability to observe and analyze geoscience problems in three dimensions and time.
5. Know how to perform their own research and to efficiently track down and critically evaluate primary literature on earth science topics to help them answer (or pose) scientific questions in the geosciences.
6. Demonstrate the ability to communicate scientific ideas and findings effectively in both oral presentations and writing to a wide range of audiences.
7. Conduct themselves professionally, rationally, and ethically.
8. Have the appropriate knowledge base from their individual concentrations to enter the workforce or to continue on to graduate school to ultimately enter industry, academia, or government service as a geoscientist.
9. Value scientific information in and of itself, and the process through which scientific knowledge is generated.
10. Be an open-minded (open to new scientific concepts and information), independent, and analytical thinker.