Mission Statement
Our mission is to serve two vital needs of the JMU students. First, the majors in geology present high-quality programs of specialized study focusing on Earth materials, internal and external Earth processes, analysis of Earth history and application of geology to environmental and engineering issues. In support of this mission is a commitment to foster the ability to think analytically and to communicate both within the discipline and with non-scientists. Course work and research experiences prepare the student for postgraduate study or professional careers that are subject to rapidly changing societal needs. Second, our department strives to enhance the university’s general education program by offering timely and challenging courses that provide insight into Earth processes and human-environment interactions. These courses promote life-long liberal learning by fostering critical thinking and an awareness of natural science.

Goals
Provide a stimulating, intellectual environment for students in geology and environmental science that will generate interest and enthusiasm for learning and will provide a solid foundation for graduate work and careers in geology and environmental science.

Teach science as science is practiced. Since the advancement of scientific knowledge often occurs within a social context – collaboration among scientists, conferences, seminars – the goal is to develop a similar mode of operation for the geology program.

Provide high-quality, relevant general studies courses within the discipline that focus on the fundamental science in the societal context (e.g., environmental change, climate change, hazards). These courses will incorporate critical thinking and an appreciation of human-environment interactions.
Degree and Major Requirements

There are two bachelor degrees offered in the Department of Geology and Environmental Science, a B.S. in geology and a B.A. in Earth science. Both degree options have a research requirement that includes a formal presentation. The B.S. degree has two concentrations: a general geology concentration designed for students who want to take a wider range of geology elective courses and an environmental and engineering geology concentration designed for students who want to focus their geology electives toward applied environmental science.

The B.A. in Earth science prepares individuals to work in a wide range of professional public sector service careers where preparation in Earth science and communication of science to nonscientific audiences is a requirement or an asset. This includes the preparation of Earth science teachers.

Bachelor of Science in Geology

Degree Requirements

Degree Requirements

Required Courses

Credit Hours

General Education 1 41
Quantitative requirement (in addition to General Education) 2 3
Scientific Literacy requirement (in addition to General Education) 2 3-4
Major requirements (listed below) 68-76
General Electives 2-11

1 The General Education program contains a set of requirements each student must fulfill. The number of credit hours necessary to fulfill these requirements may vary.
2 The quantitative and scientific literacy requirements are met by courses required by the major.

Core Requirements

Credit Hours

GEOL 110. Physical Geology 3
GEOL 110L. Physical Geology Lab 1
GEOL 230. Evolution of Earth 4
GEOL 280. Mineralogy 4
GEOL 291. Geowriting and Communication 1
GEOL 300. Introduction to Petrology 4
GEOL 387. Stratigraphy, Structure, and Tectonics 4
GEOL 388. Advanced Structure, Stratigraphy, Tectonics 4
GEOL 399. Field Geology 6

Research Requirements

2-6

In addition to GEOL 291, choose from the following to complete the research requirement. All majors must complete a minimum of two credits; Students conducting research with faculty should select GEOL 497; Honors students doing research with faculty must complete a minimum of six credits in GEOL 499. All students must give a formal presentation to fulfill this requirement.

GEOL 491. Geological Literature Research
GEOL 494. Internship
GEOL 497. Problems in Geology
GEOL 499. Honors in Geology

The B.S. degree in geology is designed for students who plan to obtain professional employment in geology or enter graduate school upon graduation. It is recommended that incoming B.S. degree students complete the following courses prior to enrolling in required geology courses numbered 300 and higher.

Recommended Schedule for B.S. Degree in Geology

First Year

Courses Credit Hours

CHEM 131-131L; 132-132L. General Chemistry I-II 8
MATH 235. Calculus I 4
or MATH 231-232. Calculus with Functions I-II 4
MATH 220. Elementary Statistics 3
or MATH 236. Calculus-II 3

Choose one of the following two sequences:

PHYS 140-140L; PHYS 150-150L. College Physics I-II with Labs 8
PHYS 240-140L; PHYS 250-150L. University Physics I-II with Labs

Students planning graduate study in some areas of the geosciences should consider courses in mathematics, physics or chemistry beyond those required for the B.S. major.

Concentrations

The B.S. degree option requires that each student complete at least 12 credit hours chosen from one of the two concentrations.

General Geology Concentration

GEOL 302. Sedimentary Petrology
GEOL 380. Genetic Mineralogy
GEOL 340. Environmental Soil Science
GEOL 350. Paleobiology
GEOL 355. Geochemistry of Natural Waters
GEOL 377. Earth Surface Processes
GEOL 390. Laboratory Techniques in Geology
GEOL 395. Geological Perspectives in Materials Science and Engineering
GEOL 398. Topics in Field Geology (must be approved by adviser)

GEOL 400. Geology and Ecology of the Bahamas
GEOL 405. Vertebrate Paleontology
GEOL 406. Paleoclimatology and Paleoenography
GEOL 410. Engineering Geology
GEOL 415. Geological Evolution of North America
GEOL 440. Geophysics
GEOL 442. Field Geophysics
GEOL 460. Hydrogeology
GEOL 489. Quantitative Methods in Geology

Environmental and Engineering Geology Concentration

GEOL 340. Environmental Soil Science
GEOL 355. Geochemistry of Natural Waters
GEOL 377. Earth Surface Processes
GEOL 390. Laboratory Techniques in Geology
GEOL 395. Geological Perspectives in Materials Science and Engineering
GEOL 398. Topics in Field Geology (must be approved by adviser)

GEOL 440. Geophysics
GEOL 410. Engineering Geology
GEOL 442. Field Geophysics
GEOL 460. Hydrogeology
GEOL 489. Quantitative Methods in Geology

Second Year

Courses Credit Hours

GEOL 280. Mineralogy 4
Bachelor of Arts in Earth Science

The B.A. in Earth science degree is designed to integrate all the Earth sciences in a systems approach to understanding the Earth. This includes incorporating and integrating subjects such as oceanography, meteorology and astronomy. The emphasis is on the preparation of individuals to work in a wide range of professional public sector service careers where preparation in Earth science and communication of science to non-scientific audiences is a requirement or an asset.

Degree Requirements

Required Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEOL 110. Physical Geology</td>
<td>3</td>
</tr>
<tr>
<td>GEOL 102. Environmental Earth</td>
<td></td>
</tr>
<tr>
<td>GEOL 115. Earth Systems and Climate Change</td>
<td></td>
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<tr>
<td>GEOL 110L. Physical Geology Lab</td>
<td></td>
</tr>
<tr>
<td>GEOL 167. History and Philosophy of the Geosciences</td>
<td>3</td>
</tr>
<tr>
<td>GEOL 211. Introduction to Oceanography or GEOL 401. Oceanography for Teachers</td>
<td>3</td>
</tr>
</tbody>
</table>

Electives

Choose one of the following: 2-6

GEOL 491. Geological Literature Research
GEOL 494. Internship
GEOL 497. Problems in Geology
GEOL 499. Honors in Geology

Research Requirements

In addition to GEOL 291, choose from the following to complete the research requirement. All majors must complete a minimum of two credits; Students conducting research with faculty should select GEOL 497; Honors students doing research with faculty must complete a minimum of six credits in GEOL 499. All students must give a formal presentation to fulfill this requirement.

GEOL 491. Geological Literature Research
GEOL 494. Internship
GEOL 497. Problems in Geology
GEOL 499. Honors in Geology

Cognate Science and Mathematics Area

<table>
<thead>
<tr>
<th>Course</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO 114. Organisms</td>
<td>4</td>
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<tr>
<td>BIO 350. Paleobiology</td>
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<tr>
<td>CHEM 131-131L. General Chemistry</td>
<td>4</td>
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<tr>
<td>CHEM 132-132L. General Chemistry II</td>
<td></td>
</tr>
<tr>
<td>PHYS 140-140L. College Physics I</td>
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<tr>
<td>PHYS 150-150L. College Physics II or GEOL 440. Geophysics</td>
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<tr>
<td>MATH 205. Introductory Calculus I</td>
<td>3-4</td>
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<tr>
<td>MATH 232. Calculus with Functions II</td>
<td></td>
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<tr>
<td>MATH 235. Calculus I</td>
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</tbody>
</table>

Recommended Minors for the Bachelor of Arts in Earth Science

The B.A. Earth science degree recommends (but does not require) that students complete a minor in a complementary program (see list below), suitable toward the career goals of the student. Approved minors include:

<table>
<thead>
<tr>
<th>Minor</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Astronomy</td>
<td>12</td>
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<tr>
<td>Biology</td>
<td>12-16</td>
</tr>
<tr>
<td>Business Analytics</td>
<td>18-19</td>
</tr>
<tr>
<td>Chemistry</td>
<td>20</td>
</tr>
<tr>
<td>Economics</td>
<td>18</td>
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<tr>
<td>Environmental Information Systems</td>
<td>24</td>
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<tr>
<td>Environmental Management</td>
<td>19</td>
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<tr>
<td>Environmental Science</td>
<td>15</td>
</tr>
<tr>
<td>Environmental Studies</td>
<td>18</td>
</tr>
<tr>
<td>Humanitarian Affairs</td>
<td>18</td>
</tr>
<tr>
<td>Geographic Science</td>
<td>19</td>
</tr>
<tr>
<td>Mathematics</td>
<td>14-18</td>
</tr>
</tbody>
</table>

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Nonprofit Studies 19-21
Physics 14-22
Political Science 19
Public Policy and Administration 19
Science, Technology and Society 18
Secondary Education 22-24
Sociology 18
Statistics 15-16
Urban and Regional Studies 24
Writing, Rhetoric and Technical Communication 18

1 Credit hours for courses in the minor that are already required courses for the B.A. in Earth Science major have been subtracted from the total hours listed here.

Students may also propose a minor that is not listed above to their adviser for approval.

Recommended Schedule for B.A. Degree in Earth Science

First Year Credit Hours
Cluster One: Skills for the 21st Century 9-12
GEOL 110. Physical Geology and GEOL 110L Physical Geology Lab 4
GEOL 167. History and Philosophy of the Geosciences 3
GEOL 230. Evolution of Earth 4
MATH 205. Introductory Calculus I 3
CHEM 131-131L. General Chemistry I 4

Second Year Credit Hours
GEOL 211. Introduction to Oceanography 3
GEOL 291. Geowriting and Communication 1
GEOL 320. Meteorology 3
GEOL 367. Genesis of Solid Earth Materials 4
GEOL 377. Earth Surface Processes 3
Foreign language courses 1 1-8
General Education courses 12

Third Year Credit Hours
GEOL 387. Stratigraphy, Structure and Tectonics 4
Choose one of the following: 3
ASTR 220. Astronomy
GEOL 272. Planetary Geology
Cognate science and mathematics 9-12
General Education courses 9

Fourth Year Credit Hours
GEOL 477. Contemporary Issues in the Geosciences 3
Cognate science 3-4
Choose one from the following: 2-6
GEOL 491. Geological Research Literature
GEOL 494. Internship
GEOL 487. Problems in Geology
GEOL 499. Honors in Geology
Geology electives 4-6
Electives 12-20

24-39

1 Foreign language at the intermediate level.

Teaching Licensure
Students interested in becoming teachers must meet specific curriculum requirements in their major as part of the undergraduate academic degree. The B.A. in Earth science includes state course requirements in astronomy, meteorology and oceanography, to total no less than 32 hours in the Earth sciences (including geology) and a minimum of 16 hours total in physics, chemistry and biology.

In addition to the general education and academic major requirements, Earth science majors desiring secondary teacher licensure must be admitted to the pre-professional program in secondary education at the undergraduate level and complete the graduate level Master of Arts in Teaching degree.

It is critical that students seeking teaching licensure consult regularly with both their education adviser and their major adviser to support their progression through the programs.

For a full description of the program in secondary teaching, refer to the Department of Middle, Secondary and Mathematics Education, in addition to the College of Education.

Minor Requirements

Geology Minor
The requirement for a minor in geology is a minimum of 18 credit hours of geology approved by the student’s geology adviser.

Geophysics Minor
The minor in geophysics is designed to provide adequate training for professional work or graduate school in geophysics in the broad sense. No more than 10 credits from the geophysics minor may be used to double count with a major. The requirements for the geophysics minor are a minimum of 21 credits, including at least one semester each of geology, mathematics and physics, distributed as follows:

Required Courses Credit Hours
Choose one of the following: 
GEOL 110 and GEOL 110L. Physical Geology and Lab
GEOL 210. and GEOL 110L. Applied Physical Geology and Lab
PHYS 140. and 140L. College Physics I and Lab
PHYS 240. and 140L. University Physics I and Lab
Complete all of the following:
GEOL 440. Geophysics
GEOL 442. Field Geophysics
MATH 238. Linear Algebra with Differential Equations
Choose one of the following elective courses: 1
ASTR 220. General Astronomy I
CHEM 331. Physical Chemistry I
GEOL 410. Engineering Geology
GEOL 460. Hydrogeology
MATH 237. Calculus III
PHYS 260. University Physics III

21-22

1 Additional elective courses permitted upon approval from minor adviser.

Note for geology majors: The geology major requires a sequence of math and physics courses (see major program for details). The following sequence of courses will satisfy the major requirements and is strongly recommended for students interested in geophysics. In particular, MATH 236 is a prerequisite for several courses included in the geophysics minor.

- MATH 235-236. Calculus I & II
- PHYS 240-250. Physics I & II (and Lab)