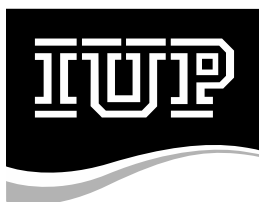


UNDERGRADUATE CATALOG 2016–17

Department of Geoscience
College of Natural Sciences and Mathematics
www.iup.edu/geoscience

This document is a direct extract from the full 2016–17 *Undergraduate Catalog*. As a result, the original page numbering will appear.

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Indiana University of Pennsylvania

Department of Geoscience

Website: www.iup.edu/geoscience

Steven A. Hovan, Chairperson; Cercone, Coles, Deardorff, Farnsworth, Lewis, Mount, Warnock; and professors emeriti Clark, Hall, Park, Richardson, Sutton

Geology is the broad science that encompasses all aspects of the Earth system. In addition to the solid Earth, this system includes the oceans and atmosphere, climate change, and most aspects of our immediate environment. Professional geologists are thus engaged in a wide range of activities, depending on their interests. Scientific questions addressed by geologists include the evolution of life, the origin of volcanic activity, the assessment of volcanic and earthquake hazards, the evolution of our planetary neighbors, climate change, mineral and energy resources, and the human impact on the environment.

The Geoscience Department offers a BS degree with a major in geology that is divided into three tracks: Geology, Environmental, and Energy Resources. All tracks give students the necessary foundation to pursue a wide variety of career goals. In addition, the department offers a BSEd degree with a major in Earth and space science education for students who are interested in teaching. The degrees and courses in the program emphasize hands-on learning, including outdoor instruction, student-oriented research, and professional experiential learning opportunities. In addition to on-campus instruction and class-related field trips, the department also offers several regional geology field workshops, which take place in Newfoundland, the northern Rockies region, Florida and the Bahamas, and the American Southwest.

BS—Geology/Geology Track

This track is designed for students who are interested in pursuing many of the various subdisciplines in geology, including oceanography/marine geology, climate change, volcanology, paleontology, and geophysics. There is also considerable overlap between geology and astronomy, as geologists study the evolution of other planetary bodies, such as the Moon, Mars and Venus; the curriculum reflects this link and provides the groundwork for planetary studies. The Geology Track thus provides students with the foundation needed to pursue a wide variety of careers, including research and graduate studies, or working as professional geologists for energy resource companies, environmental consulting firms, or federal and state regulatory agencies.

BS—Geology/Environmental Track

This track is designed for students who wish to pursue careers in the environmental field. In addition to air and water quality issues, pollution often affects the subsurface in ways that are difficult to detect and remediate. Geologists therefore play a key role in dealing with complex environmental issues; the Environmental Track prepares students to solve a variety of environmental problems. Graduates from this track will be prepared for direct entry into jobs with federal or state agencies and private environmental consulting firms, as well as graduate studies.

BS—Geology/Energy Resources Track

This track is designed for students who wish to pursue careers in the energy sector. As the world's energy demands continue to grow, nations face the challenge of maintaining reliable energy supplies. Conventional oil, coal, and natural gas continue as mainstays of the energy industry, but renewable and/or carbon-neutral energy sources are gaining attention in response to growing concerns about climate change and finite reserves of fossil fuels. western Pennsylvania is a historic coal and natural gas producing region with the potential for significant growth in the natural gas industry due to development of the Marcellus shale. The Energy Resources Track will prepare students for direct entry into the energy industry with a focus on the discovery and development of energy resources and geophysical exploration techniques.

BSEd—Earth and Space Science

This program prepares students to become certified middle- and high-school teachers in Pennsylvania and other states. Earth and space science teachers in grades 7 to 12 teach subjects that require a broad and solid foundation in science. Course work includes study of geology, meteorology, oceanography, and astronomy. A basic understanding of the cognate sciences, biology, chemistry, and physics, and mathematics is also an essential part of the major. Courses in the foundations of education and pedagogy complement the subject matter studies. Students create and present lessons, first in their courses and then in school classrooms, culminating in the student teaching experience in the final semester.

Minor in Geology

The minor in geology is designed for students who want a background in geology in conjunction with their main area of study. This minor may be particularly appropriate for students pursuing degrees in business or one of the social or physical sciences.

Bachelor of Science—Geology/Geology Track

Liberal Studies: As outlined in Liberal Studies section with the following specifications: 46

Mathematics: MATH 121

Natural Science: CHEM 111-112 or 113-114

Liberal Studies Electives: 4cr, MATH 122, no courses with GEOS prefix

Major: 58

Geoscience Core:

GEOS 201	Foundations of Geology	4cr
GEOS 202	Quantitative Methods in the Geosciences	2cr
GEOS 203	Surficial Processes	4cr

GEOS 204	Historical Geology	4cr
GEOS 301	Mineralogy	4cr
GEOS 470	Research Methods in the Geosciences	2cr
GEOS 480	Geoscience Seminar	2cr
One course from the following: GEOS 303, 401-402, 403-404, 405-406, 407-408 (1)		4cr

Geology Track:

Select two courses from the following: GEOS 302, 345, 362 8cr

Select two courses from the following: GEOS 352, 353, 354, 355 8cr

Ancillary Sciences: 6cr

Select two courses from the following: PHYS 111 or 131,

PHYS 112 or 132, MATH 216

Controlled Electives: Select 10cr from the following: (2) 10cr

One 100-level GEOS course (3)

Any 300-level GEOS course

Any 400-level GEOS course

Foreign Language Intermediate Level

BIOL 201, 202

CHEM 231, 232, 325, 326, 341

GEOG 314, 335, 341, 343, 415, 419

MATH 216 or 217 (4), 341

PHYS 121 or 141, 122 or 142, 342

COSC 110, 210, 250, 310, 362

Free Electives: 16

Total Degree Requirements: 120

- (1) Up to 4cr of a summer field camp, internship, field study, or independent study, if approved by the department, may substitute for GEOS 303 or a Geoscience Field Workshop.
- (2) Any course not applied to the Geology Track may count as a controlled elective if taken in addition to track requirements. Only one Geoscience Field Workshop (including prerequisite 1cr Seminar) may be applied toward controlled electives. Six credits of foreign language may count toward controlled elective provided intermediate level is successfully obtained.
- (3) When taken before declaring the major or when specially recommended during freshman orientation/transfer advising for students who must take remedial math courses before enrolling in GEOS 201 and 202
- (4) Cannot be counted as a controlled elective if MATH 216 is applied toward ancillary science requirements.

Bachelor of Science—Geology/Environmental Track

Liberal Studies: As outlined in Liberal Studies section with the following specifications: 46

Mathematics: MATH 121

Natural Science: CHEM 111-112 or CHEM 113-114

Liberal Studies Electives: 4cr, MATH 122, no courses with GEOS prefix

Major: 58

Required Courses:

GEOS 201	Foundations of Geology	4cr
GEOS 202	Quantitative Methods in the Geosciences	2cr
GEOS 203	Surficial Processes	4cr
GEOS 204	Historical Geology	4cr
GEOS 301	Mineralogy	4cr
GEOS 470	Research Methods in the Geosciences	2cr
GEOS 480	Geoscience Seminar	2cr
One course from the following: GEOS 303, 401-402, 403-404, 405-406, 407-408 (1)		4cr

Environmental Track:

Select two courses from the following: 8cr

GEOS 345 Igneous and Metamorphic Petrology

GEOS 352 Sedimentation and Stratigraphy

GEOS 356 Coastal Geology and Processes

Select two courses from the following: 8cr

GEOS 310, 311, 312, 323

Ancillary Sciences:	6cr
Select two courses from the following: PHYS 111 or 131, PHYS 112 or 132, MATH 216	
Controlled Electives: Select 10cr from the following: (2)	10cr
One 100-level GEOS course (3)	
Any 300-level GEOS course	
Any 400-level GEOS course	
Foreign Language Intermediate Level	
BIOL 201, 202	
CHEM 231, 232, 325, 326, 341	
GEOG 314, 335, 341, 343, 415, 419	
MATH 216 or 217 (4), 341	
PHYS 121 or 141, 122 or 142, 342	
COSC 110, 210, 250, 310, 362	
Free Electives:	16
Total Degree Requirements:	120
(1) Up to 4cr of a summer field camp, internship, field study, or independent study, if approved by the department, may substitute for GEOS 303 or a Geoscience Field Workshop.	
(2) Any course not applied to the Environmental Track may count as a controlled elective if taken in addition to track requirements. Only one Geoscience Field Workshop (including prerequisite 1cr Seminar) may be applied toward controlled electives. Six credits of foreign language may count toward controlled elective provided intermediate level is successfully obtained.	
(3) When taken before declaring the major or when specifically recommended during freshman orientation/transfer advising for student who must take remedial math courses before enrolling in GEOS 201 and 202	
(4) Cannot be counted as a controlled elective if MATH 216 is applied toward ancillary science requirements.	

PHYS 121 or 141, 122 or 142, 342	
COSC 110, 210, 250, 310, 362	
Free Electives:	16
Total Degree Requirements:	120
(1) Up to 4cr of a summer field camp, internship, field research study, or independent study, all of which must be approved by the department, may substitute for GEOS 303 or a Geoscience Field Workshop.	
(2) Any course not applied to the Energy Resources Track may count as a controlled elective if taken in addition to track requirements. Only one Geoscience Field Workshop (including prerequisite 1cr Seminar) may be applied toward controlled electives. Six credits of foreign language may count toward controlled elective provided intermediate level is successfully obtained.	
(3) When taken before declaring the major or when specifically recommended during freshman orientation/transfer advising for student who must take remedial math courses before enrolling in GEOS 201 and 202	
(4) Cannot be counted as a controlled elective if MATH 216 is applied toward ancillary science requirements.	

Minor—Geology 18

Required Courses:	
GEOS 201 Foundations of Geology	4cr
GEOS 202 Quantitative Methods in the Geosciences	2cr
12cr from the following:	12cr
GEOS 203 Surficial Processes	
Any 300-level GEOS course	
Any 400-level GEOS course, except GEOS 470 and 480 (1)	
(1) Only one Geoscience Field Workshop (including prerequisite seminar) can be counted toward the minor.	

Bachelor of Science—Geology/Energy Resources Track

Liberal Studies: As outlined in Liberal Studies section with the following specifications:	46
Mathematics: MATH 121	
Natural Science: CHEM 111-112 or CHEM 113-114	
Liberal Studies Electives: 4cr, MATH 122, no courses with GEOS prefix	
Major:	58
Required Courses:	
GEOS 201 Foundations of Geology	4cr
GEOS 202 Quantitative Methods in the Geosciences	2cr
GEOS 203 Surficial Processes	4cr
GEOS 204 Historical Geology	4cr
GEOS 301 Mineralogy	4cr
GEOS 470 Research Methods in the Geosciences	2cr
GEOS 480 Geoscience Seminar	2cr
One course from the following: GEOS 303, 401-402, 403-404, 405-406, 407-408 (1)	4cr
Energy Resources Track:	
Two courses from the following: GEOS 302, 323, 324	8cr
Two courses from the following: GEOS 352, 353, 355, 362	8cr
Ancillary Sciences:	6cr
Two courses from the following: PHYS 111 or 131, PHYS 112 or 132, MATH 216	
Controlled Electives: Select 10cr from the following: (2)	10cr
One 100-level GEOS course (3)	
Any 300-level GEOS course	
Any 400-level GEOS course	
Foreign Language Intermediate Level	
BIOL 201, 202	
CHEM 231, 232, 325, 326, 341	
GEOG 314, 335, 341, 343, 415, 419	
MATH 216 or 217 (4), 341	

Bachelor of Science in Education—Earth and Space Science (*)

Liberal Studies: As outlined in Liberal Studies section with the following specifications:	48
Mathematics: MATH 121	
Natural Science: CHEM 111-112	
Social Science: PSYC 101	
Liberal Studies Electives: 6cr, MATH 217, PHYS 111, no courses with GEOS prefix	
College:	31
Preprofessional Education Sequence:	
COMM 103 Digital Instructional Technology	3cr
EDSP 102 Educational Psychology	3cr
Professional Education Sequence:	
EDEX 301 Education of Students with Disabilities in Inclusive Secondary Settings	2cr
EDEX 323 Instruction of English Language Learners with Special Needs	2cr
EDSP 477 Assessment of Student Learning: Design and Interpretation of Educational Measures	3cr
EDUC 242 Pre-student Teaching Clinical Experience I	1cr
EDUC 342 Pre-student Teaching Clinical Experience II	1cr
EDUC 441 Student Teaching	12cr
EDUC 442 School Law	1cr
EDUC 451 Teaching Science in the Secondary School	3cr
Major:	39
Required Courses:	
BIOL 201 Principles of Ecology and Evolution	4cr
GEOS 201 Foundations of Geology	4cr
GEOS 202 Quantitative Methods in the Geosciences	2cr

GEOS 341	Planetary Geology	4cr
GEOS 342	Stellar Astronomy	4cr
GEOS 353	Paleontology	4cr
GEOS 370	Oceanography	4cr
GEOS 371	Meteorology	3cr
PHYS 121	Physics I Lab	1cr

Controlled Electives:

Select 9cr from the following: 9cr

GEOS 203 Surficial Processes

Any 300-level GEOS course

Any 400-level GEOS course, except GEOS 470 and 480

PHYS 112 Physics II Lecture 3cr

PHYS 122 Physics II Lab 1cr

Free Electives: 2

Total Degree Requirements: 120

(*) See requirements leading to teacher certification, titled “3-Step Process for Teacher Education,” in the College of Education and Educational Technology section of this catalog.

Certificate—Shale, Gas, and Energy (*) 18

Required Geoscience Courses:

GEOS 119 Geology of Energy Resources (1) 3cr

GEOS 409 Geology of Shale Gas Field Workshop 3cr

Required Geography Courses:

GEOG 109 Geographic Information Science and Systems for Energy Applications (1) 3cr

GEOG 409 Spatial Analysis Applications in the Energy Sectors Workshop 3cr

Required Safety Science Courses: 6

SAFE 104 Introduction to Safety in the Natural Gas Industry (1) 3cr

SAFE 204 Principles of Safety in the Natural Gas Industry 3cr

(*) Certificate pending Council of Trustees approval.

(1) With departmental permission, one 100-level introductory course may be substituted by an appropriate upper-division course.