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| LSC Use Only No: | LSC Action-Date: | UWUCC USE Only No. | UWUCC Action-Date: | Senate Action Date: |
| | | 07-14c | App-2/10/09 | App 2/24/09 |

Curriculum Proposal Cover Sheet - University-Wide Undergraduate Curriculum Committee

| | |
|---|---------------------------------|
| Contact Person Ken Coles | Email Address kcoles@iup.edu |
| Proposing Department/Unit Geosciences - Natural Sciences and Mathematics | Phone 724-357-5626 |

Check all appropriate lines and complete information as requested. Use a separate cover sheet for each course proposal and for each program proposal.

1. Course Proposals (check all that apply)

New Course Course Prefix Change Course Deletion
 Course Revision Course Number and/or Title Change Catalog Description Change

| | |
|---|---|
| <i>Current Course prefix, number and full title</i> | <i>Proposed course prefix, number and full title, if changing</i> |
|---|---|

2. Additional Course Designations: check if appropriate

This course is also proposed as a Liberal Studies Course. Other: (e.g., Women's Studies, Pan-African)
 This course is also proposed as an Honors College Course.

3. Program Proposals

New Degree Program Catalog Description Change Program Revision
 New Minor Program Program Title Change Other
 New Track

B.S. in Ed.-Earth and Space Science

| | |
|-----------------------------|---|
| <i>Current program name</i> | <i>Proposed program name, if changing</i> |
|-----------------------------|---|

4. Approvals

| | Date |
|---|------------------|
| Department Curriculum Committee Chair(s) <i>[Signature]</i> | 2/4/08 |
| Department Chair(s) <i>[Signature]</i> | 2/4/08 |
| College Curriculum Committee Chair | |
| College Dean <i>[Signature]</i> | 2-11-08 |
| Director of Liberal Studies * | |
| Director of Honors College * | |
| Provost * <i>[Signature]</i> | 1/27/08 |
| Additional signatures as appropriate: (include title) | |
| UWUCC Co-Chairs <i>[Signature]</i> | Received 2/10/09 |

* where applicable

SEP 26 2008

FEB 14 2008

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|------------------|------------------|--------------------------|--------------------|---------------------|
| LSC Use Only No: | LSC Action-Date: | UWUCC USE Only No. 08-80 | UWUCC Action-Date: | Senate Action Date: |
|------------------|------------------|--------------------------|--------------------|---------------------|

Curriculum Proposal Cover Sheet - University-Wide Undergraduate Curriculum Committee

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|---|---------------------------------|
| Contact Person Ken Coles | Email Address kcoles@iup.edu |
| Proposing Department/Unit Geosciences - Natural Sciences and Mathematics | Phone 724-357-5626 |

Check all appropriate lines and complete information as requested. Use a separate cover sheet for each course proposal and for each program proposal.

1. Course Proposals (check all that apply)

New Course Course Prefix Change Course Deletion
 Course Revision Course Number and/or Title Change Catalog Description Change

Current Course prefix, number and full title Proposed course prefix, number and full title, if changing

2. Additional Course Designations: check if appropriate

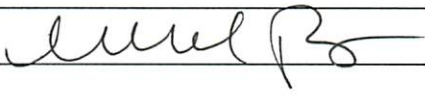
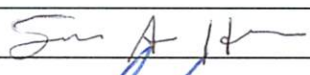


This course is also proposed as a Liberal Studies Course. Other: (e.g., Women's Studies, Pan-African)
 This course is also proposed as an Honors College Course.

3. Program Proposals

New Degree Program Catalog Description Change Program Revision
 New Minor Program Program Title Change Other
 New Track

B.S. in Ed.-Earth and Space Science

Current program name Proposed program name, if changing

| 4. Approvals | | Date |
|---|--|--------------------|
| Department Curriculum Committee Chair(s) |  | 10/9/08 10/9/08 |
| Department Chair(s) |  | |
| College Curriculum Committee Chair |  | 10/09/08 |
| College Dean |  | 10/15/08 |
| Director of Liberal Studies * | | |
| Director of Honors College * | | |
| Provost * | | |
| Additional signatures as appropriate: TECC (include title) | Joseph Domaradzi TECC | 1-26-09 |
| | May Ann Rafaths Dean COE-E7 | 1-26-09 |
| UWUCC Co-Chairs | | |

* where applicable

Received
 JAN 29 2009
 Liberal Studies

Geoscience Department: Program Revision for B.S. in Education-Earth and Space Science

Part II. Description of Curriculum Change

1. Catalog Description

Note: This revised catalog description applies to the Geoscience Department's B.S. in Geology/Geology Track, B.S. in Geology/Environmental Track, B.S. in Education-Earth and Space Science, and Minor in Geology.

The catalog will be revised to read as follows:

Geology is a far-ranging science and encompasses various 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 and perhaps most importantly, the human impact on our environment.

The department offers a B.S. degree in Geology that is divided into two tracks: Geology and Environmental. Either track gives students the necessary foundation to pursue a wide variety of career goals. In addition, we offer education degrees for those students who are interested in teaching. The degrees and courses in our program emphasize hands-on learning, including outdoor instruction and 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.

Our B.S. in Geology/Geology Track is designed for students who are interested in pursuing any of the various sub-disciplines in Geology, including Oceanography/Marine Geology, Climate Change, Volcanology, Paleontology, Meteorology 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; our 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 career goals, including research (and postgraduate studies), teaching, or careers as professional geologists working with private businesses, environmental firms, or as a consultant for federal and state agencies.

The B.S. in Geology/Environmental Track is designed for students who wish to pursue careers in the rapidly expanding environmental field. While our planet has evolved over a 4.5 billion year history, our presence has had a significant impact upon our surroundings, in spite of our brief time of residence. Geologists play a key role in dealing with environmental issues, and the Environmental Track prepares students to solve 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 postgraduate studies.

The B.S. in Education-Earth and Space Science prepares students to become certified teachers in Pennsylvania and other states. Earth and Space Science teachers in middle and high school grades teach subjects that require a broad and solid foundation in science. Coursework includes study of

including teaching English Language Learning and students with disabilities

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~~ in pedagogy complement the subject matter studies. Students create and present lessons, first in Geoscience courses and then in school classrooms, culminating in the student teaching experience in the last semester.

The Minor in Geology is designed for students who desire a background in Geology, in conjunction with degrees in business or one of the social or physical sciences.

**List of courses and credits for the proposed revised program:
Bachelor of Science in Education - Earth and Space Science***

Liberal Studies Requirements: **52**

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

Natural Science: CHEM 111-112

Social Science: PSYC 101

Mathematics: MATH 121

Liberal Studies Electives: MATH 217, PHYS 111, no courses with GEOS prefix

College:

Preprofessional Education Sequence: **31**

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 Outcomes 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:

Required Courses: **39**

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

BIOL 111 Principles of Biology I 4cr

PHYS 121 Physics I Lab 1cr

Controlled Electives: **9cr**

Nine (9) credits from the following:

GEOS 203 Surficial Geology

Any 300-level GEOS course

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

PHYS 112 Physics II

PHYS 122 Physics II Lab

Total Degree Requirements: **122**

*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.

2. Summary of Changes

2 (a). Comparisons of current and proposed programs

Bachelor of Science in Education— Earth and Space Science*

(Current)

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

Mathematics: MATH 121

Natural Science: CHEM 111-112

Social Science: PSYC 101

Liberal Studies Electives: 6 cr., MATH 217, PHYS 111, no courses with GEOS prefix

College:

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

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:

Required Courses:

BIOL 103 General Biology I 4cr

GEOS 121 Physical Geology 3cr

GEOS 122 Physical Geology Laboratory 1cr

GEOS 131 Historical Geology 3cr

GEOS 132 Historical Geology Laboratory 1cr

GEOS 341 Solar System 3cr

GEOS 342 Stellar Astronomy 3cr

GEOS 350 Operation of the Planetarium 1cr

GEOS 361 Physical Oceanography 3cr

GEOS 371 Meteorology I 3cr

PHYS 112 Physics II Lecture 3cr

PHYS 121 Physics I Lab 1cr

PHYS 122 Physics II Lab 1cr

Controlled Electives:

Geology electives (200 level or higher) 9cr

Total Degree Requirements:

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

Bachelor of Science in Education— Earth and Space Science*

(Proposed)

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

Mathematics: MATH 121

Natural Science: CHEM 111-112

Social Science: PSYC 101

Liberal Studies Electives: 6 cr., MATH 217, PHYS 111, no courses with GEOS prefix

College:

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:

Required Courses:

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

BIOL 111 Principles of Biology I 4cr

PHYS 121 Physics I Lab 1cr

Controlled Electives:

Select nine (9) credits from the following: 9cr

GEOS 203 Surficial Geology

Any 300-level GEOS course

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

PHYS 112 Physics II Lecture

PHYS 122 Physics II Lab

Total Degree Requirements:

(*) 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.

2 (b). List of Associated Course Changes

This proposal is being submitted in conjunction with other Geoscience program revision proposals. Here we attach only the course change proposals relevant to the Earth and Space Science Ed. proposal.

Course Proposals Associated with Program Revisions

| New # | Old # | Title | Format | Revision |
|----------|-------|---|-----------|---|
| GEOS 111 | NA | Earth Science for Educators I | NA | Deleted |
| GEOS 112 | NA | Earth Science for Educators I Lab | NA | Deleted |
| GEOS 113 | NA | Earth Science for Educators II | NA | Deleted |
| GEOS 114 | NA | Earth Science for Educators II Lab | NA | Deleted |
| GEOS 121 | NA | Physical Geology | NA | Deleted |
| GEOS 122 | NA | Physical Geology Lab | NA | Deleted |
| GEOS 123 | NA | Applied Mathematics in the Geosciences | NA | Deleted |
| GEOS 132 | NA | Historical Geology Lab | NA | Deleted |
| GEOS 141 | NA | Introduction to Ocean Science | NA | Deleted |
| GEOS 201 | NA | Foundations of Geology | 3c-3l-4cr | New course |
| GEOS 202 | NA | Quantitative Methods in the Geosciences | 2c-0l-2cr | New course |
| GEOS 203 | NA | Surficial Processes | 3c-3l-4cr | New course |
| GEOS 220 | NA | Mineralogy | NA | Deleted |
| GEOS 250 | 150 | Geology of National Parks | 3c-0l-3cr | Renumbered from GEOS 150 |
| GEOS 251 | 151 | The Age of Dinosaurs | 3c-0l-3cr | Renumbered from GEOS 151 |
| GEOS 252 | 221 | Physical Resources of the Earth | 3c-0l-3cr | Renumbered from GEOS 221 |
| GEOS 253 | 226 | Forensic Geology | 3c-0l-3cr | Renumbered from GEOS 226 |
| GEOS 301 | NA | Mineralogy and Petrology | 3c-3l-4cr | New course |
| GEOS 302 | 325 | Structural Geology | 3c-3l-4cr | Renumbered from GEOS 325; increased from 3 to 4cr |
| GEOS 303 | 326 | Field Geology | 3c-3l-4cr | Renumbered from GEOS 326; increased from 3 to 4cr |
| GEOS 310 | 310 | Environmental Geology | 3c-3l-4cr | Increased from 3 to 4cr |
| GEOS 311 | 332 | Geochemistry | 3c-3l-4cr | Renumbered from GEOS 332; increased from 3 to 4cr |
| GEOS 312 | 331 | Hydrogeology | 3c-0l-3cr | Renumbered from GEOS 331; removed laboratory |
| GEOS 313 | 333 | Soils and Soil Geochemistry | 2c-3l-3cr | Renumbered from GEOS 333 |
| GEOS 320 | NA | Igneous and Metamorphic Petrology | NA | Deleted |
| GEOS 341 | 341 | Planetary Geology | 3c-3l-4cr | Renamed; increased from 3 to 4cr |
| GEOS 342 | 342 | Stellar Astronomy | 3c-3l-4cr | Increased from 3 to 4cr |
| GEOS 350 | NA | Operation of the Planetarium | NA | Deleted |
| GEOS 351 | 132 | Historical Geology | 3c-3l-4cr | Renumbered from GEOS 131-132 |
| GEOS 352 | 412 | Sedimentation and Stratigraphy | 3c-3l-4cr | Renamed from GEOS 412; increased from 3 to 4cr |
| GEOS 353 | 330 | Paleontology | 3c-3l-4cr | Renumbered from GEOS 330; increased from 3 to 4cr |
| GEOS 354 | 327 | Geomorphology | 2c-3l-3cr | Renumbered from GEOS 327 |
| GEOS 355 | 411 | Sedimentary Petrology | 2c-3l-3cr | Renumbered from GEOS 411 |
| GEOS 370 | 361 | Oceanography | 3c-3l-4cr | Renumbered from GEOS 361; increased from 3 to 4cr |
| GEOS 371 | 371 | Meteorology | 2c-3l-3cr | Renamed; description change |
| GEOS 401 | NA | Northern Rockies Seminar | 1c-0l-1cr | New course |
| GEOS 402 | 336 | Northern Rockies Field Workshop | var-3cr | Renamed from GEOS 336 |
| GEOS 403 | NA | Newfoundland Seminar | 1c-0l-1cr | New course |
| GEOS 404 | 337 | Newfoundland Field Workshop | var-3cr | Renamed from GEOS 337 |
| GEOS 405 | NA | American Southwest Seminar | 1c-0l-1cr | New course |
| GEOS 406 | 338 | American Southwest Field Workshop | var-3cr | Renamed from GEOS 338 |
| GEOS 407 | NA | Carbonate Geology Seminar | 1c-0l-1cr | New Course |
| GEOS 408 | 441 | Carbonate Geology Field Workshop | var-3cr | Renamed from GEOS 441 |
| GEOS 440 | NA | Subsurface Geology | NA | Deleted |
| GEOS 470 | 380 | Research Methods in the Geosciences | 2c-0l-2cr | Renumbered from GEOS 380 |
| GEOS 480 | 480 | Geoscience Seminar | 2c-0l-2cr | Increased from 1 to 2cr |

Note: Many of the attached course proposals involve changing course numbers to conform to a more consistent numbering scheme. All 100-level courses will be introductory, liberal studies courses with

associated lab sections (101-106). 200-level courses will be introductory courses for majors (201-203), as well as liberal studies courses without lab sections (250-254). 300-level courses form the core of our upper-level majors classes and are grouped according to classic subdivisions with the Geosciences (301-371). 400-level courses include field workshops and associated seminars (401-408), our senior-level two-course research sequence (470, 480), special topics, independent study and internship courses (481-482, 493). Below are our proposed course offerings listed by “new” course numbers.

Proposed Geoscience Course Offerings

| Course | Title | Format | Prerequisites |
|---------------|---|---------------|--|
| GEOS 101 | The Dynamic Earth | 3c-0l-3cr | None |
| GEOS 102 | The Dynamic Earth Lab | 0c-1l-1cr | None |
| GEOS 103 | Oceans and Atmospheres | 3c-0l-3cr | None |
| GEOS 104 | Oceans and Atmospheres Lab | 0c-1l-1cr | None |
| GEOS 105 | Exploring the Universe | 3c-0l-3cr | None |
| GEOS 106 | Exploring the Universe Lab | 0c-1l-1cr | None |
| GEOS 201 | Foundations of Geology | 3c-3l-4cr | Geoscience majors and minors, and Science or Science Education majors/minors, Anthropology, Geography and Regional Planning majors, or instructor permission |
| GEOS 202 | Quantitative Methods in the Geosciences | 2c-0l-2cr | Geoscience majors and minors only, or permission of instructor; must be taken after or concurrently with GEOS 201 |
| GEOS 203 | Surficial Processes | 3c-3l-4cr | GEOS 201 |
| GEOS 250 | Geology of National Parks | 3c-0l-3cr | None |
| GEOS 251 | The Age of Dinosaurs | 3c-0l-3cr | None |
| GEOS 252 | Physical Resources of the Earth | 3c-0l-3cr | None |
| GEOS 253 | Forensic Geology | 3c-0l-3cr | None |
| GEOS 254 | Exploration of Space | 3c-0l-3cr | None |
| GEOS 301 | Mineralogy and Petrology | 3c-3l-4cr | GEOS 201, 202 |
| GEOS 302 | Structural Geology | 3c-3l-4cr | GEOS 201, 202 |
| GEOS 303 | Field Geology | 3c-3l-4cr | GEOS 201, 202 |
| GEOS 310 | Environmental Geology | 3c-3l-4cr | GEOS 202, 203 |
| GEOS 311 | Geochemistry | 3c-3l-4cr | GEOS 201, 202 |
| GEOS 312 | Hydrogeology | 3c-0l-3cr | GEOS 201, 202 |
| GEOS 313 | Soils and Soil Geochemistry | 2c-3l-3cr | GEOS 201, 202 |
| GEOS 341 | Planetary Geology | 3c-3l-4cr | MATH 121, PHYS 111 |
| GEOS 342 | Stellar Astronomy | 3c-3l-4cr | MATH 121, PHYS 111 |
| GEOS 351 | Historical Geology | 3c-3l-4cr | GEOS 202, 203 |
| GEOS 352 | Sedimentation and Stratigraphy | 3c-3l-4cr | GEOS 202, 203 |
| GEOS 353 | Paleontology | 3c-3l-4cr | GEOS 201, 202 |
| GEOS 354 | Geomorphology | 2c-3l-3cr | GEOS 202, 203 |
| GEOS 355 | Sedimentary Petrology | 2c-3l-3cr | GEOS 202, 203 |
| GEOS 362 | Plate Tectonics | 2c-3l-3cr | PHYS 111-112; 20cr of geology |
| GEOS 370 | Oceanography | 3c-3l-4cr | GEOS 201, 202 |
| GEOS 371 | Meteorology | 2c-3l-3cr | GEOS 201, 202 |
| GEOS 401 | Northern Rockies Seminar | 1c-0l-1cr | GEOS 201, 202 |
| GEOS 402 | Northern Rockies Field Workshop | var-3cr | GEOS 401 and instructor permission |
| GEOS 403 | Newfoundland Seminar | 1c-0l-1cr | GEOS 201, 202 |
| GEOS 404 | Newfoundland Field Workshop | var-3cr | GEOS 403 and instructor permission |
| GEOS 405 | American Southwest Seminar | 1c-0l-1cr | GEOS 201, 202 |
| GEOS 406 | American Southwest Field Workshop | var-3cr | GEOS 405 and instructor permission |
| GEOS 407 | Carbonate Geology Seminar | 1c-0l-1cr | GEOS 201, 202 |
| GEOS 408 | Carbonate Geology Field Workshop | var-3cr | GEOS 407 and instructor permission |
| GEOS 470 | Research Methods in the Geosciences | 2c-0l-2cr | 75cr or instructor permission |
| GEOS 480 | Geoscience Seminar | 2c-0l-2cr | GEOS 380, Senior standing |

GEOS 481 Special Topics
GEOS 482 Independent Study
GEOS 493 Geoscience Internship

var-1-3cr As appropriate to course content
var-1-3cr Prior approval through advisor, faculty member
var-1-12cr None

Rationale for Geoscience Department Programmatic Changes

Note: This section applies to proposed program revisions for the Geoscience Department's B.S. in Geology/Geology Track, B.S. in Geology/Environmental Track, B.S. in Education-Earth and Space Science, and Minor in Geology. As such, this text will be repeated in the revision proposals for all these programs.

Never has the need for broad public understanding of our Earth and its dynamic systems been as critical as at present. Our understanding of large-scale geological processes and the volume of knowledge encompassed by the geosciences have grown exponentially over the past several decades. At the same time, our pedagogical appreciation of "how students think and learn" has driven a substantial shift in our approach to teaching science. In a series of meetings held over the past three years, the Geoscience Department outlined a number of goals (see below), which would significantly improve our programs both pedagogically and mechanically. The following outlines these goals and the ways in which the proposed program revisions will work toward achieving them.

Constructing a Strong Student Knowledge/Skills Base

It is essential that students receive a complete education in the core material of their chosen discipline. Students must learn to recognize rock and mineral specimens and learn their chemical formulas, understand the history of the Earth, recognize surficial features and how geologic processes shape them, etc. We have developed a "core" set of courses for each track using existing course offerings as well as new courses that provide breadth of knowledge and skills that are critical to the training of future geoscientists and Earth science educators. Students' first steps into the programs will now occur through a series of three introductory courses that will develop the standard knowledge base and numerical and foundational skills of the discipline using creative new pedagogy of team and active learning exercises rather than the traditional "lecture/lab" approach. These courses, GEOS 201 Foundations of Geology, GEOS 202 Quantitative Methods in the Geosciences, and GEOS 203 Surficial Processes, will serve as the prerequisites for almost all of our upper-level courses.

Developing Collaborative and Experiential Learning

Meaningful participatory experience can have a profound impact on student intellectual development and may be the greatest single influence to transform young science students into young scientists. Pedagogical evidence clearly supports the benefits of active learning. It enhances professional skills such as science and math competency, data analysis, communication, etc. It also develops personal attitudes, increases confidence and builds intrinsic interest in learning. In short, this style of learning gives students the cognitive capacity necessary for success and, perhaps even more importantly, develops self-knowledge and beliefs that provide students with a sense of why they learn. The combination of our students' collective experiences and abilities lead to a richer understanding of the Earth's complexity and fosters a community of learning. In our new programs, we capitalize on existing strengths we offer through interactive, hands-on learning and integrate new opportunities for paired Seminar-Field Workshop courses. We are modifying our traditional field trips into project-based field experiences unique to the particular field area (GEOS 402, 404, 406, 408). In addition we are developing a preliminary one-credit seminar for each Field Workshop to introduce students to the necessary background and skills needed to successfully complete these projects (GEOS 401, 403, 405, 407).

Fostering Creative Thought and Critical Analysis

While facts are undeniably the raw materials for science, creative thought is the process by which science grows. Students must be able to use the facts to think scientifically. Hypothesis testing, falsification, and interpretation in the face of incomplete or contradictory data are critical steps in a

student's intellectual growth. Our new program integrates intellectually challenging projects and real world exercises that challenge their imagination and creativity. New courses are designed to foster creative thinking and develop analytical skills, and revised existing courses expand such opportunities for our students. In addition, we are increasing research credits in GEOS 480, and expanding opportunities for project-based exercises in GEOS 201-203.

Modernizing Curricular Offerings

The need to modernize our curriculum and course content arises from changes in the subfields of the geosciences over the past twenty years. A number of our course proposals involve the increase in the number of lecture hours to accommodate additional course content. These include (see above table; numbers given are "new" course numbers): GEOS 302 Structural Geology, GEOS 303 Field Geology, GEOS 310 Environmental Geology, GEOS 311 Geochemistry, GEOS 341 Planetary Geology, GEOS 353 Paleontology, and GEOS 370 Oceanography. Where appropriate, we have also combined courses into single courses reflecting a de-emphasis of particular subfields. These include GEOS 301 Mineralogy and Petrology (combines former courses GEOS 220 Mineralogy and GEOS 320 Igneous and Metamorphic Petrology) and GEOS 342 Stellar Astronomy (incorporates content from GEOS 350 Operation of the Planetarium).

Improving 4-year Graduation Rate

Although specific data are not available, it is clear that very few of our Geology and Environmental Track students graduate in the four years typical of undergraduate programs. There are several reasons for this. First, it is widely acknowledged amongst undergraduate geology and geoscience departments that, of the students who eventually major in the geosciences, relatively few enter their first year of college specifically knowing that this will be their major. Rather, many if not most eventual geoscience majors "discover" the major while taking an introductory course, often as a science requirement. Second, we have a large number of students that transfer into our major either from other IUP programs, or from other universities. Third, our current curriculum has a complicated set of prerequisites which, when coupled with the fact that many of our upper-level courses are only taught every other year, creates many situations where students are unable to take a required course when it is offered and must wait up to two years for that course to be taught again. In any of these cases, our current programs provide little scheduling flexibility that would help students to graduate within the typical four-year timeframe.

We are proposing a number of program revisions to combat these issues. First, we are creating a new set of introductory courses, GEOS 201 Foundations of Geology, GEOS 202 Quantitative Methods in the Geosciences, and GEOS 203 Surficial Processes that will serve as prerequisites for almost all 300-level and 400-level courses. In addition, we plan to offer GEOS 201 and GEOS 202 (they will typically be taken concurrently) every semester which will provide maximum access to upper-level courses for students transferring into the program in either the fall or spring semester. Second, we are increasing the ability of students to select freely from upper-level Geoscience and allied science classes, increasing the number of controlled elective credits from 9-10 to 19 in the Geology Track, and from 8-9 to 20 in the Environmental Track. Third, we are allowing credit from one 100-level or 200-level course to count toward controlled electives to add increased flexibility for the student who chooses to major in Geosciences after taking one of our liberal-studies courses. Recognizing the unique nature of each student's schedule, we anticipate that students who begin either the Geology or Environmental track as late as the spring semester of their sophomore year will still be able to fulfill program requirements within the four-year timeframe.

Developing a Sense of Community within the Geoscience Department

Finally, we believe that our program revisions will help to develop of a distinct community to which individuals (students, faculty, and staff) have a “sense of belonging”. Opportunities for active and small group learning are particularly important for encouraging identity with the geoscience community. Field trips and field workshops are integrated into the new program at all levels and allow close student-faculty interactions as well as invaluable practical experiences.

Rationale for Changes Specific to the B.S. in Education/Earth and Space Science

Changes to the B.S. in Education in Earth and Space Science increase the depth of work in science content and address concerns raised in the accreditation process. The following are program revision changes specific to the Earth and Space Science Education Program:

- 1) The Pennsylvania State Board of Education adopted changes that affect all Pennsylvania’s teacher and educational specialist certification programs by adding 9 credits or 270 hours or equivalent combination for adaptations and accommodations for diverse students in an inclusive setting and 3 credits or 90 hours or equivalent combination to meet instructional needs of English language learners. The course EDEX 323 Instruction of English Language Learners with Special Needs (2 cr) is being added as a required course in order to add the additional number of hours required by the state. All of the other hours are currently included in other coursework and practicum experiences. This addition results in 122 credits being required for the Earth and Space Science Education Program. PASSHE has approved institutions exceeding the 120-credit minimum up to 123 credits in order to fulfill these new requirements so our program will still be in compliance.
- 2) The major required course BIOL 103 General Biology I is changed to BIOL 111 Principles of Biology I. Requiring BIOL 111 instead of BIOL 103 helps to meet the requirements of NCATE accreditation (administered through the National Science Teachers Association, NSTA). Specifically, teacher-candidates are required to "demonstrate knowledge of research and investigation in science." The laboratory experience in BIOL 111 includes a carefully structured set of projects that allow us to document this experience. Furthermore, all the science education programs (Biology Education, Chemistry Education, and Physics Education) will require BIOL 111 for this same reason and because all science education programs are accredited as a group.
- 3) GEOS 121/122 Physical Geology and Lab as well as GEOS 131/132 Historical Geology and Lab are being replaced with two courses from the new Geoscience Department introductory course sequence GEOS 201 Foundations of Geology and GEOS 202 Quantitative Methods in the Geosciences (see attached course proposals). The replacement of our introductory sequence reflects our department’s need to modernize its curricular offerings in the face of changes in emphasis within the broader geosciences. An additional new course GEOS 203 Surficial Processes will be available to Earth and Space Science Education Students as a controlled elective (see attached course proposal).
- 4) GEOS 353 Paleontology will be added to the required major courses. GEOS 353 is a vital addition to the Earth and Space Science Education program as secondary science teachers are in the front line of controversies over the teaching of evolution as a basic concept in science. Firsthand knowledge of fossils and the physical evidence for evolution is more important than ever for these professionals.
- 5) GEOS 131/132 Historical Geology and Lab are being merged into a single 300-level class and will be no longer required as a major class. While the new course GEOS 351 Historical Geology has the same title as the old sequence GEOS 131/132, the scope and intent of the new course is considerably different. Historical Geology is now a specialized, upper-level course for students who wish

specialized knowledge of Earth history and will still be available to Earth and Space Science Education students as a controlled elective. The initial experience with Earth history and the rock record covered in the old GEOS 131/132 are now provided in GEOS 201 and 202, while understanding and use of fossils is covered in GEOS 353.

6) PHYS 112/122 Physics II Lecture and Lab will no longer be a required course but will be available as a controlled elective. Important concepts in electricity and magnetism, particularly magnetic fields of the Earth, planets, and Sun, are covered in the expanded GEOS 342 Stellar Astronomy (see attached course proposal). Nuclear synthesis of elements in stars and the details of nuclear fusion are also key topics in GEOS 342.

7) GEOS 350 Operation of the Planetarium is currently a required class for Earth and Space Science Education students. This course is being deleted (see attached course deletion proposal) with the content being folded into the expanded GEOS 342 Stellar Astronomy course.

8) Several courses currently required for the Earth and Space Science Education program are being renumbered, renamed, and/or revised by increasing the number of credits from three to four. GEOS 341 Solar System is being renamed to GEOS 341 Planetary Geology with credits increasing from three to four. The increase in lecture hours will allow for more in-depth learning activities, as well as an increase in the emphasis on geologic topics making the course more appropriated for students in the Geology and Environmental Geology tracks (see attached course proposal). GEOS 342 Stellar Astronomy will increase in credits from three to four. This change is required to allow for incorporation of the content of GEOS 350 Operation of the Planetarium. GEOS 361 Physical Oceanography is being renumbered and renamed to GEOS 370 Oceanography, with credits increasing from three to four. The increase in lecture hours is required to accommodate recent emphasis on global climate change and the interactions of the oceans with other Earth systems (see attached course proposal).

Part III. Implementation

1. How will the proposed revision affect students already in the existing program?

We anticipate full implementation of the new programs in Fall of 2008 or 2009 depending on the length of the approval process. At that time, all program changes and associated course changes will be enacted immediately. Students who are already enrolled in these programs will be affected by these changes although we do not anticipate serious problems as the new programs provide a substantial increase in flexibility with respect to scheduling and course selection. Although it is impossible to foresee every possible situation that will arise, we will use the following guidelines to work students through the transition period without compromising the rigor or quality of their individual programs.

Earth and Space Science Education Students

In Fall 2008, students who are already enrolled in the Earth and Space Science Education program will adopt their respective new program requirements. The Liberal Studies component as well as both the Preprofessional and Profession Education Sequences remain unchanged in the proposed program. As students will have completed a portion of the Major requirements for the old program, faculty advisors will tailor each individual student's program appropriately based on the following guidelines:

*add
credits
could*

-The total number of credits required for the major (39) will always remain unchanged although the distribution of credits between the required courses and free electives will be flexible.

-If a student has taken a course under the old program, that student may not take the same or correlative course under the new program, even if the number of credits or course number has changed.

-If a student has already taken the 3-credit version of a particular course with the 4-credit version of the same course being required under the new program, that student will have to add one credit to the total controlled elective requirements. Conversely, if a student has taken the 4-credit version of a class with the 3-credit version required under the new program, that student will subtract one credit from the total controlled elective requirements.

-Students who have already taken GEOS 121/122 Physical Geology/Lab will not be required to take GEOS 201 Foundations of Geology or GEOS 202 Quantitative Methods in the Geosciences.

-Students who have already taken GEOS 131/132 Historical Geology/Lab may use these credits as either 1) a substitute for GEOS 353 Paleontology under the new program requirements, or 2) a substitute for GEOS 203 Surficial Geology as controlled elective credits.

-Students who have taken PHYS 112/122 under the old program requirements may use these as controlled elective requirements under the new program.

2. Are faculty resources adequate? If you are not requesting or have not been authorized to hire additional faculty, demonstrate how this program will fit into the schedule(s) of current faculty.

No additional faculty resources are required. We can implement the proposed programs with our existing faculty while maintaining strong support to the Liberal Studies Science elective course offerings.

3. Are other resources adequate?

Yes, there are no program changes that require facilities or resources not already available.

4. Do you expect an increase or decrease in the number of students as a result of these revisions? If so, how will the department adjust?

Although difficult to assess in light of the overall decline in demographics for western Pennsylvania's college matriculation, we anticipate a steady or perhaps slight increase in enrollment to major's courses over the next few years. Our new program eases non-major student transition into the program by removing scheduling pre-requisite barriers that currently penalize students who transfer into our program from our introductory sections. Even so, we can still accommodate at least a 50-75% increase in most of our major's courses without any difficulty.

Part IV. Periodic Assessment

1. Describe the evaluation plan. Include evaluation criteria. Specify how student input will be incorporated into the evaluation process.

Like all education majors at IUP, the Earth and Space Science education program is subject to accreditation review by NCATE. This review is administered for NCATE by the National Science Teachers Association (NSTA). The NSTA Standards for Science Teacher Preparation have been significantly revised in recent years. This has required substantial change to program assessments to make a strong case for accreditation, the approval of which is pending at the time of this proposal. Student input is collected in one-on-one sessions with the advisor and program coordinator as well as through the considerable number of formal assessments listed below.

Key Assessments are made in the following required courses: GEOS 201, 202, 341, 342, 353, 370, 371, and in the controlled elective, GEOS 203. Each course objective has corresponding assessments (for example, a lab quiz or a written project); these are mapped to the NSTA Standards and in turn to the Conceptual Framework for all education programs at IUP. For each course, two or three of the assessments are designated Key Assessments, and ratings for these assessments are entered by faculty into the digital Key Assessment Rating System (KARS). Data in KARS are mapped to the Conceptual Framework and are used for program revision and improvement at the College and program level.

In addition, eight comprehensive assessments are required for NCATE accreditation of the program. Majors must satisfy all of these to complete the program and qualify for a teaching certificate.

1. Praxis II Exam: a national exam testing content knowledge. The passing score is set by the Pennsylvania Department of Education.
2. Science Content GPA: All majors must maintain a 3.0 overall GPA and pass required courses with a grade of "C" or better. In addition, we compile the GPA for required science and math courses alone to monitor our preparation of majors to be knowledgeable science teachers.
3. Unit Plan: During student teaching, a Unit Plan is required. The Student Teacher must create and implement the plan and provide a record of its use in the classroom. The university supervisor rates the Unit Plan according to a detailed rubric.
4. Student Teaching Evaluation (science portion): In parallel with the required evaluation of all IUP student teachers, the supervising teacher keeps a written record of the classroom practices and professional conduct of the student teacher. This forms the basis for ratings on the newly revised Student Teacher Evaluation for science.
5. Teacher Work Sample: All student teachers must document the impact of their planning and instruction on student learning, including reflection by those students on their own learning. The Teacher Work Sample rubric used by all education programs is joined with ratings specific to the science classroom.
6. Safety and Ethics Exam: Majors must pass an exam of their knowledge of legal issues, classroom safety, and ethical treatment of living things prior to student teaching. The exam, along with self-guided study modules, is Web-based.
7. Research Design: Twice, in BIOL 111 and then in GEOS 342, Earth and Space Science Education majors design and carry out a science research project. Specific elements of the project and presentation of results are given in one rubric used by the program coordinator to rate the project.
8. Electronic Portfolio: The Electronic Portfolio common to all education programs at IUP includes science-specific requirements for Earth and Space Science education majors. These are aligned to specific NSTA standards and must meet the criteria in a detailed rubric used by all the science education programs. By the end of student teaching, the portfolio must include artifacts that demonstrate skills, practices, and professionalism on the part of the student teacher.

2. Specify the frequency of the evaluations.

Assessment data is collected each semester by individual faculty members for Key Assessments in required courses. The program coordinator for Earth and Space Science Education will oversee the collection of data for the NCATE/NSTA assessments, including the Praxis II scores, Safety and Ethics Exam, and Research Design during coursework and the Unit Plan, Teacher Work Sample, and Student Teaching Evaluation during student teaching. The Electronic Portfolio and Science GPA are evaluated at the end of the last semester.

3. Identify the evaluating entity.

As part of the application for national accreditation of the Earth and Space Science education program, we have designed new rubrics for all of the NCATE/NSTA assessments and have begun implementing these in Spring 2008. This data is archived in the Geoscience Department.

Part V. Course Proposals

Attached are all required course proposals for the above changes.

Part VI. Letters of Support or Acknowledgement

The Geoscience Department respects the need for other programs and departments affected by our proposed program revisions to be suitably informed of these revisions and given the opportunity to express support or lack of support for them. The following table outlines our efforts to inform departments affected by revisions to the Earth and Space Science Education program.

Biology Department

August 28, 2008: The attached letter was sent to Dr. Carl Luciano, chair of the Biology Department seeking support for the change from BIOL 103 to BIOL 111. We received the attached letter of support from Dr. Luciano on September 26, 2008.

Physics Department

August 28, 2008: The attached letter was sent to Dr. Stan Sobolewski, coordinator for the Physics Education program, seeking support for the transfer of PHYS 112/122 Physics II Lecture and Lab from a required course to a controlled elective option. We received the attached letter of support from Dr. Sobolewski on September 4, 2008.

Chemistry Department

Chemistry Education students were formerly required to take GEOS 111/112 or GEOS 113/114, all of which are being deleted as part of the larger curriculum changes within the Geoscience Department. These students will now take the new course GEOS 201 Foundations of Geology. A letter of support from Dr. John Woolcock regarding this change is attached.

Dr. Hovan:

I am writing in support of the Earth and Space Science Education proposal which includes EDEX 323 Instruction of English Language Learners with Special Needs as a required course in the teacher certification program. By including this course in your curriculum your program adds significant special education and English Language Learning content into your program. The faculty in the Department of Special Education and Clinical Services looks forward to working with your students on the addition of this new and exciting course in your program.

Joseph Domaracki
Chairperson,
Department of Special Education and Clinical Services

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

Earth and Space Science Education

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|-------------|----------------------|-------------------|--------------------------|-------------------------|
| Special Ed. | 138.5 In Class Hours | 277 Contact Hours | 00 In Class Hours Needed | 00 Contact Hours Needed |
| E.L.L. | 61 In Class Hours | 122 Contact Hours | 00 In Class Hours Needed | 00 Contact Hours Needed |

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|--|---|------|----------------------|
| Liberal Studies: As outlined in Liberal Studies section with the following specifications: Mathematics: MATH 121 (1) Natural Science: CHEM 111-112 Social Science: PSYC 101 Liberal Studies Electives: 6cr, MATH 217 , PHYS 111 , no courses with prefix of chosen track in major | | | 52 |
| College: | | | 31 |
| Preprofessional Education Sequence: | | | Contact Hours |
| COMM 103 | Digital Instructional Technology (EDEX 103) | 3cr | (32 SPED / 4 ELL) |
| EDSP 102 | Educational Psychology | 3cr | 60 SPED / 24 ELL |
| Professional Education Sequence: | | | |
| EDEX 301 | Education of Students with Disabilities in Inclusive Secondary Settings | 2cr | 60 SPED / 4 ELL |
| EDSP 477 | Assessment of Student Learning: Design and Interpretation of Educational Measures | 3cr | 36 SPED / 24 ELL |
| EDUC 242 | Pre-Student Teaching Clinical Experience I | 1cr | |
| EDUC 342 | Pre-Student Teaching Clinical Experience II | 1cr | 60 SPED |
| EDUC 441 | Student Teaching | 12cr | |
| EDUC 442 | School Law | 1cr | 8 SPED / 8 ELL |
| EDUC 451 | Teaching Science in the Secondary School | 3cr | 8 SPED / 2 ELL |
| EDEX 323 | Instruction of English Language Learners with Special Needs | 2 cr | 60 SPED / 60 ELL |
| Major: | | | 39 |
| Required Courses: | | | |
| GEOS 102 | 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 | |
| Biol 111 | Principles of Biology | 4cr | |
| PHYS 121 | Physics I Lab | 1cr | |
| Controlled Electives: Select nine credits from the following | | | 9cr |
| GEOS 203 Surficial Geology Any 300 level GEOS COURSE Any 400 level GEOS course, except GEOS 470 & 480 PHYS 112 Physics II Lecture PHYS 122 Physics II Lab | | | |
| Total Degree Requirements: | | | 122 |