

January 11, 2022, Magali Billen, Chair EPS Graduate Program

Graduate Program in Earth and Planetary Sciences 2023 Interim Modifications to Degree Course Requirements

The EPS Graduate Program committee has been discussing various, continuing issues with our course offerings for graduate students over the past 1.5 years. Based on these discussions, we have approved these interim modifications to our current degree requirements at our December 5, 2022 meeting. These changes are to take effect immediately. The faculty will fully review and vote on these changes along with other proposed changes to the degree requirements in the future. However, we felt that a solution was so long overdue that it was better to implement these as interim changes now, as is allowed by the Program By-Laws and our ability to allow for course substitutions.

Background/Motivation: Over the past decade as the disciplinary breadth of the EPS disciplines has expanded and undergraduate teaching commitments remain high, graduate students have increasingly found it difficult to find enough graduate level courses that meet their academic requirements and provide specialized graduate level instruction in topics that support their dissertation research.

Due to the broad range of disciplines/specialization in undergraduate preparation of our incoming graduate students and the depth of expertise required for innovative graduate level research, we have found it difficult to offer both graduate level breadth and depth courses that meet the varying levels and needs of the graduate students. At the same time, the training needs of some sub-disciplines can be met with graduate courses from other departments, while others do not have this option. Finally, the projects our graduate students are doing also have an increased need for quantitative analysis skills, including various types of programming and quantitative data analysis (GIS, Statistics, PDEs, Machine Learning).

We currently require categories of coursework:

- BREADTH: 3 graduate level EPS courses, each in a different subdiscipline category (there are 7 categories)
- DEPTH/DISSERTATION-SPECIFIC: 2-5 (MS-PhD) graduate (200+) or upper-division undergraduate (100+) courses (depth)

New Requirements: To meet these various educational needs and challenges within the current degree requirements, the EPS Graduate Committee has approved a change to the above required categories of courses to provide more options and flexibility. The modified requirements are

- BREADTH: 3 upper-division EPS undergraduate (100+) or graduate (200+) courses, each in a different subdiscipline (4 categories); one of these breadth courses can be a lower or upper-division programming or quantitative skill course providing a completely new skill to the student.
- DEPTH/DISSERTATION-SPECIFIC: 2-5 (MS-PhD) graduate (200+) or upper-division undergraduate (100+) courses in any department on campus.

Explanation: The reasons behind these changes are:

- BREADTH:
 - students who are building breadth may need to start at an undergraduate level because they have little/no prior experience in the subfield
 - Faculty have been encouraged to add a 1-unit GEL 298 graduate level activity to upper divisions EPS courses to augment/enhance the learning opportunity for graduate students taking these courses. Students are encouraged to ask for and enroll in this added unit of coursework.
 - all students need stronger programming and quantitative skills to do their research and need to start learning these at the level appropriate to their background.
 - If a student has no formal/minimal experience with a quantitative/programming topic they can take a lower division course. Note, if this option is chosen this course will NOT count towards the units required for the degree – it will meet the breadth requirement. However, because students also GEL 299 courses and this coursework does count toward required units; there will be no issue with sufficient units.
 - Reduction from 7 to 4 disciplines will ensure that there are sufficient choices in each breadth area.
 - If a quantitative/programming course is taken, then neither breadth course can be in the student's "subdiscipline" area.
- DEPTH/DISSERTATION-SPECIFIC:
 - by allowing students to gain breadth at the upper-division undergraduate level, the graduate courses taught in the department can be taught at a higher level, move more quickly, and provide more depth of knowledge to the students.
 - Student will retain the flexibility to take these courses in other departments to meet their learning objectives.

Implementation: Verifying that courses meet the degree requirements is done at the department level when both the graduate coordinator and graduate advisor review and sign the MS candidacy or PhD QE application forms. Therefore, we can adopt these interim measures while the Graduate Program continues to review its requirements and structure. The faculty will discuss and vote on these changes when all proposed modifications to the degree requirements have been discussed by the full program. Continuing students who are completing coursework can adopt these new requirements. They add new flexibility in course selection rather than restricting any flexibility in the current degree requirements.

Course selection must be discussed with the graduate and major advisor in the context of the student's prior preparation, the skills and knowledge needed for their thesis work. The student should be prepared to demonstrate that none of the upper (or lower) division courses have a significant overlap with previous coursework from their undergraduate degree. Previous coursework can be viewed by the graduate advisor on the student's transcript in GradHub.

New EPS-GP Breadth Topic Areas and Courses

*Courses populated by what has been actually taught in the past 6 years (grad) by current faculty
And 2 years (undergrad)*

I. Geology/Petrology

Grad Level

- 205: Advance Field Stratigraphy (Sumner)
- 206: Stratigraphic Analysis (Sumner)
- 214: Active Tectonics (Oskin)
- 216: Tectonics (Cowgill)
- 218: Analysis of Structures in Deformed Rocks (Cowgill)
- 226: Advanced Sedimentary Petrology (Sumner)
- 230: Geomorphology & River Management (Pinter)
- 298: Coastal Ecogeomorphology (Pinter)
- 253: Petrology Seminar (Ratschbacher)
- 296: Advanced Problems in Tectonics (Cowgill)
- 298: TBD (Oskin)

Upper Division

- 101: Structural Geology (note: 101L does not count as a breadth course)
- 103: Field Geology
- 105: Earth Materials: Igneous Rocks
- 109: Sediments & Strata (note: 109L does not count as a breadth course)
- 136: Ecogeomorphology of Rivers & Streams
- 140: Introduction to Process Geomorphology
- 150B: Geological Oceanography

II. Geochemistry/Petrology

Grad Level

- 250: Advanced Geochemistry Seminar (Yin)
- 251: Advanced Topics in Isotopes in Cosmochemistry & Geochemistry (Mukhopadhyay)
- 227: Stable Isotopes Biogeochemistry (Atekwana)
- 281N: Instrumental Techniques (Yin)
- 298: Aqueous Geochemistry (Atekwana)
- 298: Radiogenic Isotope Geochemistry (Cooper)
- 298: Early Earth History (Mukhopadyhay)
- 298: TBD (Griffin)
- 298: TBD (Mukhopadhyay)

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Upper Division

- 108: Paleoclimates
- 116N: Oceanography
- 133: Environmental Geochemistry
- 150A: Physical and Chemical Oceanography

III. Geophysics/Planetary

Grad Level

- 219: Fracture and Flow of Rocks (Billen)
- 240: Geophysics of the Earth (Rudolph, Stewart or Billen?)
- 298: Geodynamic Modeling (Rudolph)
- 298: Planet Formation (Stewart)
- 298: Planetary Geology and Geophysics (Stewart)
- 298: Planetary Impact Processes (Stewart)

Upper Division

- 131: Risk: Natural Hazards & Related Phenomena
- 160: Geological Data Analysis
- 161: Geophysics Field Methods
- 162: Geophysics of the Earth
- 163: Planetary Geophysics

IV. Geo-/Paleobiology

Grad Level

- 232: Oceans and Climate Change (Gold)
- 260: Paleontology
- 262: Paleobiology Seminar (Motani)
- 298: Geobiology (Grettenberger, paired with 144)
- 298: TBD (Gold)
- 298: Microbial Photosynthesis (Grettenberger)

Upper Division

- 107: Earth History: Paleobiology (note: 107L does not count as a breadth course)
- 141: Evolutionary History of Vertebrates
- 144: Historical Ecology