

## Graduate Courses 2023-2024

### Fall 2023

Course	Course Title	Units	Instructor	Breadth area
GEL 219	Fracture & Flow of Rocks	3	Billen	3
GEL 227	Stable Isotopes Biogeochemistry	4	Atekwana	2
GEL 235	Surface Processes	3	Oskin	1
GEL 290	Seminar	1	TBD	N/A
GEL 298	Marine Chemistry and Geochemistry <i>CRN: 35135</i>	TBD	Griffin	2
GEL 298	Geobiology <i>CRN: 35136</i> <i>Taught alongside GEL 144</i>	TBD	Grettenberger	4
GEL 390	Methods of Teaching Geology	2	Billen	N/A

### Winter 2024

Course	Course Title	Units	Instructor	Breadth area
GEL 217	Topics in Geophysics	3	Stewart	3
GEL 230	Geomorphology & River Management <i>Application required for CRN</i>	3	Pinter	1
GEL 290	Seminar	1	TBD	N/A
GEL 294	Structure & Tectonics forum	1	Roeske	N/A
GEL 296	Advanced Problems in Tectonics Topic: Anatomy of an Orogen: Geologic Evolution of the Caucasus	3	Cowgill	1
GEL 298	TBD <i>CRN: 26781</i>	TBD	Mukhopadhyay	2
GEL 298	TBD <i>CRN: 26787</i> <i>Taught alongside GEL 107</i>	TBD	Gold	4
GEL 298	TBD <i>CRN: 26794</i>	TBD	TBD	TBD

### Spring 2024

Course	Course Title	Units	Instructor	Breadth area
GEL 232	Oceans and Climate Change	3	Hill	4
GEL 251	Isotope Geochemistry & Cosmochemistry	3	Yin	2
GEL 253	Petrology Seminar <i>CRN: TBD</i>	3	Ratschbacher	1
GEL 290	Seminar	1	TBD	N/A

# Course Descriptions

Fall 2023

**GEL 219: Fracture & Flow of Rocks (Billen)**

*Graduate course breadth area: #3*

This course is designed to provide students with a strong foundation in brittle, ductile, and viscous behavior of rocks. Emphasis is on brittle/ductile behavior of the lithosphere, including the rheologies used to model earthquake rupture and mechanisms of viscous deformation. For each topic, I will present the experimental data, the equations used to describe the behavior and a discussion of the microscopic origin of the observed behavior. Weekly homework assignments emphasize foundational concepts different types of deformation. Targeted paper discussions will occur at key junctures in the course to help synthesize the topics and learn how to critically read papers establishing or applying rheological concepts. Each student will also complete a literature review-based term project on a specific type of tectonology of relevance to their own research.

**GEL 227: Stable Isotopes Biogeochemistry (Atekwana)**

*Graduate course breadth area: #2*

Stable Isotopes biogeochemistry is an important discipline within the earth sciences. The use of stable isotopes is widespread from studies that seek to understand natural variations in isotopes in geologic system to those that relate to human perturbation of the world's ecosystems. This course is an introduction to the basic principles of stable isotope. Students will study of the production, distribution, and use of select naturally occurring stable isotopes applied to geology, hydrology, biogeochemistry, and environmental change. The main objective of this course is to provide an elementary understanding of the principles and application of stable isotope in earth and environmental systems. The course will focus on commonly used light stable isotopes (e.g., H, C, N, O and S). The course will also cover other stable and radioactive isotopes as appropriate. At the end of the course, students should have a working knowledge of the principles of stable isotopes and be able to apply their use in geologic studies and in their research.

**GEL 235: Surface Processes (Oskin)**

*Graduate course breadth area: #1*

Description coming soon.

**GEL 290: Seminar (TBD)**

*Does not count as a breadth or general course for graduate degree requirements.*

**GEL 298: Marine Chemistry and Geochemistry (Griffin)**

*CRN: 35135*

*Graduate course breadth area: #2*

Description coming soon.

**GEL 298: TBD (Grettenberger)**

*CRN: 35136*

*Graduate course breadth area: #4*

*Taught alongside GEL 144*

Description coming soon.

**GEL 390: Methods of Teaching Geology (Billen)**

*Does not count as a breadth or general course for graduate degree requirements.*

Description coming soon.

**Winter 2024**

**GEL 217: Topics in Geophysics (Stewart)**

*Graduate course breadth area: #3*

Order of magnitude physics for Earth and Planetary Science problems. Scaling laws and estimation.

**GEL 230: Geomorphology & River Management (Pinter)**

*Application required for CRN*

*Graduate course breadth area: #1*

Description coming soon.

**GEL 290: Seminar (TBD)**

*Does not count as a breadth or general course for graduate degree requirements.*

**GEL 294: Structure & Tectonics forum (Roeske)**

*Does not count as a breadth or general course for graduate degree requirements.*

This on-going discussion group meets once/week to discuss a paper selected by participants in the group. The theme of the articles varies each quarter; the seminar's goal is to emphasize breadth and we read and discuss a range of articles that cover the diverse interests of members of the group. As an example, we have recently read articles on subduction zone processes, ranging from UHP metamorphism and exhumation, to response of the upper plate to degree of coupling in the subduction zone. If schedules allow, we plan a multi-day field trip to examine rocks that may show some of the processes of interest to the group and focus the reading around the field trip.

**GEL 296: Advanced Problems in Tectonics (Cowgill)**

*Graduate course breadth area: #1*

Topic: Anatomy of an Orogen: Geologic Evolution of the Caucasus.

**GEL 298: TBD (Mukhopadhyay)**

*CRN: TBD*

*Graduate course breadth area: #2*

Description coming soon.

**GEL 298: TBD (Gold)**

*CRN: TBD*

*Graduate course breadth area: #4*

*Taught alongside GEL 107*

Description coming soon.

**GEL 298: TBD (TBD)**

*CRN: TBD*

*Graduate course breadth area: #TBD*

Description coming soon.

## Spring 2024

### **GEL 232: Oceans and Climate Change (Hill)**

*Graduate course breadth area: #4*

This graduate course looks at the connections between oceans, earth, and climate systems. Topics vary by year and are selected by students and faculty. Recent topics have included reconstruction of past climates of western North America through the Holocene, and the history and future of oxygen minimum zones in the ocean. Class is structured to feature peer reviewed literature as well as including elements of public science communication on oceans and climate change.

### **GEL 251: Isotope Geochemistry & Cosmochemistry (Yin)**

*Graduate course breadth area: #2*

Description coming soon.

### **GEL 253: Petrology seminar (Ratschbacher)**

*Graduate course breadth area: #1*

This seminar will focus on recent topics of arc magmatism with an emphasis on understanding the physical, chemical, and temporal evolution of arc magmas in the crust. Lecture and discussion topics will include differentiation processes in the crust, magma ascent and emplacement, geochronology, and the role of water in magmatic processes. In addition, the seminar will focus on introducing students to petrological tools such as geothermobarometry, trace element and isotopic studies, optical analysis of rocks, and identification of magmatic to solid-state fabrics. Lecture topics as well as papers discussed in the discussion section can be changed based on the interest of participating students.

### **GEL 290: Seminar (TBD)**

*Does not count as a breadth or general course for graduate degree requirements.*