Course Change Request

New Course Proposal

Date Submitted: 02/16/21 9:06 am

Viewing: GEOL 510 : Advanced Structural Geology

Last edit: 02/16/21 9:06 am

Changes proposed by: muhen

In Workflow

1. **AOES Chair**
2. **SC Curriculum Committee**
3. SC Associate Dean
4. Assoc Provost-Graduate
5. Registrar-Courses
6. Banner

Approval Path

1. 02/16/21 7:41 am Jim Kinter (ikinter): Rollback to Initiator
2. 03/02/21 10:25 am Jim Kinter (ikinter): Approved for AOES Chair

Are you completing this form on someone else's behalf?

Yes

Requestor:

Name	Extension	Email
Paul Betka	3455	pbetka@gmu.edu

Effective Term: Fall 2021

Subject Code: GEOL - Geology

Course Number: 510

Bundled Courses:

Is this course replacing another course? No

Equivalent Courses:

Catalog Title: Advanced Structural Geology

Banner Title: Advanced Structural Geology

Will section titles vary by semester? No

Credits: 3

Schedule Type: Lecture

Hours of Lecture or Seminar per week: 3

Repeatable: May be only taken once for credit, limited to 3 attempts (N3)

Max Allowable Credits: 3

Default Grade Mode: Graduate Regular

Recommended Prerequisite(s):

GEOL 401 or equivalent and graduate standing. Undergraduates that have taken Geol 401 my enroll with approval of instructor.

Recommended Corequisite(s):

Required Prerequisite(s) / Corequisite(s) (Updates only):

Registrar's Office Use Only - Required Prerequisite(s)/Corequisite(s):

And/Or	(	Course/Test Code	Min Grade/Score	Academic Level	)	Concurrency?

Registration Restrictions (Updates only):

Registrar's Office Use Only - Registration Restrictions:

Field(s) of Study:

Class(es):

Level(s):

Degree(s):

School(s):

Catalog Description:

Advanced concepts in structural geology including, stress in the lithosphere, strain analysis, constitutive laws, balanced cross-section construction and restoration, and quantitative analysis of crystal-plastic deformation.

Justification:

A graduate course intended for students conducting research in structural geology and tectonics.

Does this course cover material which crosses into another department? No

Learning Outcomes:

Attach Syllabus

geol510syllabus.pdf

Additional Attachments

Staffing:

Paul Betka

Relationship to Existing Programs:

This will be an elective for ESS MS students and available to graduate students in related programs like ESP.

Relationship to Existing Courses:

This is a more advanced study of structural geology, which is covered for undergraduates in GEOL 401.

Additional Comments:

Reviewer Comments

Jim Kinter (ikinter) (02/16/21 7:41 am): Rollback: Revision needed

Key: 17152

George Mason University
Department of Atmospheric, Oceanic, and Earth Sciences
GEOL 510 ADVANCED STRUCTURAL GEOLOGY – 3 credits

Course description: Advanced concepts in structural geology including, stress in the lithosphere, strain analysis, constitutive laws, balanced cross-section construction and restoration, and quantitative analysis of crystal-plastic deformation.

Learning outcomes Part I, Brittle Structure.

- Apply principles of geomechanics, the 3D state of stress at depth, and relationships among elastic moduli and seismic wave velocity to analyze stress and pore pressure at depth in sedimentary basins.
- Apply rock failure criterion and fracture scaling relationships to predict the mechanisms of brittle deformation under various geological states of stress.
- Analyze fault-related folding in extensional regimes.
- Analyze fault-related folding in thin- and thick-skinned contractional regimes.
- Apply critical taper theory to predict the mechanical evolution of thrust wedges.

Learning outcomes Part II, Ductile Structure.

- Apply techniques of microstructural analysis and the interpretation of deformation textures in thin section, hand samples and the outcrop.
- Apply constitutive equations and plastic flow laws for solid-state deformation of geologic materials to examine the mechanisms and effects of brittle and plastic deformation.
- Recognize and interpret kinematic indicators and perform kinematic analyses of rock fabrics in thin section, hand sample, and outcrop scales.
- Place microstructural observations in the context of local to regional-scale structural observations to interpret a tectonic history.

Class Times
Class will meet twice a week. Weekly classes will be divided into a lecture and groupwork on the problem sets. Students will be asked to complete one problem set every one-two weeks, some problem sets will include a geologic report to synthesize observations and results.

Prior Knowledge
I expect that students have used a petrographic microscope before in at least one prior class. I also expect that students are familiar with, or can catch up on, the basics of mineralogy and crystallography. Students will apply mineral identification skills and basic petrology in class exercises. Recommended prerequisites include courses in structural geology, petrology, field geology, physics, and calculus.

Grading scheme
The work for this class consists of weekly readings and 8 graded problem sets. Some problems sets include short (<1000 word) write-ups to synthesize results.

Final Grade: Problem sets (8, 12.5% ea.)……100%

Grade scale: A+ = 97 - 100%, A = 94 – 97%, A- = 90 – 94%, B+ = 87 – 90%, B = 84 - 87%, B- = 80 - 84%, C+ = 77 - 80%, C = 74 - 77%, C- = 70-74%, D = 60 - 70%, F = 0 - 60%

Week	Description	Homework	Readings
Aug. 23	**Part I:** Tectonic stress field at depth in sedimentary basins	Problem set 1: stress and constitutive laws	Zoback Ch. 1-2
Aug. 30	Constitutive laws and elastic moduli		Zoback Ch. 3
Sept. 6	Failure criterion	Problem set 2: 3D faulting and fractures at depth	Zoback Ch. 4
Sept. 13	Faults and fractures at depth, 3D Mohr Diagrams		Zoback Ch. 5
Sept. 20	Thrust wedge mechanics, critical taper theory	Problem set 3: critical taper theory	Nemcok et al., Ch. 1-3
Sept. 27	Thin-skinned thrust-belt structures	Problem set 4: kinematic modeling	Nemcok et al., Ch. 4
Oct. 4	Thick-skinned thrust-belt structures		Nemcok et al., Ch. 5
Oct. 11	Growth structures	Problem set 5: interpreting slip rates from growth	Nemcok et al., Ch. 6
Oct. 18	**Part II:** Intro. to microtectonics, flow and deformation	Problem set 6: identifying microstructures	Passchier & Trouw Ch. 1-2
Oct. 25	Deformation mechanisms		Passchier & Trouw Ch. 3
Nov. 1	Foliations, lineations, lattice preferred orientations	Problem set 7: shear zones and LPO	Passchier & Trouw Ch. 4
Nov. 8	Shear zones		Passchier & Trouw Ch. 5
Nov. 15	Dilation sites	Problem set 8: veins, fringes, porphyroblasts and reaction rims	Passchier & Trouw Ch. 6
Nov. 22	Porphyroblasts and reaction rims		Passchier & Trouw Ch. 7
Nov. 29	Special techniques and microgauges	EBSD demonstration (field trip?)	Passchier & Trouw Ch. 9-10

DISABILITIES: Students with disabilities or medical conditions that affect classroom performance should contact GMU Disability Support Services immediately at 993-2474. NOTE: Students will not receive any disability accommodations unless official GMU paperwork from Disability Resource Office is provided for and signed by Dr. Paul Betka.

HONOR CODE: Adherence to the GMU honor code is expected of all students. Class exercises are expected to be individual efforts, unless teams are specifically assigned. Students are encouraged to discuss the concepts and procedures among themselves, but each student is expected to complete the lab assignment individually using their own words.

To promote a stronger sense of mutual responsibility, respect, trust, and fairness among all members of the George Mason University Community and with the desire for greater academic and personal achievement, we, the student members of the university community, have set forth this Honor Code: Student Members of the George Mason University community pledge not to cheat, plagiarize, steal, or lie in matters related to academic work.
[http://academicintegrity.gmu.edu/honorcode]