Autumn 2021

**American University of Central Asia**

**Structural geology and Tectonics (AGEO-120)**

Structural geology and Tectonics (AGEO-120)

Autumn 2021 Syllabus

**Lecturer:** Assistant Prof. Cholponbek Ormukov

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**Course schedule** Tuesday 9:25

 Thursday 9:25

**1 Course Description:**

The course of Structural geology and Tectonics (AGEO-120) will be given in Autumn 2020. The course provides a general idea of the geological structures produced by brittle and ductile rock deformation at scales from the local to plate boundaries, and an insight into the relationships between the deformational structures and plate tectonic settings. The emphasis will be made on the description and interpretation of structures visible in the field. This course includes an introduction to the techniques of geological mapping in a structurally complex terrain, and the interpretation of geological maps and sections. Lab exercises will involve calculations and graphical exercises, and for this purpose a basic math preparation is sufficient to follow the course. There will be two day trips for the weekend, including a trip to the Issyk-Ata fault. The weekend trips are tentatively planned for the first and second decades of October 9-10 and October 16-17, respectively: in both cases exact dates will be announced later in class.

**2 Course Aims:**

The main aim of this the course is to better understand how rocks are deformed in geological time at different levels of the lithosphere and methods of analysis of structural forms in geological mapping.

**3 Course objectives:**

Course Objectives: Upon successfully completing the course, students should be able to explain

and apply knowledge and skills central to the domain of professional geologists, including:

* concepts of stress, strain, and deformation
* significance of brittle, plastic, and ductile deformations and their products
* origin and mechanisms of formation of faults, fractures, and folds
* effects of time, temperature, and pressure on deformation
* processes and fabrics that occur in shear zones & their kinematic significance
* field techniques for measuring linear and planar geologic features using a compasses
* construction of objective cross-sections
* deriving tectonic histories from analysis of geologic maps

**4. Course Textbook** :

**Book 1** (Lecture) [Robert J. Twiss](https://www.google.kg/search?tbo=p&tbm=bks&q=inauthor:%22Robert+J.+Twiss%22&source=gbs_metadata_r&cad=2), [Eldridge M. Moores](https://www.google.kg/search?tbo=p&tbm=bks&q=inauthor:%22Eldridge+M.+Moores%22&source=gbs_metadata_r&cad=2). Structural Geology // Second Edition 2006.

**Book 2** (Lecture): B.A. Van Der Pluijm, S. Marshak. Earth Structure – an introduction to structural geology and tectonics (second edition), W.W. Norton & Company Ink., New York – London, 2004, pp. 656 (the hard copy is available at AUCA library). **Book 1** Patrice F. Rey. Introduction to Structural Geology // Download for free from the; <http://www.geosci.usyd.edu.au/users/prey/Patrice_Intro_to_SG.pdf>

**5. Lecture**: A typical class meeting will combine mini-lectures, discussions, group activities, multimedia presentations, and other demonstrations and activities to give you an opportunity to learn concepts in as active a manner as possible.

**6. General course rules:**

1. Students must attend all classes and participate in all activities. Absence is not an excuse for not completing homework and other tasks. Do not forget to complete each task before the start of the class and be prepared to classes.

2. All written assignments must be submitted to the course before the deadline. Tasks submitted after the deadline will not be accepted and evaluated. Late submission will be decreased by subtracting 50% of the grade received.

Absence does not relieve the student of the obligation to check the website and email in the assignment or correspond with the teacher to extend the deadline for completing the assignment.

3. Skip alerts: when a student skips classes due to illness or other valid reasons it is excused absence. If you miss the test / exam due to illness / emergency, please contact the lecturer before the test and present the medical certificate and authentication at the AUCA Medical Office. In this case, you will have the opportunity to test. In other cases, a missed test / exam will be counted as “zero”.

5. Review of work. Students who complete assignments on time are allowed to review them based on teacher feedback. The submitted documents and projects must comply with all the minimum requirements for assigning a rubric. If the assignment does not meet the minimum heading standards, it is considered incomplete work and must be completed by the student in order to be evaluated.

6. The class starts quickly at the appointed time. Being late for a lesson undermines the learning process and does not reflect superiority in the academic environment. Do not interfere with the class when leaving the room and returning back.

7. Laptops / tablets should not be used in the classroom without the approval of the instructor.

8. The use of a mobile phone is strictly prohibited. They should be silenced and removed throughout the lesson.

9. The presentation should be presented in class on the day they should. Late submission will be - 50% of the grade received;

10. Students are expected to follow university policies and student guidelines. All types of plagiarism are strictly prohibited.

Materials needed for labs and lab tests:

* colored pencils (10 or so--good quality)
* H pencils
* set of drafting triangles
* protractor (accurate to at least ½ degree)
* good quality tracing paper
* ruler (centimeters and millimeters) scale
* graph paper (10 or 20 squares per inch)
* drawing compass (for making accurate circles)
* calculator with trigonometric functions

**7. Assignments/Assessment**

Attendance - 10%

Attendance is required and is 10% of your final grade. To be successful in this course, you need to attend classes every time! Attendance sheets will be distributed in each lecture. Each unjustified absence will reduce your attendance score by 4%. If you become ill, you must notify the instructor and present an official document (certificate) from the doctor, especially if you are planning a presentation in the classroom or submit a written assignment. Four unjustified passes will result in an “F” for the entire course.

Lectures activities – 15%

Participation means more than good attendance. Reading has a significant role in the development of students' analytical and critical thinking. You should be prepared to discuss readings during each workshop, as indicated in the schedule. Most of the materials that I give in my lectures can also be found in books, so if you systematically read the literature, you will have a good chance of writing tests successfully. The book is difficult in places, so I would suggest the following strategy:

1. Read the assigned text before each lecture.

2. Take notes during the lecture, referring to my PowerPoint lecture slides.

Labs – 25%

The lab is an important part of this class and makes up 36% of your total class score. There will be 8 labs, the duration of each is one week. Most of the work will be done in groups, but apart from that there will be more individual work that you will have to complete yourself. If you fail to make a labs on time, you will lose 25% assigned for the labs.

Term tests – 25%

During the semester there will be 2 tests. These tests will be consisting of questions from past lectures and laboratory exercises. These tests can be considered as preparatory processes for the final exam. I will announce the specific coverage of each test one week before the tests, and the announcement will be posted on the classroom site. Testing will cover laboratory exercises as well as lecture material. Tests should be completed in the allotted time.

Final exam – 25%

The final exam is a multi-choice test based on the lecture book Structural geology. In case of academic dishonesty, you will receive zero for the job. The test and exam will cover laboratory exercises as well as lecture material. Testing should be completed at the scheduled time. Students should have colored pencils, an eraser, and a calculator with them.

**8. EVALUATION SCHEME**

Attendance - 10%

Lectures activities - 15%

Labs - 25%

Term tests – 25%

Final exam – 25%

**9. Grading system**

Your final grade will be determined as follows:

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| A | A- | B+ | B | B- | C+ | C | C- | D+ | D | D- | F |
| >90 | 86-89 | 82-85 | 78-81 | 74-77 | 70-73 | 66-69 | 62-65 | 58-61 | 54-57 | 50-53 | <50 |

 **10.**  **2021 Autumn Course Calendar – Lecture Sessions (subject to change)**

**Schedule of lecture and laboratory topics: subject to change with notice:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Week** | **Day** | **Lecture titles** | **Lab titles** |
| September | **02/07** | **What are Structural Geology and Tectonics?**Structural Geology, Tectonics and use of models; The Earth’s Crust and Plate Tectonic introduction. (Book 1, Chapter 1, p. 1-9) | Introduction of geological mapping |
| September | **09/14** | **Fractures and Joints**Geometry of Fracture systems; Features of Fractures surfaces; Timing of fractures Formation. (Book 1, Chapter 2, p-37-57) | Introduction to tectonic maps |
| September | **16/21** | **Introduction of faults**Recognition of faults; Determination of Fault Displacement; Fault Geometry. (Book 1, Chapter 3, p 61-81) | Introduction to geological maps  |
| September | **23/28** | **Normal Faults**Characteristic of Normal Faulting; Shape and Displacement of Normal Fault; Structural associations of normal Fault. (Book 1, Chapter 4, p 91-107) | Field trip to Yssyk-Kul area- Fault mapping |
| September/ October | **30/05** | **Thrust and Reverse faults**Recognition of Thrust faults; Shape and Displacement of Thrust faults; Geometry and Kinematics of Thrust faults. (Book 1, Chapter 5, p 115-131) | Field trip to Chunkarchak and Yssyk-Ata faults |
|  |  | **Midterm exam** |  |
| October | **07/12** | **Strike-Slip Faults**Characteristics of Strike-Slip FaultsShape and Displacement of Strike-Slip Faults; Structural associations of Strike-Slip Fault; Kinematic Models of Strike-Slip Faults system. (Book 1, Chapter 6, p- 135-148)  | Structural Analysis tectonic structures |
| October | **14/19** | **Stress**Force, Traction and Stress; The Mohr Diagram for Two-Dimensional Stress; The stress of Tensor(Book 1, Chapter 7, p -151-180) | Fault geometry assessment |
| October | **21/26** | **Mechanic of Fracturing and Faulting**Experimental Fracturing of Rocks; Fracture criterion for Tension Fractures; The Coulomb fracture criterion for confined Compression. (Book 1, Chapter 9, p- 209-226 ) | Explanation type of fractures on brittle rocks  |
| October/November | **28/02** | **Geometrical description of folds** Fold hinge, axis, axial surface, fold crest; Inclined folds and plunging folds; Fold asymmetry, enveloping surface of a fold train; Fold style: parallel, concentric, similar, kink geometries. (Book 1, Chapter 10, p 273-292) | Fold elements and analysis |
| November | **04/12** | **Description of folds** (continuation) | Folding geometry types |
|  |  | **Midterm exam** |  |
| November | **11/19** | **Kinematic Analysis of Folds**Flexural Folding of a Layer; Homogeneous Flattening of Folds; Folding of Multilayers; Fault bend Fold and Fault-Propagation Folding of a Multilayer (Book 1, Chapter 13, p 364-395) | Fault bend Fold and Fault propagation Fold  |
| November | **18/25** | **Rheology**(Book 1, Chapter 16, p 460-487) | Measures of strain rate |
| November/December  | **30/02** | **Brittle deformation** | Work on Synthesis Project |
| December | **07/09** | **Elastic and Ductile deformations** |  |
| December | **14/16** | **Plate boundaries and transform faults** Convergent; Divergent; Transform Topographic and structural expression of mid-ocean ridges; Kinematic behavior of transform faults; Seismicity and topographic expression of transform faults. (Book 1, Chapter 19, p 581-626) |  |
| December | **21/23** | **Plate Tectonics and Mountain Building** • Benioff seismic zones * Intro to Plate Tectonics, Wegner, and Pangea
* Major Plate Boundaries
* Terrain Accretion and Continental Shields
* Plate Tectonics and Mountains
 |  |
|  |  | **Final exam** |  |