Structural Geology
(JEO256E)

The Structural Geology course will involve 13 one hour lecturers and two hour practicals. It is very important that the students attend all the lecturers and practicals. There will be a mid-term exam, and a homework. As part of the course a day field trip to the Çatalca region will be organized. I personally read and mark all the homeworks, so please take it seriously. The final marks are calculated as follows: 65% of the results of the final exam, 30% of that of the mid-term exam, and 5 % homework, attendance etc.

Information on course sylabus, practical handouts (11 pages), past exam questions and answers can be found at the web page http://web.itu.edu.tr/~okay/AralOkayTeaching.htm

For all the lectures please bring along. **a) Pencil, b) Ruler, c) Protractor (açıölçer), d) Electronic calculator, e) Millimetric paper**

You can contact me any time in my room in the Eurasian Institute of Earth Sciences below the "Dekanlık koridoru" or through email (okay@itu.edu.tr).

Syllabus

1) Introduction to structural geology

2) Deformation; strain and stress concepts, elastic, ductile and brittle deformation; changes in the lengths and angles during deformation and their description.

Practical: Changes in lengths during deformation. Please bring along a pencil, protractor, ruler, millimetric paper.

3) The concept of strain ellipse; finite and incremental strain; strain rate, application of the strain ellipse concept to the geology; shear fractures, styllolites and pressure solution.

Practical: Changes in angles during deformation. Please bring along a pencil, protractor, ruler, millimetric paper.

4) Fields of the strain ellipse and their geologic significance; pressure solution and stylolites, strain in three dimensions; Strain ellipsoid, classification of strain ellipsoids (classification according to the absolute e values, Flinn diagram)

Practicals: Use of Flinn diagrams

5) Foliation (cleavage, foliation, schistosity), axial planar cleavage, relation between bedding and cleavage. Relation between the foliation and the strain ellipsoid, crenulation cleavage, Definition and description of dip and strike for planes, plunge and trend for linear structures. Theory behind the streographic projections, representation of planes and lines on the stereograms

Practical: Streographic projections (β diagrammes) of planes

6) Lineation: slickensides, mineral lineation, intersection lineation, boudinage and folding. Relation between the lineation and the strain ellipsoid; Definition and description of plunge and trend for linear structures. Representation of lines on the stereograms

Practical: Streographic projections (β diagrammes) of lines and planes

7) Folds I Fold geometry - fold limbs, hinge, inflexion points, fold hing and fold axis, fold axial plane, monocline, vertical and neutral folds, anticline-antiform, syncline-synform; facing direction of folds; cyclindrical folds; deppressions and culminations, domes and saddles, profile of a fold; fold tightness

Practical: stereographic projections - determination of fold axis determination of plunge and trend of the intersection lineations, passing a plane through two lines, measuring the angle between two lines

8) Folds II Polyharmonic folding; parasitic folds, S, Z and M-folds, chevron and kink folds; conjugate folds; box folds, parallel and similar folds; symmetrical and asymmetrical folds, fold vergence, sheat folds.
Practical: Streographic projections (π diagrammes).

9) Mid-term examination

10) Faults I. Normal faults, representation of normal faults on the block diagrammes;

Practical: Streographic projections: π diagramme of an area in Thrace, contouring of the π diagrammes

23rd April, Field trip to Çatalca

11) Faults II. Listric faults, reverse faults and thrusts. Stratigraphic differences between normal and reverse faults. Nappe, klippe and tectonic window, flat and steeps of the reverse faults, autochthonous and allochthonous units, imbricate and dublex structures, horse.

Practical: Streographic projections: contouring of the π diagrammes

12) Faults III and joints. Strike-slip faults and minor structures associated with such faults; joints and rose diagrammes, fault rocks: cataclasites and mylonites; introduction to stress, principles of stress, Anderson's theory of faulting.

Practical: Busk construction for the folds. Please bring along a compass and a ruler.

13) Faults and earthquakes; Faults and stress; Mohr diagramme; Coulomb Criteria for faulting.

Practical: Finding the principal stress directions from conjugate faults. Use of the Mohr circle for stress and strain. Please bring along a compass and a (crystal plasticity, grain boundary sliding)ruler

14) Faults and earthquakes; Mohr diagramme; Coulomb Criteria for faulting.

Source list for the Structural Geology

Check the webpage http://atlas.cc.itu.edu.tr/~okay/AralOkayTeachingTR.htm for past exam questions and answers and other materials for the course.

The main course text books are:

Ramsay, J.G. and Huber, M.I., 1983, The Techniques of Modern Structural Geology, Volume 1: Strain Analysis. Academic Press, London, 307 pp, ISBN 0-12-576921-0.

Ramsay, J.G. and Huber, M.I., 1987, The Techniques of Modern Structural Geology, Volume 2: Folds and Fractures. Academic Press, London, 393 pp, ISBN 0-12-576922-9.

Both are excellent text books, which cover subjects in much more detail than that can be done in a single course. We have translated several important chapters from both text books into Turkish, which is available in the wed page http://web.itu.edu.tr/~okay/AralOkayTeaching.htm or from the photocopier in the Faculty of Mines.

Also recommended are the following text books:

Davis, G.H., and Reynolds, S.J., 1996, Structural Geology of Rocks and Regions, 2nd edition. John Wiley & Sons, Inc., New York, 776 p. ISBN 0-471-52621-5.

A profusely illustrated, very readable text on structural geology.

Ragan, D.M., 1973, Structural Geology, An Introduction to Geometrical Techniques, 2nd edition. John Wiley & Sons, New York, 208pp, ISBN 0-471-70481-4.

Rowland, S.M., and Duebendorfer, E.M., 1994, Structural Analysis and Synthesis, A Lobarotory Course in Structural Geology. Blackwell Scientific Publications, Boston, 279 pp. ISBN 0-86542-366-0.

Both textbooks are instructive on the geometrical aspects of the structural geology.

All these text books are present in the Mustafa Inan Library.

Prof. Dr. Aral Okay