Structural Geology 206-12311

Teacher: Liran Goren, gorenl@bgu.ac.il, Room 233, Building 58

Course structure:

Lectures – 2hr/w
Practicals - 2hr/w
Field excursions – 2 days

Office hours and communication:

Office hours of Liran Goren: Thursdays between 15:30 – 17:30.
At the beginning of the semester the T/As will announce their weekly office hours.
Teaching material, assignments, and messages will be posted on the course website as part the Moodle system.

Evaluation:

Weekly assignments - 35% (Mandatory submission of 90% of the homework assignments. Assignments that will not be submitted on time will be graded as zero.)
Field reports – 15%
Final exam – 50%
Passing the course is conditioned by a pass grade in each of the evaluation components independently, and by participation in both field excursions.

Literature:

1. Structural Geology, Haakon Fossen, Cambridge University Press.
2. Earth Structure, Ben A. van der Pluijm and Stephen Marshak, WW Norton and Company.

Course topics:

Week	
1	Principles of structural geology: geometrical, kinematic and dynamic analyses. Introduction to deformation and strain.
2	Simple shear, pure shear, tectonites, strain markers (I.e. c-s structures), the strain ellipse.
3	Tensors, the deformation gradient tensor, the small strain tensor, principle axes of finite stain, principle axes of small strain, coordinate transformation, strain invariants, mean strain, deviatoric strain.
4	Force and stress, the stress tensor, Cauchy's stress, principle axes of stress, the relation between the stress tensor and Mohr's diagram, hydrostatic stress, deviatoric stress, differential stress, effective stress.
5	The state of stress in the crust: lithostatic stress and uniaxial strain. Stress state that relates to burial and exhumation (Poisson effect, thermal effect, exhumation fracturing), tectonic stresses, Anderson model.
6	Introduction to rheology: elasticity, plasticity, viscosity.
7	The effect of environmental conditions (confining stress, temperature, etc.) on stress – strain (rate) relationships of natural rocks. Creep

	experiments. Combined rheological models: elasto-plastic, visco-elastic, visco-plastic.
8	Brittle deformation and fracturing: modes, Griffith theory, tensile cracks, control on fracture spacing, exfoliation, radial fractures, morphologies of tensile crack planes.
9	Shear fractures: dynamic and geometric criteria, the combined failure envelope, friction, sliding on weak planes, stress inversion.
10	Faults: geometry, nomenclature, architecture of faults and fault zones, sense of shear indicators, fault rocks.
11	Faults: displacement and growth, subsidiary structures, faults and folding, fault systems, fault and stress, stress inversion.
12	Micro processes of ductile deformation: lattice defects, types of dislocations, dislocation motion, diffusion of vacancies, pressure solution, rheological laws, microstructures related to lattice defects (subgrains, recrystallization, etc.)
13	Folds and folding: geometry and nomenclature, parasitic folds. Dynamics of folding: buckling, bending, and passive folding. Dip isogons, interference patterns.

Field excursions:

Day 1, Maktesh Katan. Geometry, kinematic, and dynamic analysis of fault systems. Main structures: normal faults, fault splays, horst and graben.

Day 2, Nahal Pratzin. Geometry, kinematic, and dynamic analysis of folding and fracturing. Main structures: folds, reverse faults, clastic dikes.