UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Structural Geology

2526-2-E3401Q055

Aims

Giving the basis for the recognition, classification and description of the geological structures, by lectures, practical classes with geological maps, and field activities.

Dublin Descriptors:

Knowledge and understanding
With this teaching, the student will begin to understand the fundamentals of structural geology. He/she will acquire knowledge in the field of structural architectures and related processes and dynamic causes, which will allow him/her to understand and interpret complex geological processes of endogenous type at small and large scale, with particular reference to the geodynamics of extensional, compressional and transcurrent tectonic areas.
Furthermore, he/she will learn the techniques to elaborate geological sections at various scales starting from geological maps and charts, as well as acquire direct knowledge on the ground of geological structures.
Such knowledge is acquired through attendance at lectures, exercises, and field trips under the supervision of teachers.

Ability to apply knowledge and understanding
Thanks to the knowledge acquired, the student will be able to analyze in detail the structure of a given area; independently carry out geological-structural survey activities, also using modern techniques for collecting ground data, organizing and representing the acquired data with appropriate graphs with statistical and/or descriptive value; integrate field and laboratory observations with theoretical knowledge related to the functioning of tectonic systems.

Autonomy of judgment
The student will acquire the ability to characterize and evaluate the reliability of the information collected, the level of uncertainty in the data and measurements, and the complexity of the models available for problem solving. This ability will therefore allow them to independently evaluate the structural characteristics of an area.

Communication skills

Through some examples and discussions in class, the student will acquire awareness of the extreme importance of the ability to communicate in a concise and effective way their assessments and proposed solutions to both a specialist and non-specialist audience.
Furthermore, the student will acquire knowledge of technical terms also in English.

Learning skills
The student will acquire the ability to independently learn new concepts and new theories by drawing on both Italian and foreign literature in English, which will be summarized and presented in the slides in class. Indications on various articles in English for possible further study will also be provided.

Contents

It includes the course of “Structural geology” of Prof. A. Tibaldi, the course of “Geologic cartography” of Prof. F. Bonali and S. Mittempergher, and two days of field training.

Structural geology: Stress and strain. The principal types of deformations: reverse, transcurrent and normal faults, folds, foliations and scistosity, fractures and tectonic joints. Elements of structural geology applied to neotectonics.

Geologic cartography: how to read a geological map and prepare geological-structural cross sections.

Field activities: recognition, measurement and mapping of basic geological structures such as faults, folds and joints.

Detailed program

Course of Structural geology:
Stress and strain.
Simple shear and pure shear.
Fundamental equations and relations in different conditions of pressure, temperature and time.
The scale of deformations.
The principal types of deformations: faults, characteristics, types, classification based on their dip and kinematics, methods and limits of reconstructing fault kinematics, problems and limits for the calculus of fault offset, faults with and without morphological features, possible causes and interactions between endogenous dynamics and exogenous modelling.
Possible associations of reverse, transcurrent and normal faults.
Triple junctions.
Folds: nomenclature, scale, amplitude, wavelength, persistence, coherence and interference, styles in relation with rock rheology, origin of stresses, and crustal environment.
Foliations and scistosity.
Fractures and tectonic joints, types, characteristics, causes and environment of formation.
The main structures linked with magmatic stress and methods for distinguishing them from the tectonic deformations s.s.
Geology of earthquakes. Main methods for the application of structural geology as a contribution for the assessment of seismic hazard. examples of areas in Italy under seismic threat.

Cartography:
Exercises on geological maps containing faults and folds, aimed at learning the methods for the reasoned reading of maps and for the drafting of geological-structural sections on a scale from 1.25,000 to 1:50,000.

Field activity:
Two days dedicated to the field description of brittle and ductile geological structures, their recognition and classification, measurement and transposition on a topographic map.

Prerequisites

Base knowledge of geology. Course on security on the field.

Teaching form

Structural geology: 24 two-hour lectures, in person, Delivered Didactics;

Cartography: 12 three-hour practical classes, in person, Interactive Teaching;

Two daily excursions: 2 six-hours field activities, in person, Interactive Teaching.

The three courses are given in Italian language.

Textbook and teaching resource

Tibaldi Alessandro, 2025. Principi di Geologia Strutturale. Lulu Press, Raleigh, USA, 312 pp (available on: www.Lulu.com).
George H. Davis and Stephen J. Reynolds, 1996. Structural Geology of Rocks and Regions, Editor John Wiley & Sons Inc, 776 pp.

Semester

Second semester

Assessment method

Structural Geology: written exam on 4 open questions related to the delivered didactics and grade out of thirty. There are no ongoing tests.

Cartography: the exam focuses on the development of 2 geological-structural sections and their evaluation out of thirty.

Field activities: the learning path in the two days will be evaluated by questions with multiple choice, and their evaluation out of thirty.

The final grade is a weighted average between the grade obtained in Structural Geology (6/10), in Cartography (3/10) and in the test on the field work (1/10).

Office hours

By appointment fixed by email.

Sustainable Development Goals