



UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Geologia Strutturale

2627-2-E3402Q008

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

The evaluation of the Structural Geology course takes into account the Dublin descriptors, as these find direct application in an integrated evaluation based on three specific components: theory (delivery teaching), cartography and field activities.

The final grade out of thirty derives from a weighted average divided as follows:

- 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).

This specific examination method according to the 5 Dublin descriptors is structured as follows:

1. Knowledge and understanding What is evaluated: The theoretical understanding of rock mechanics, the theory of stresses and deformations, and the characteristics of the main tectonic structures (faults, folds, foliations, etc.). How it is verified: Through the 4 open questions of the written exam of Structural Geology. The student must demonstrate that he/she has assimilated the physical and geometric concepts described in class.
2. Applying knowledge and understanding. What is evaluated: The ability to translate the theoretical notions of tectonics into three-dimensional geometric models and to be able to read the geological structures in the subsurface. How it is verified: Through the Cartography test, which requires the practical development of 2 geological-structural sections starting from the reading of a geological map. The correct projection of strike, dip and dip angle of strata and structures reflects this expertise.
3. Making judgements What is evaluated: The ability to interpret geological-structural data in the field, formulating coherent hypotheses on the deformation history of an area. How it is verified: During the two days of field trips, the teachers assess the student's ability to observe a real outcrop, collect structural measurements and independently interpret the nature of the deformations suffered by the rocks.
4. Communication skills What is evaluated: The appropriate use of the technical glossary of structural geology and the clarity in graphically illustrating a geological section. How it is verified: Both transversally in the quality of the written presentation of the open questions (theoretical exam) and in the precision of the drawing of the structural sections.
5. Learning skills What is evaluated: The ability to connect this teaching to other Earth sciences and to be able to apply structural methods independently in the subsequent compulsory course of Geological Campaign 2 or in the writing of the thesis. How it is verified: Through the evaluation of the global learning path demonstrated during the field trips and thesis's researches, which certifies the student's autonomy in knowing how to orient himself in the face of unprecedented three-dimensional geological problems.

Office hours

By appointment fixed by email.

Sustainable Development Goals
