UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Applied Structural Geology

2627-1-F7402Q049

Aims

To be able to develop structural geology projects through the collection of data at various scales, their analysis, and the development of quantitative models. Particular attention will be dedicated to the applications of structural geology to topics related to sustainability and decarbonization, such as reservoirs of geofluids in fractured rocks, characterized with outcrop analogues. This will also allow for a broader approach to the characterization and prediction of deformation processes across various contexts.

Contents

The course is aimed at developing the ability to collect multi-scale structural data, analyze these data, and develop quantitative models. It is structured around case studies related to both general structural geology (large fault zones) and applied structural geology (characterization and modeling of fracture networks for geofluid reservoir studies, and the general characterization and prediction of deformation states).

Detailed program

During a few modules, which will address case studies related to fracture networks in sedimentary rocks and/or the basement, as well as fault zones in brittle and ductile environments, the following activities will be carried out, simulating all phases of a general or applied structural characterization and modeling project according to the most up-to-date standards:
(1) Geological, structural, and tectonic framework, based on bibliographic data (scientific papers, geological maps, etc.);
(2) Field structural survey at various scales and high-detail surveys using photogrammetric 3D Digital Outcrop Models (DOMs) (UAV/drone or terrestrial);

(3) Data processing, photogrammetric processing, and interpretation on 2D and 3D DOMs;
(4) Quantitative structural analysis at the meso-scale: kinematic analysis and relative chronology, directional statistics, and statistical parameterization of fault and fracture networks;
(5) Microstructural analysis, supported by image analysis techniques, aimed at defining—depending on the case study—deformation mechanisms, mechanical conditions, relationships with vein systems and other evidence of fluid circulation, as well as the textural and hydraulic characteristics of fault rocks, etc.;
(6) Quantitative modeling using analytical or numerical methods selected based on the deformation processes resulting from the analyses;
(7) Discussion of results and conclusions, in relation to the objectives, including applied purposes, of the module/project.

Prerequisites

Having attended the Tectonics and Structural Geology course (F7401Q101) and passed the Field Safety Course (E3401Q033).

Teaching form

Lessons, laboratory experiences, and fieldwork.:
7 one-hour lectures, in person, Delivered Didactics
12 two-hour lab activities, in person, Interactive Teaching
2 six-hour field activities, in person, Interactive Teaching

For meteo-climatic reasons, we are considering the possibility to carry out the field trips before the beginning of the semester, or in the first week. We will send further communications on this topic.

Textbook and teaching resource

Slides, scientific papers, references to selected chapters from textbook, presented in a logical order on e-LEARNING.

Semester

First semester

Assessment method

Report on case studies.

Oral examination regarding all the topics and reports.

Office hours

All days in office hours.

Sustainable Development Goals

QUALITY EDUCATION | CLEAN WATER AND SANITATION | AFFORDABLE AND CLEAN ENERGY | CLIMATE ACTION