UNIVERSITÀ DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Stabilità dei Versanti

2021-1-F7401Q076

Aims

Advanced knowledge of processes and mechanisms of natural and engineered slope instability; ability to recognize and characterize different types of slope instabilities; ability to use stability analysis methods and tools to solve practical problems.

Contents

Theory and techniques for the recognition, characterisation and modelling of slope instability processes in soils and rocks.

Detailed program

Lectures:

1) Slope system and its geological, topographic and hydrological setting; landslide terminology, classification, controls and triggers; landslide risk.

2) Landslide investigations: photo-interpretation and field mapping, monitoring, site investigations (topographic, borehole, geophysical).

3) Slope instability processes: physic-mechanical and constitutive features of soils and rocks relevant to slope

stability; stress distributions and paths in a slope; role of water in slope instability; concept of Safety Factor; total stress and effective stress analyses; short- vs. long-term in slope stability; weakening, softening, and progressive failure; first-time rupture vs. reactivation.

4) Landslide types: large rock slope instabilities: morphostructural features, lithological and structural controls, triggering processes and long-term evolution; rockfalls: processes, characterization and modelling of onset and propagation, susceptibility and risk assessment; rainfall-indiced shallow landslides: characterization, hydrological and mechanical aspects, stability analysis, regional-scale prediction; flow landslides and debris flows: rheology of water-sediment mixtures, onset and propagation processes, field evidence and dynamic modelling.

5) Methods of stability analysis: Limit Equilibrium (LEM) methods for circular failures: Taylor, Fellenius, GLE, Spencer, Bishop simplifiied, Janbu simplified); methods for "structurally-controlled" failure mechanisms (planar and wedge failure, topplings): kinematic analysis and LEM methods; probabilistic and reliability analyses; numerical methods.

6) Monitoring: aims and applications; ground-based and remote surface displacements monitoring techniques; underground deformation monitoring; monitoring of hydro-meteorological variables and pore pressures; monitoring network architecture.

7) Landslide risk mitigation: active vs. passive approaches; slope stabilization techniques; active and passive structural protection; non-structural protection and Early Warning.

Lab work:

1) landslide mapping from aerial photos, ortho-photos and HRDEM, characterization of geological controls and interactions with elements at risk

2) Reconstruction of a landslide geological model from field, site investigation and monitoring data.

3) Application of software tools to the ptactical solution of slope stability problems in soils and rock masses using: a) kinematic stability analysis methods for structurally controlled block failure modes; b) limit equilibrium analysis methods (LEM, deterministic e probabilistic) for soil and rock slopes, including the effects of water, dynamic loading, external actions and stabilization works; c) numerical finite-element methods (SSR-FEM).

Field work:

Field trip in the Central Alps: recognition and mapping of typical features related to different landslide types, visit to important historical or active landslide sites.

Prerequisites

Geology, hydrogeology, engineering geology

Teaching form

- Lectures, 28 hours (4 CFU)
- Lab work, 12 hours (1 CFU)
- Field work, 10 hours (1 CFU)

During the Covid-19 emergency, teaching will be held in mixed mode, with delayed video-recorded lectures and partial physical presence (practical activities, i.e. some labs and fieldwork).

Textbook and teaching resource

Lecture notes and supplementary material

Semester

2nd semester

Assessment method

Oral examination with a discussion on a project assignment and 4 questions on the theory

Office hours

On appointment