

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                        |                                      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|--------------------------------------|
| <b>Course:</b><br>Geological risks in the project of civil engineering works                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                        | <b>Teaching Language:</b><br>Italian |
| <b>SSD (Subject Areas):</b> GEOS-03/B                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                        | <b>CREDITS:</b> 9                    |
| <b>Course year:</b> -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Type of Educational Activity:</b> C |                                      |
| <b>Teaching Methods:</b> in person                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                        |                                      |
| <b>Contents extracted from the SSD declaratory consistent with the training objectives of the course:</b><br>Basics of basic geology · Internal Constitution of the Earth; plate tectonics; volcanism; earthquakes. Tectonics, and main geomorphological processes. · The main outcropping rocks (igneous, sedimentary and metamorphic). · The main geological domains of the centralsouthern Apennines: risks and resources. Notes on the main natural risks · The volcanic risk and the seismic risk · The risk of landslides; classification of landslides: study methods, interventions and monitoring. · Rapid debris-mud flows. · Slow-moving landslides. · Rock landslides. · Torrential alluvial phenomena. · Liquefaction and sudden sinking phenomena (sinkhole). · The hydrogeological risk and the PAI of the Basin Authorities. The analysis of photo interpretation in the design of engineering works - Drafting of basic maps through drone and laser scanner flights; orthophotomaps - Photo interpretation, stereoscopy, recognition of lithotypes, landslides and other morphologies and geological structures. - Exercises on both zenith and frontal stereoscopic pairs for the study of landslides. Areas affected by mud and debris flows - Photointerpretation; slope geomorphology; thickness of the pyroclastic cover; slopes. - Susceptibility to landslides and calculation of the run-out of landslides; estimate of the magnitude of landslides. - Notes on design choices for risk mitigation, interventions and monitoring plan. Areas affected by rock landslides - Photo interpretation of frontal stereoscopic pairs; geology and geomorphology of the wall. - Geological and structural layout of the wall; geomechanical laying and classification of the rock mass. - Susceptibility to collapse; breaking mechanisms and design block estimation. - Notes on the possible intervention planning choices and monitoring plan. Areas affected by slow-moving landslides. - Photointerpretation; geomorphological evolution of landslide slopes. - Anomalies of the hydrographic network and definition of the landslide body in plan. - Investigation plan to evaluate the depth of the sliding surface. - Design choices of interventions for risk mitigation; monitoring plan. Areas affected by hyperconcentrated flows of alluvial fans. - Photointerpretation; geomorphology and characteristics of the catchment area. - Geomorphology of the conoid apparatus; active and fossil conoids; conoids interlocked and superimposed. - Interactions of hyperconcentrated flows with the urbanized. - Definition of the survey campaign for the study of alluvial fans. - indications on the possible design choices of interventions and monitoring plan. The phenomena of liquefaction and sudden sinking (sinkhole) - Liquefaction phenomena and geological characteristics of the sites. - Natural sinkholes and karst areas. - Mining, underground cavities and anthropogenic sinkholes. - Interactions between sinkholes and engineering works. - Investigation plan for the recognition of underground cavities. - Notes on possible interventions and monitoring plan. Execution of detailed technical geological sections and application problems for the design of: Roads; railways; aqueducts; galleries; dams. Educational field-trip - Geostructural analysis of rocky ridges in landslide, geomechanical layings and classification of masses Guided tour of landslide areas and active alluvial fans and related risk mitigation interventions |                                        |                                      |
| <b>Objectives:</b><br>The course aims to provide the different study methodologies for the mitigation of "geological risk" in the design of civil engineering works. The geological-application problems associated with the stability of the slopes affected by both "fast" and slow moving landslides and areas susceptible to liquefaction or sudden sinking ("sinkhole") are dealt with. For the flood hazard, the study of torrential phenomena that feed active alluvial fans is undertaken. Students, also through photointerpretation analyses and on-site inspections, will have the opportunity to practice in the search for possible solutions for the mitigation of geological risk to be taken into account in the design of roads, railways, tunnels and dams.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                        |                                      |

**Propaedeuticities:** none

**Is a propaedeuticity for:** none

**Types of examinations and other tests:**

Written and oral