COURSE DESCRIPTION
DIGITAL MAPS AND GEOLOGICAL 3D MODELS

SSD: GEOLOGIA APPLICATA (GEO/05)

DEGREE PROGRAMME: TRANSPORTATION ENGINEERING AND MOBILITY (P55)
ACADEMIC YEAR 2022/2023

COURSE DESCRIPTION

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GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: NOT APPLICABLE
MODULE: NOT APPLICABLE
CHANNEL: FG A-Z
YEAR OF THE DEGREE PROGRAMME: I
PERIOD IN WHICH THE COURSE IS DELIVERED: SEMESTER I
CFU: 9

REQUIRED PRELIMINARY COURSES

None

PREREQUISITES

None

LEARNING GOALS

The course provides general knowledge about engineering geology and its digital application. It is a multidisciplinary subject of study at the intersection of Earth Sciences and Engineering focused on the geologic phenomena and the role of geological variables and environmental conditions in engineering design and construction. Topics include rock and mineral types, soil properties, rock mechanics, geologic structures, active tectonics, geological mapping and earthquake hazards, slope stability and landslides, groundwater, rivers, and flood hazards. The course introduces the general concepts of geological data acquisition through survey techniques and point clouds. The course also provides the basics for managing and elaborating geospatial data with Geographic

Information Systems (GIS) and building 3D subsurface geological models.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

Students acquire knowledge of methodologies for the identification and analysis of the geological variables and environmental conditions in engineering design and construction. S

Applying knowledge and understanding

tudents are expected to acquire and properly use GIS, statistical analyses and modelling techniques for data collection, management and exploitation aimed at hazard and susceptibility assessments. Students are required to understand and acquire the scientific and technical terminology and to come up with high level discussions about geological application to engineering activities.

COURSE CONTENT/SYLLABUS

•Basic concepts on Geology
o Identification of rocks and soils
o Regional geology
• Geological mapping
o Reading and interpretation of topographic maps
o Digital topographic profiles
o Reading and interpretation of geologic maps
o Digital geologic cross-sections
o Introduction to geodata and GIS
• Investigations for rocks and soils characterization
o Introduction to the main investigations
o Reading and interpretation of boreholes
o Collection and exploitation of meteorological data through statistical analyses
o Collection, storage and exploitation of groundwater data using GIS
o Elaboration of groundwater levels and hydrogeochemical data using GIS
• 3D Geological modelling
o Main survey techniques and point clouds management
o Reconstruction of 3D subsurface geology aimed at hydrogeological models
o 3D rock masses reconstruction
• Hazard assessments
o Engineering geology in the seismic risk assessment
o Landslides and floods
o Landslides and susceptibility mapping using GIS
o Groundwater vulnerability methods using GIS and 3D models

READINGS/BIBLIOGRAPHY

Dearman W.R. (1991). Engineering Geological mapping. Butterworth –Heinemann Ltd.
González de Vallejo L., Ferrer M. (2011). Geological Engineering. CRC Press/ Taylor &Francis Group.
Fetter C.W., Boving T., Kreamer D. (2018). Contaminant Hydrogeology. Waveland press inc.
Sethi R., Di Molfetta A. (2019) Groundwater Engineering. A Technical Approach to Hydrogeology, Contaminant Transport and Groundwater Remediation. Springer.
Freeze A. and Cherry J. (1979). Groundwater. Prentice hall inc.
Griffiths J.S. (2002). Mapping in Engineering Geology. The Geological Society London.
Reddy D.V. (2010). Engineering Geology. Vikas Publishing House.
Scientific papers.
Notes from the lessons.

TEACHING METHODS OF THE COURSE (OR MODULE)

Lectures, interactive tutorials, laboratory activities and exercises. Field trip aimed at data acquiring.
The used software is prevalently open source and only marginally covered by educational licenses.

EXAMINATION/EVALUATION CRITERIA

a) Exam type

- [x] Written
- [x] Oral
- [x] Project discussion
- [x] Other : The exam consists of an oral test and the preparation of reports on the activities carried out during the practice exercise (exploitation and analyses of geological and hydrogeological data, implementation susceptibility maps through GIS, development of 3D geological and hydrogeological models).

In case of a written exam, questions refer to

- [ ] Multiple choice answers
- [ ] Open answers
- [x] Numerical exercises

b) Evaluation pattern