COURSE DESCRIPTION
THREE-DIMENSIONAL DIGITALIZATION. TOOLS AND METHODOLOGY

SSD: DISEGNO (ICAR/17)

DEGREE PROGRAMME: GEOSCIENZE PER L'AMBIENTE, LE RISORSE E I RISCHI NATURALI (DH0)
ACADEMIC YEAR 2025/2026

COURSE DESCRIPTION

TEACHER: REPOLA LEOPOLDO
PHONE:
EMAIL: leopoldo.repola@unina.it

GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: NOT APPLICABLE
MODULE: NOT APPLICABLE
TEACHING LANGUAGE: ITALIANO
CHANNEL:
YEAR OF THE DEGREE PROGRAMME: I
PERIOD IN WHICH THE COURSE IS DELIVERED: SEMESTER I
CFU: 6

REQUIRED PRELIMINARY COURSES

"None"

PREREQUISITES

Basic knowledge of CAD software.

LEARNING GOALS

The course aims to: transfer the necessary knowledge in the field of three-dimensional survey, management and processing of spatial data; provide adequate mastery in the choice and use of the various instruments according to the survey contexts; strengthen the students' critical capabilities to support data management procedures aimed at the correct representation of places and phenomena. The course aims at the management of digital data in each phase of its life cycle: surveying, analysis, design and monitoring.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

The student must demonstrate adequate knowledge in the field of three-dimensional surveying, in the management and processing of spatial data; he/she must demonstrate mastery in the choice and use of the different instruments according to the contexts of study. The student must also be able to control data management procedures for the correct representation of places, in order to critically describe the qualities and phenomena that characterize the surveyed spaces.

Applying knowledge and understanding

The student must be able to define a three-dimensional digitization project of large portions of the territory, optimizing execution times, the data size and the representation requirements of the geomorphological characteristics of the sites. The student must also be able to manage data from first phases of point clouds alignment, to produce analytical models, both polygonal and NURBS, to support the study phases of the contexts, whether they are geological, urban or related to cultural heritage. Students must be able to develop data management strategies within logical models to support the design of digital platforms in a GIS environment, where data analysis and visualization tools are implemented. These activities relate to the development and management phases of the DiSTAR Proximaterra platform active in the Campi Flegrei area.

COURSE CONTENT/SYLLABUS

Frontal Lessons

- Reality based survey. The virtual as a method for analysis and design. Founding principles of the discipline of surveying in three dimensions. Digital technologies for production, management and representation of data to support the land survey phases.
- Technologies for three-dimensional land and coastal surveying. Laser instruments and photogrammetric systems.
- Technologies for three-dimensional underwater surveying. Marine geophysical surveys, prototype photogrammetric and stereophotogrammetric systems.
- Technologies and systems for very high resolution surveying (fossils, minerals, etc.).
- Software and procedures for data management. From point clouds to polygonal models. Analysis and semantic segmentation of models. Principles of reverse engineering and parametric modelling.
- GNSS in precision topographic surveying. Data management and correlation in the GIS environment.

Workshop

- Three-dimensional laser scanner applications.
- Aerial photogrammetric survey.
- Terrestrial photogrammetric survey.
- Structured light scanner applications.
- Post processing. Alignment and georeferencing of models. Optimization and production of drawings in CAD-GIS environment.

READINGS/BIBLIOGRAPHY

LEVY P., (1997). Il virtuale. Raffaello Cortina Editore, Milano, ISBN-10, 8870784460.
REPOLA L., MARAZZI M., TILIA S., (2017). *Constructing and Representing: A new project for 3d surveying of Yazilikaya - Hattuša*. In: The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences. Volume XLII-5/W1, 2017 GEOMATICS &RESTORATION –Conservation of Cultural Heritage in the Digital Era, 22–24 May 2017, Florence, Italy.
REPOLA L. (2013). *Dal rilievo all'exhibit design*. In: Ricerca, formazione e sviluppo di tecnologie innovative. Sperimentazioni sul campo nel settore dei beni culturali archeologici. Napoli: Università degli Studi Suor Orsola Benincasa, pp. 51-78, ISBN 978 88 96055 48 9
DE STEFANO R., REPOLA L., GUERRIERO L., IOVANE D., MORRA V., PAGANO F., DI MARTIRE D., (2021). *Rockfall Threatening Cultural Heritage in the Cumae Archeo-logical site (Phlegrean Fields Park –Naples)*. In: Sustainability, EISSN: 2071-1050, doi.org/10.3390/su13031390.
REPOLA L., LEIDWANGER J., GREENE E.S., (2020). *Digital models for the analysis and enhancement of hybrid spaces: Architecture of the mattanza*. In ISPRS-Archives volume XLIV-M-1-2020 –HERITAGE2020 (3DPast | RISK-Terra) International Conference on Vernacular Architecture in World Heritage Sites. Risks and New Technologies. https://doi.org/10.5194/isprs-archives-XLIV-M-1-2020-443-2020
REPOLA L., VARRIALE G., ILACQUA S., LETIZIA M.A., (2025). *Cumae Archeological Site—Processes and Technologies for the Analysis and Monitoring of Anthropogenic Cavities*. In: Heritage, 2025, 8, 199, doi.org/10.3390/heritage8060199.
REPOLA L., COLLINA C., PIPERNO M., (2020). *La Grotta paleolitica di Roccia San Sebastiano (Mondragone, CE). Una metodologia per l'analisi dei dati in spazi simbolici*. In: Archeologia e Calcolatori, All'Insegna del Giglio s.a.s., pp.167-187, (ISSN 1120-6861, e-ISSN 2385-1953) ISBN 978-88-9285-002-6, e-ISBN 978-88-9285-003-3, doi 10.19282/ac.31.1.2020.05.
REPOLA L., (2023). *Extraction of constructive geometries from numerical models. The city walls in the Hattusa Gorge*. In: DisegnareCon, Volume 16, Number 30, October 2023, ARCHITECTURAL AND ARCHAEOLOGICAL HERITAGE. ISSN 1828-5961, DOI: 10.20365/disegnarecon.30.2023.10.

TEACHING METHODS OF THE COURSE (OR MODULE)

Teaching will be delivered in a dual mode through lectures and workshop activities.

EXAMINATION/EVALUATION CRITERIA

a) Exam type

- ☐ Written
- ☑ Oral
- ☑ Project discussion
- ☐ Other

In case of a written exam, questions refer to

- ☐ Multiple choice answers
- ☐ Open answers
- ☐ Numerical exercises

b) Evaluation pattern

The production of the project paper is binding for access to the oral test. The oral test and the assessment of the project paper will be given equal weight in the candidate's evaluation.