



## **COURSE DESCRIPTION** **3D digital survey for heritage**

**SSD: DISEGNO (ICAR/17)**

DEGREE PROGRAMME: ARCHITECTURE AND HERITAGE (P53)  
ACADEMIC YEAR 2023/2024

## **COURSE DESCRIPTION**

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## **GENERAL INFORMATION ABOUT THE COURSE**

INTEGRATED COURSE: U3997 - INTEGRATED COURSE OF CRITICAL KNOWLEDGE OF ARCHITECTURAL HERITAGE

MODULE: U3998 - 3D digital survey for heritage

TEACHING LANGUAGE:

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 architecture and places. The course aims at the management of digital data in each phase of its life cycle: surveying, processing, visualization, analysis, design.

## **EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)**

### **Knowledge and understanding**

The student must demonstrate adequate knowledge in the field of three-dimensional surveying, in the processing of spatial data; he/she must demonstrate mastery in the choice and use of the different instruments according to the contexts of study. in the selection of software procedures for the optimization of models for the restoration and enhancement of historic buildings and the urban context. The student must also be able to develop data processing strategies for the representation and visualization of information compatible with the fields of exhibit design and digital communication.

### **Applying knowledge and understanding**

The student must be able to define a three-dimensional digitization project of large portions of historical artefacts and architectural contexts, optimizing execution times, the data size and graphic layouts to the needs of the geometrical/configurative reading of places.. 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 study of cultural heritage. The student is also required to have a deep knowledge of surface modelling techniques for production and dynamic verification of design solutions in simulated numerical spaces.

## **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 architectural study phases.
- Technologies for the three-dimensional survey of architecture. Laser instruments and photogrammetric systems.
- Technologies for the three-dimensional survey of urban contexts. Mobile laser scanner, drone photogrammetric survey and prototype stereophotogrammetric systems.
- Technologies and systems for very high resolution surveying. Structured light scanners and photogrammetric micro-digitalization.
- 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.
- Spatial data management and correlation. Introduction to GIS and digital mapping environments.

### **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 environment.

- Digital design.

## READINGS/BIBLIOGRAPHY

GIORDANO A., REPOLA L., (2016). *The double dynamics of knowledge: reality and virtual reality in the enhancement project of Torre Maggiore of Villa Rufolo, Ravello*. In: DISEGNARE CON, Vol 9, N° 17: Musei Virtuali dell'architettura e della città', ISSN 1828-5961.

REPOLA L., MARAZZI M., TILIA S., (2017). *Constructing and Representing: A new project for 3d surveying of Yazılıkaya - Hattuşa*. 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., (2018). *Spazi coesistenti|Coexisting spaces*. In: Salerno Rossella Drawing as (in) tangible representation, Milano, Gangemi Editore International, pp.781-788, ISBN 978-88-492-3651-4.

GARÍ B., COLESANTI G., REPOLA L., SOLER-SALA M., (2018). *De Claustra a Paisajes Espirituales: Proyectos de digital humanities sobre el espacio monástico medieval (siglos XI-XV)*. In Archeologia e Calcolatori. SUPPLEMENTO, p. 155-171, ISSN: 2385-202X, doi: <https://doi.org/10.19282/ACS.10.2018.10>.

DI LUGGO A., CAMPI M., REPOLA L., CERA V., SCANDURRA S., PULCRANO M., FALCONE M., (2019). *Evaluation of historical heritage documentation: Reality base survey and derivative models*. In: The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences. Volume XLII-2/W17, 2019 6th International Workshop LowCost 3D –Sensors, Algorithms, Applications, 2–3 December 2019, Strasbourg, France, pp. 115-122. This contribution has been peer-reviewed. <https://doi.org/10.5194/isprs-archives-XLII-2-W17-115-2019>.

REPOLA L., BRUZELIUS C., (2020). *Monuments and Methods in the age of Digital Technology: A Case Study and its Implications*. In Cultura in Transito Ricerca e tecnologie per il Patrimonio culturale. «L'ERMA» di BRETSCHNEIDER, Roma-Bristol. pp. 15-24, ISBN: 978-88-913-2082-7, ISSN 2612-3711.

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., (2020). *The city walls on the Hattusa gorge. From digital survey to the signs of an architecture*. In: News from the Lands of the Hittites, Scientific Journal for Anatolian Research. Suor Orsola University Press, Napoli, pp.181-200, ISSN: 2611-0555.

DE STEFANO R., REPOLA L., GUERRIERO L., IOVANE D., MORRA V., PAGANO F., DI MARTIRE D., (2021). *Rockfall Threatening Cultural Heritage in the Cumae Archeological site (Phlegrean Fields Park –Naples)*. In: Sustainability, EISSN: 2071-1050, [doi.org/10.3390/su13031390](https://doi.org/10.3390/su13031390).

LEIDWANGER J., REPOLA L., GREENE E.S., SGROI F., (2021). *The Marzamemi Maritime Heritage Project: From the seabed to the museum and beyond*. In: Trinacria, 'an island outside time'. International archaeology in Sicily, a cura di Christopher Prescott, Arja Karivieri, Peter Campbell, Kristian Göransson, Sebastiano Tusa, Oxbow book, Oxford & Philadelphia, pp.45-53, ISBN: 978-1-78925-592-8, ISBN: 978-1-78925-592-8 (epub).

### 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. The final grade, on the basis of the results and skills demonstrated in the discussion of the project paper as well as the topics and papers from the different modules, will be weighted on the CFUs of each course and thus composed as follows: 3D digital survey for heritage 50%; Methodology of historical research in architecture 50%.