



# UNIVERSITÀ DEGLI STUDI DI PALERMO

<b>DEPARTMENT</b>	Ingegneria		
<b>ACADEMIC YEAR</b>	2023/2024		
<b>MASTER'S DEGREE (MSC)</b>	CIVIL ENGINEERING		
<b>INTEGRATED COURSE</b>	EXPERIMENTAL DYNAMICS, MONITORING AND BIM - INTEGRATED COURSE		
<b>CODE</b>	21624		
<b>MODULES</b>	Yes		
<b>NUMBER OF MODULES</b>	2		
<b>SCIENTIFIC SECTOR(S)</b>	ICAR/08, ICAR/06		
<b>HEAD PROFESSOR(S)</b>	LO BRUTTO MAURO	Professore Associato	Univ. di PALERMO
<b>OTHER PROFESSOR(S)</b>	LO BRUTTO MAURO	Professore Associato	Univ. di PALERMO
	MASNATA CHIARA	Ricercatore a tempo determinato	Univ. di PALERMO
<b>CREDITS</b>	12		
<b>PROPAEDEUTICAL SUBJECTS</b>			
<b>MUTUALIZATION</b>	3D AND BIM SURVEY - Corso: INGEGNERIA DEI SISTEMI EDILIZI 3D AND BIM SURVEY - Corso: BUILDING ENGINEERING		
<b>YEAR</b>	2		
<b>TERM (SEMESTER)</b>	Annual		
<b>ATTENDANCE</b>	Not mandatory		
<b>EVALUATION</b>	Out of 30		
<b>TEACHER OFFICE HOURS</b>	<b>LO BRUTTO MAURO</b> Monday 09:00 12:00 Dipartimento di Ingegneria - Area Geomatica - viale delle Scienze - Edificio 8 - scala F6 - secondo piano. Tuesday 09:00 12:00 Dipartimento di Ingegneria - Area Geomatica - viale delle Scienze - Edificio 8 - scala F6 - secondo piano.		

**DOCENTE:** Prof. MAURO LO BRUTTO

<b>PREREQUISITES</b>	Dynamics of systems with more than one degree of freedom. Dynamics of continuous systems. Frequency domain analysis. Aleatoric dynamics. Topographical measurement notions.
<b>LEARNING OUTCOMES</b>	<p>Knowledge and understanding The student, at the end of the course, will have acquired knowledge and methods to address and solve in original ways problems related to the monitoring of structural vibrations in both civil and mechanical fields.</p> <p>Applying knowledge and understanding The student at the end of the course will be able to independently develop vibration monitoring projects together with methodologies for the study of the effects induced by vibrations.</p> <p>Making judgments The student will be able to critically analyze and evaluate effectively the risk of any records of structural vibrations.</p> <p>Communication The student will be able to communicate competently and with appropriate terms complex problems of mechanical language of vibrations even in highly specialized settings.</p> <p>Learning skills The student will be able to deal autonomously with issues related to the dynamics of structures and monitoring. The student will be able to analyze complex issues such as the dynamic response of structures even with non-linear behaviour, the dynamic stability of complex systems, the design of passive vibration control systems.</p>
<b>ASSESSMENT METHODS</b>	Oral exam and presentation of a Case study. The vote is expressed in thirtieths with possible praise, according to the scheme reported at the bottom of the degree program homepage, i.e. "Metodi di valutazione". The presentation of the Case study will be related to the topics discussed during the course, such as monitoring of structural vibrations in civil and mechanical engineering fields, control and stability of complex systems, vibration-induced effects, sensors and testing devices, BIM modeling.
<b>TEACHING METHODS</b>	Lectures, practical exercises, workshops, and webinars. The lessons of the part "Experimental Dynamics and Monitoring" will be given in English.

**MODULE  
3D AND BIM SURVEY**

*Prof. MAURO LO BRUTTO*

**SUGGESTED BIBLIOGRAPHY**

Materiale didattico fornito dal docente, dispense, articoli riviste

<b>AMBIT</b>	20558-A scelta dello studente
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<b>INDIVIDUAL STUDY (Hrs)</b>	98
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<b>COURSE ACTIVITY (Hrs)</b>	52
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**EDUCATIONAL OBJECTIVES OF THE MODULE**

The module is aimed to give information on the most important Geomatics techniques for the geometric analysis of buildings and structures. During the course, the laser scanner survey for the modelling of buildings in BIM environment will be discussed and in particular the Scan-to-BIM approach.

**SYLLABUS**

Hrs	Frontal teaching
7	General concepts on 3D survey techniques. Review of topographic survey techniques. Modern topographic survey tools.
7	General concepts on terrestrial photogrammetry and RPAS (Remote Piloted Aircraft Systems) photogrammetry. Applications of photogrammetry for 3D survey.
7	Theoretical principles of the terrestrial laser scanner. Procedures for surveying. The terrestrial laser scanner for 3D modelling.
7	Introduction to BIM concepts. The Scan-to-BIM approach for the management and maintenance of existing buildings.

Hrs	Practice
6	Instruments for geometric surveying. Total station survey.
6	Photogrammetry survey and processing.
6	Laser scanner survey acquisitions and processing.
6	Exercises on the Scan-to-BIM process. Case study presentation.

**MODULE**  
**EXPERIMENTAL DYNAMICS AND MONITORING**

*Prof.ssa CHIARA MASNATA*

**SUGGESTED BIBLIOGRAPHY**

Vibration Monitoring, Testing, and Instrumentation

Edited by Clarence W. de Silva The University of British Columbia Vancouver, Canada Ltfi) CRC Press, Boca Raton London New York CRC Press is an imprint of the Taylor & Francis Group, 2007

ISBN 9781420053197

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**EDUCATIONAL OBJECTIVES OF THE MODULE**

The course, which will be given in English, aims at providing the criteria and methods for the design of any structural monitoring system, even from remote, and the analysis and design of structural control systems. In this context, basic knowledge related to the use of sensors suitable for structural monitoring will be provided, as well as the consequent acquisition, processing, and analysis of the recorded signals.

Several structural dynamic identification methods will be analyzed and implemented in Matlab environment. Further, various practical applications will also be carried out both with guided tours in the laboratory and on full-scale structures, with the aim of learning how to use the necessary devices for dynamics tests and structural monitoring procedures.

**SYLLABUS**

<b>Hrs</b>	<b>Frontal teaching</b>
3	Sampling and acquisition of signals
3	Basics of Signal analysis
2	Displacements and accelerations measurement devices. Tools for structural excitation: Shaker, shaking tables and impact hammers. Contact-less vibration measurements: single point contact, Laser Scanner Vibrometer, Radar Interferometer
4	Analysis of single and multi-degree of freedom dynamical systems in the time domain
4	Analysis of single and multi-degree of freedom dynamical systems in the frequency domain
4	Identification methods for single degree of freedom systems
4	Dynamics identification methods and monitoring for multi degree of freedom structures
4	Seismic base isolation and vibration control
<b>Hrs</b>	<b>Practice</b>
3	Experimental Vibration tests of single-degree-of-freedom systems in the Laboratory
2	Experimental devices and tests for structural control and Monitoring
3	Experimental Vibration tests of multi-degree-of-freedom systems in the Laboratory
4	Experimental modal analysis
4	Application of dynamic identification methods on multi-degree-of-freedom structures.
4	Experimental monitoring test with accelerometers and Interferometric Radar
4	Presentation of case studies of structural monitoring. Guided Skype visit in national and international experimental dynamics laboratory