UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria		
ACADEMIC YEAR	2022/2023		
MASTER'S DEGREE (MSC)	BUILDING ENGINEERING		
INTEGRATED COURSE	EXPERIMENTAL DYNAMICS, MONITORING AND BIM - INTEGRATED COURSE		
CODE	21624		
MODULES	Yes		
NUMBER OF MODULES	2		
SCIENTIFIC SECTOR(S)	ICAR/08, ICAR/06		
HEAD PROFESSOR(S)	LO BRUTTO MAURO	Professore Associato	Univ. di PALERMO
OTHER PROFESSOR(S)	LO BRUTTO MAURO MASNATA CHIARA	Professore Associato Ricercatore a tempo determinato	Univ. di PALERMO Univ. di PALERMO
CREDITS	12		
PROPAEDEUTICAL SUBJECTS			
MUTUALIZATION			
YEAR	2		
TERM (SEMESTER)	1° semester		
ATTENDANCE	Not mandatory		
EVALUATION	Out of 30		
TEACHER OFFICE HOURS	**LO BRUTTO MAURO** 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

PREREQUISITES	Dynamics of systems with more than one degree of freedom. Dynamics of continuous systems. Frequency domain analysis. Aleatoric dynamics. Topographic survey and statistical analysis of measurements.
LEARNING OUTCOMES	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. He will also have knowledge of 3D surveying and parametric modeling of buildings. 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 and 3D survey projects of buildings and structures. Making judgments The student will be able to critically analyze and evaluate effectively the risk of any records of structural vibrations, to identify the most appropriate approach for geometric knowledge of the structures. Communication The student will be able to communicate competently and with appropriate terms complex problems of mechanical language of vibrations and 3D survey even in highly specialized settings. Learning skills The student will be able to deal autonomously with issues related to 3D geometric knowledge of the structures, 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 behavior, the dynamic stability of complex systems, the design of passive vibration control systems, the management of geometric data in the BIM environment.
ASSESSMENT METHODS	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, 3D survey and BIM modeling. There will be an intermediate test at the end of the first module, based on a discussion of a case study related to the topics discussed during the module.
TEACHING METHODS	Lectures, practical exercises, workshops, and webinars. The lessons of the "Experimental Dynamics and Monitoring" part will be given in English.

MODULE
3D AND BIM SURVEY

Prof. MAURO LO BRUTTO

SUGGESTED BIBLIOGRAPHY	
Materiale didattico fornito dal docente, dispense, articoli riviste	
AMBIT	20562-A scelta dello studente
INDIVIDUAL STUDY (Hrs)	98
COURSE ACTIVITY (Hrs)	52
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 of structural monitoring. Monitoring with topographic techniques. Main instruments for geometric monitoring. Robotic total stations.
7	General concepts on terrestrial photogrammetry and RPAS (Remote Piloted Aircraft Systems) photogrammetry. Applications of photogrammetry for the monitoring of structures.
7	Theoretical principles of the terrestrial laser scanner. Procedures for surveying. The terrestrial laser scanner for 3D modelling and monitoring.
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

AMBIT	20562-A scelta dello studente
INDIVIDUAL STUDY (Hrs)	98
COURSE ACTIVITY (Hrs)	52

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 Matlbab 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

Hrs	Frontal teaching
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

Hrs	Practice
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