



# UNIVERSITÀ DEGLI STUDI DI PALERMO

<b>DEPARTMENT</b>	Ingegneria
<b>ACADEMIC YEAR</b>	2022/2023
<b>MASTER'S DEGREE (MSC)</b>	CIVIL ENGINEERING
<b>SUBJECT</b>	PRINCIPLES OF APPLIED CIRCULAR ECONOMICS FOR CIVIL BUILDING ENGINEERING
<b>TYPE OF EDUCATIONAL ACTIVITY</b>	D
<b>AMBIT</b>	20558-A scelta dello studente
<b>CODE</b>	22315
<b>SCIENTIFIC SECTOR(S)</b>	ICAR/04
<b>HEAD PROFESSOR(S)</b>	DI MINO GAETANO      Professore Associato      Univ. di PALERMO
<b>OTHER PROFESSOR(S)</b>	
<b>CREDITS</b>	6
<b>INDIVIDUAL STUDY (Hrs)</b>	98
<b>COURSE ACTIVITY (Hrs)</b>	52
<b>PROPAEDEUTICAL SUBJECTS</b>	
<b>MUTUALIZATION</b>	
<b>YEAR</b>	1
<b>TERM (SEMESTER)</b>	2° semester
<b>ATTENDANCE</b>	Not mandatory
<b>EVALUATION</b>	Out of 30
<b>TEACHER OFFICE HOURS</b>	<b>DI MINO GAETANO</b> Wednesday 15:00 - 17:00    da definire

DOCENTE: Prof. GAETANO DI MINO

<b>PREREQUISITES</b>	knowledge of the topics of Bachelor's degree in civil engineering with detail reference to: road design, geotechnics, building technology and appraisal and economics
<b>LEARNING OUTCOMES</b>	<p>Knowledge and understanding Acquisition of knowledge and methodologies to interpret and manage the specific phases of the engineering process such as the design, construction, maintenance and decommissioning of a civil work according to a circular economic model. Development of skills to acquire the suitable assessment method of circularity rate of a construction product and of a construction process in the Civil Engineering framework.</p> <p>Applying knowledge and understanding Acquisition of knowledge and methodologies to keep up with the ecological transition and the principles of environmental, economic and social sustainability, which are the priority criteria for the design, construction and maintenance of civil engineering works, regulated by the legislator and required by the market. Autonomy of judgment Acquisition and formation of the concepts on linear and circular economic models, with reference to the manufacturing processes of raw and secondary construction products and civil engineering works, capable of allowing a complete and integrated vision of the various aspects dealt with. Such a vision leads to an autonomous analysis of any problem inherent to the topics of the course and to face it with a good set of skills, the result of the examination of the case studies and research carried out during the course. Communication skills Development of specific communication skills consisting in written and verbal treatment, with adequate language properties, of issues such as: the traditional economic paradigm (linear model) and the innovative economic paradigm (circular model); the reuse, refurbishment and recycling of resources; methods for assessing the circularity of engineering products and processes; building materials in civil engineering; linear executive processes of civil engineering; ; circular executive processes of the civil engineering; close-loop economic technical models; cross-sector circularity (open-loop models); notes on dynamic systems for the analysis of applying the circular economy on a territorial scale.</p> <p>Learning ability Ability to update and deepen, by consulting the scientific publications on the circular economy and sustainability implemented in the field of engineering, on innovation of design and construction processes as well as the use of non-traditional and alternative materials. Use of the wealth of knowledge acquired during the course, for the conscious participation in second-level masters, in-depth courses, in specialized seminars on specific topics of the course</p>
<b>ASSESSMENT METHODS</b>	The final assessment will be made through an individual oral examination by a score up to 30. The candidate must answer at least three questions that cover the entire syllabus. The pivotal criteria of the oral exam are: knowledge and mastery of subject content; enforcement capacity and conceptual rigor; expressive and explaining capacity, multidisciplinary connection and original reworking. the evaluation in terms of 30/thirty is based on the following criteria within the voting range: 18/21 overall sufficient knowledge, skills and expression; 22/24 overall fair knowledge, skills and expression; 25/27 overall good knowledge, skills and expression; 28/30 overall very good knowledge, skills and expression; 30 cum laude/excellent knowledge, skills and expression.
<b>EDUCATIONAL OBJECTIVES</b>	The objective of the module is to provide and train the technical and economic skills inherent to the entire life cycle of the civil infrastructure upon circular and sustainable vision. The approach to the study of the various topics is centered on case histories and research and professional experiences of the teacher, accompanied by cutting-edge methods to evaluate the current degree of circularity and by recycling techniques of construction resources to increase such a degree, due to new market needs and to regulations and standards which increasingly privilege and favor the ecological transition
<b>TEACHING METHODS</b>	lessons, exercises, educational workshop with periodic meeting in presence and on-line (if required)
<b>SUGGESTED BIBLIOGRAPHY</b>	Gaetano Di Mino - Dispense del Corso 2022-23 Ellen Mac Arthur Foundation - Circularity Indicators/project - PANTA Ellen Mac Arthur Foundation - Circularity Indicators/methodology - PANTA Strade -Teoria e Tecnica delle Costruzioni Stradali vol.2 Pearson ISBN 9788891903044

## SYLLABUS

Hrs	Frontal teaching
2	summary of the course

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Hrs	Frontal teaching
5	the economic models of the civil construction sector: the linear model; the circular model
10	Assessment method of circularity over close loop model: product level methodology with material circularity indicators and complementary ones; notes on company level methodology
6	The circularity potential of a product over national scale: supply/demand analysis; product performance assessment; regulations thresholds ; circularity potential calculation.
5	Assessment method of the product circularity over open loop model (cross sector collaboration): data analysis and calculation over different construction civil sector
Hrs	Practice
8	The Material Circularity Index of products for construction over an close loop model: MCI calculation of a raw material (soil); MCI calculation of a secondary material (bituminous mixture)
4	Circularity assessment of the Construction and Demolition Waste for road infrastructure construction
Hrs	Workshops
4	the products for construction in civil engineering: raw materials (soil and natural aggregates); secondary materials (bituminous mixture and concrete)
4	alternative materials for construction: scrap materials; waste materials.
2	traditional production and execution processes (linear model)
4	production and execution processes according to the circular economic model: re-use, refurbishment and recycling of the resources
6	Impact analysis of the circular economic model through System Dynamics tool