



UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Scienze Agrarie, Alimentari e Forestali		
ACADEMIC YEAR	2023/2024		
MASTER'S DEGREE (MSC)	LANDSCAPE ARCHITECTURE		
INTEGRATED COURSE	TECHNOLOGIES OF GREEN AREAS AND URBAN HYDROLOGY - INTEGRATED COURSE		
CODE	20962		
MODULES	Yes		
NUMBER OF MODULES	2		
SCIENTIFIC SECTOR(S)	AGR/02, AGR/08		
HEAD PROFESSOR(S)	CAROLLO FRANCESCO	Professore Associato	Univ. di PALERMO
	GIUSEPPE		
OTHER PROFESSOR(S)	IACUZZI NICOLÒ	Ricercatore a tempo determinato	Univ. di PALERMO
	CAROLLO FRANCESCO	Professore Associato	Univ. di PALERMO
	GIUSEPPE		
CREDITS	12		
PROPAEDEUTICAL SUBJECTS			
MUTUALIZATION			
YEAR	2		
TERM (SEMESTER)	1° semester		
ATTENDANCE	Not mandatory		
EVALUATION	Out of 30		
TEACHER OFFICE HOURS	<p>CAROLLO FRANCESCO GIUSEPPE</p> <p>Tuesday 15:00 17:00 stanza n. 127 Edificio 4 Wednesday 14:00 16:00 stanza n. 127 Edificio 4 Friday 09:00 11:00 stanza n. 127 Edificio 4</p> <p>IACUZZI NICOLÒ</p> <p>Monday 09:00 12:00 tutti i giorni previo appuntamento via mail: nicolo.iacuzzi@unipa.it Tuesday 09:00 13:00 Stanza docente, Edificio 4, ingresso L, secondo piano. Wednesday 09:00 12:00 Polo Universitario di Caltanissetta</p>		

DOCENTE: Prof. FRANCESCO GIUSEPPE CAROLLO

PREREQUISITES	Knowing the general principles of agronomy and skills on graphic representation and on the use of CAD tools.
LEARNING OUTCOMES	<p>Knowledge and understanding: Acquisition of the ability to set suitable design choices for the management of urban outflows according to the concept of hydraulic invariance. Ability to evaluate the irrigation needs necessary to maintain and manage urban green areas. Ability to use the specific language of the discipline and to speak with knowledge of causes.</p> <p>Autonomy of judgment: Being able to prepare the planning lines inherent the urban green areas and the hydraulic works used to mitigate hydraulic risks.</p> <p>Communication skills: Knowing the way to expose the projects to an expert and non-expert public. Being able to support the importance and highlight the environmental effects of the proposed choices. Ability to update through the consultation of scientific publications specific to the sector. Learning skills: Ability to follow, using the knowledge acquired in the course, specialized seminars in the sector.</p>
ASSESSMENT METHODS	<p>The exam consists of an oral test, with questions on the topics and on the practical examples addressed in the class, aimed to verify the disciplinary knowledge, as well as the ability to use the language of the discipline.</p> <p>Evaluation is expressed in thirtieths. The minimum threshold mark will be reached from students who show, in general terms, a limited knowledge and comprehension of the treated topics and minimal skills to solve the proposed problems. Students should also demonstrate to be able to transmit their knowledge. Below this threshold, the exam will be insufficient. On the other hand, the more the students are able to interact with the examiners and to express in detail their knowledge and application skills, the more positive will be the evaluation. The evaluation (minimum grade is 18 and maximum is 30 cum laude) is stated using the following scheme:</p> <ol style="list-style-type: none">1) Basic knowledge of the matter, with limited capability to apply the learned knowledge, to analyze the studied problems, and to present the topics is judged sufficient (18-21);2) Not very thorough knowledge of the matter, capability to apply the learned knowledge, to analyze the studied problems, to present the topics is judged fair (22-25);3) In-depth knowledge of the matter, with adequate capability to apply the learned knowledge, to analyze the studied problems, and to present the topic is judged between good and high (26-28);4) Very good knowledge of the topics, with excellent capability to apply the learned knowledge, to analyze the studied problems, and to present the topic is judged excellent (29-30 cum laude).
TEACHING METHODS	Lecturers and practical training in the classroom. Technical visits.

MODULE
HYDROLOGY OF GREEN AREAS

Prof. FRANCESCO GIUSEPPE CAROLLO

SUGGESTED BIBLIOGRAPHY

Charlesworth S., Booth C.A. Sustainable surface water management: A handbook for SuDS. John Wiley & sons, Ltd. ISBN 9781118897706.

Diapositive ed appunti relativi agli argomenti trattati a lezione. (Slides and notes illustrated during the course)

AMBIT	50366-Ecologia del Paesaggio e Ingegneria Naturalistica
INDIVIDUAL STUDY (Hrs)	102
COURSE ACTIVITY (Hrs)	48

EDUCATIONAL OBJECTIVES OF THE MODULE

Knowing the main hydrological processes occurring in the urban environment and how to identify innovative solutions, methods, and tools to improve environmental conditions of urban areas. Acquiring tools for the profession in the field of green technologies, with specific reference to the basic concepts of agricultural and technical hydrology applied in urban areas. At the end of the course, the student will be able to know and plan the most advanced green technologies for the mitigation of hydraulic risk, on the basis of conscious and reasoned choices, also in light of economic and social evaluations.

SYLLABUS

Hrs	Frontal teaching
1	Introduction to the course. Contents and aims. Method of the final exam and evaluation criteria.
5	Agricultural hydrology: Hydrostatics and hydrodynamics of water in agriculture. Soil-water relationships: Physical-mechanical characteristics of the soil (gravimetric and volumetric water content, physical and effective porosity, apparent density). Water potential and its components. Soil water retention curve. Field capacity and wilting point. Plant available water. Principles of water movement in saturated porous media. Filtration and permeability; Darcy's law. The movement of water in unsaturated porous media. Infiltration and redistribution processes. Soil water profiles. Generalized Darcy law.
4	Water balance of the water in the soil and evapotranspiration estimate: Agro-hydrological modeling and application of the FAO-56 model. Water evaporation and transpiration. Methods for estimating evapotranspiration in urban areas. Determination of actual evapotranspiration.
4	Principles of technical hydrology: collection of hydrological data. Rainfall intensity. Precipitation and meteoric inflows. Inflow-outflow models. Water catchment area and its geometric characteristics. Evaluation of flood discharges. Time concentration method. Flood lamination.
4	Irrigation systems for urban green: Types of irrigation systems for urban green areas. Sprinkler and micro irrigation systems. Simplified hydraulic design criteria.
8	Innovative tools and technologies for urban green areas: Tools and methodologies to design and manage irrigation systems in urban recreational and sports areas (parks, gardens and green roofs). Environmental sensors. Hydraulic and hydrological invariance. Tools and methodologies to design and manage the hydraulic works used to mitigate hydraulic risk. Sustainable urban drainage systems and green and blue infrastructures (SuDS, Sustainable drainage systems). Green roofs, permeable floors, draining trenches, depression and infiltration basins, gardens and green infrastructures for accumulation of rainwater.
Hrs	Practice
18	- The planned activities will allow to face to the design from a hydraulic/hydrological point of view. - Application of the hydraulic invariance concept to solving practical cases.
Hrs	Others
4	Technical visits.

**MODULE
GREEN TECHNOLOGIES FOR THE URBAN ENVIRONMENT**

Prof. NICOLÒ IACUZZI

SUGGESTED BIBLIOGRAPHY

Materiale didattico distribuito dal docente

Testi Fondamentali

- Francesco Orsini, Agricoltura urbana, Edagricole, 2023.
- Matteo Fiori (a cura di), "Coperture a verde – Ricerca, progetto ed esecuzione per l'edificio sostenibile". Hoepli, 2011
- Fabio Veronesi, Tappeti erbosi - Costruzione e Manutenzione -, Edagricole, 2022.

Letture Integrative

- Maurizio Corrado, Le piante e l'architetto. Sistemi Editoriali, 2010.
- Gianni scudo, Spazi verdi urbani. Sistemi Editoriali, 2003.
- Maurizio Corrado, Vegetecture, Sistemi Editoriali, 2011.
- Paolo Abram, Il verde pensile. Progettazione dei sistemi. Manutenzione. Sistemi Editoriali, 2004.
- Paolo Abram, Giardini pensili. Coperture a verde e gestione delle acque meteoriche.
- Bellomo Antonella, "Pareti verdi – Linee guida alla progettazione". Sistemi Editoriali, 2003
- Paolo Abram, "Verde pensile in Italia e in Europa". Il Verde Editoriale , 2006.
- Maurizio Corrado, Il verde verticale. Sistemi Editoriali, 2010. Sistemi Editoriali, 2004
- Elena Giacomello, "Copertura a verde e risorsa idrica – Implicazioni tecnologiche e benefici per l'ambiente urbano". Franco Angeli 2012.
- Woods Ballard, B, Wilson, Udale-Clarke, H, Illman, S, Scott, T, Ashley, R, Kellagher, R. The SuDS Manual. © CIRIA 2015. ISBN: 978-0-86017-760-9.

AMBIT	50366-Ecologia del Paesaggio e Ingegneria Naturalistica
INDIVIDUAL STUDY (Hrs)	102
COURSE ACTIVITY (Hrs)	48

EDUCATIONAL OBJECTIVES OF THE MODULE

The information provided with the module "GREEN TECHNOLOGIES FOR THE URBAN ENVIRONMENT" constitute the necessary basis for understanding the issues inherent in the design and construction of green roof areas, rain gardens, vertical greenery, tall vegetable gardens and grassed areas in an urban environment. The course introduces students to the knowledge of techniques, species and materials for creation and management of systems (intensive and extensive) of green roofs at different levels of cultural inputs, rain gardens and grassed areas. Through the presentation of case studies and classroom exercises, students are provided with practical examples of achievements in different environmental conditions and on different types of buildings.

SYLLABUS

Hrs	Frontal teaching
2	Presentation of the course.
3	The microclimatic action of vegetation in an urban environment. Evaluation and study of microclimatic effects.
6	Definition and general aspects of green technologies for the urban environment with particular reference to green roofs, vertical green areas, technical grassing and rain gardens.
4	Technical and functional aspects of green technologies for the urban environment (microclimatic conditions, thermal insulation, biodiversity, increase in the social, environmental and economic value of buildings).
4	Main types of green technologies for the urban environment: intensive, extensive, vertical, high gardens.
3	Building integrated agriculture systems.
3	Turfgrass. Historical notes, economic aspects, benefits and agrotechnics.
6	Construction techniques: substrates and species, waterproofing materials, water requirements for the green technologies, for technical grassing and rain gardens in urban environments.
2	Current legislation and regulations on green roofing of buildings.
Hrs	Practice
10	The planned activities will allow to address, from an agronomic point of view, the design of various structures presented during the course.
Hrs	Others
5	Educational visit