UNIVERSITÀ DELLA CALABRIA
DIPARTIMENTO DI **INGEGNERIA DELL'AMBIENTE**

SUSTAINABLE WATER MANAGEMENT

A.A. 2021/2022

Teaching Unit	SUSTAINABLE WATER MANAGEMENT	
Unit Code	27005656	
Degree title (CdS)	ENVIRONMENTAL AND TERRITORIAL SAFETY ENGINEERING	
Degree level	SECOND	
Module code	0773	
Scientific Disciplinary Sector (SSD)	ICAR/02	
Number of ECTS credits (CFU)	6	
Teaching Unit Category (TAF)		
Teaching Unit Qualification	MANDATORY	
Course year	SECOND	
Semester	SECOND	
Instructor	Mario Maiolo	
Other instructors involved	----------	
Module breakdown	**Hours of Lectures**	36
	Hours of Practicals	12
	Hours of Laboratory	---
	Hours of Individual study	102
Content		
Language	ENGLISH	
Mandatory prerequisites	SCENARI DI CAMBIAMENTI CLIMATICI. FLUSSO E TRASPORTO DI CONTAMINANTI NEL SOTTOSUOLO COSTRUZIONI IDRAULICHE PER LO SVILUPPO SOSTENIBILE DEL TERRITORIO STRUMENTI OPERATIVI PER GLI STUDI IDRAULICO-AMBIENTALI	
Prerequisites	Hydraulic calculations of water systems. Linear programming. Cost and benefit analysis. Environmental Regulations.	
Content	The course deals with the main aspect of the disciplinary sector of Hydraulic Constructions, amed to knowledge of Integrate Water System and of sustainable water supply management.	
Teaching objectives	The course aims to provide knowledge of the main aspects of sustainable management of water resources, of simple and complex water systems, in order to assess the impact on the hydraulic-environmental aspects, on energy and on economic and financial costs. **Specific skills:** ● understanding of the legislative and planning provisions; ● knowledge of the structure of an Integrated Water System; ● understanding of the fundamental elements for the identification of design alternatives; ● knowledge of project choice, and the impacts of various possible solutions; ● ability to use the main specialist software; ● basic knowledge of the design of the hydraulic infrastructure of integrated water system;	

	● ability to identify the resolution of management problems through an approach to economy and efficiency. **Transversal skills:** • innovative and creative thinking, adaptability, flexibility and problem solving, each developed through the analysis of multiple case studies; • team working and influencing skills; • personal and intellectual autonomy to critically evaluate ideas, evidence and design solutions from an open-minded and reasoned perspective.
Programme	**Introduction to issues of sustainability, use of water, integrated water systems, optimal management of water systems** Meteorological data. Models of climate simulation. Estimated demand for water for different uses, energy needs and conflict assessment. Access to water availability and security. Natural limits of water availability. Reduction in discharges. Protection of public health. Hydraulic infrastructure: management integration between the aqueducts, sewers and sewage treatment plants. Risk analysis and risk drinking water. Sensitivity analysis and uncertainty. Cost analysis of business scenarios. Modeling methods, and procedures for multi-criteria optimization. Sustainability of the management of water systems: evaluation methods and control. **Regulatory and institutional framework** Hierarchy of legislative sources, and management impacts. Global strategies for the sustainability of the planet's resources. Legislation and EU directives on water quality and on the sustainable management of water resources. National and regional legislation. Current system of governance of water management. **Assessment of availability and demand for water resources** Quality characteristics of water bodies and water intended for different uses. Estimation of available water resources. Estimation of water consumption. Water budgets. Reuse of treated wastewater. Environmental account. Problems of planning and regulation of competing water uses, in situation of water scarcity. Planning of the water in the river basin. Blueprint to safeguard Europe's water resources. Ground water protection. **Integrated Water System** Optimal Territorial Area. Integrated Water System survey. The integrated water service and the determination of the tariff. Integrated Water Management System: Organization charts, procedures and flows **Optimal management of water systems** Measuring instruments, control and monitoring of water systems. District metering of water distribution systems. Telemetry and data management acquisition of water networks. Elements of linear programming. Simulation models. Optimization models.

	Forecast and prevention of water emergencies. Systems management in drought conditions. Smart cityes and communities. Environmental balance. Energy balance. Economic engineering: methods of investment evaluation, comparison of project alternatives. **Evaluation methods of Sustainability** Evolution historical, cultural and scientific of the concept of sustainability. Definitions and indicators of sustainability. Efficiency and sustainability. Reversibility and entropy. Irreversibility. Models of sustainability in global, national, regional and local levels. Parametric models of sustainable water management
Delivery Mode	*TRADITIONAL*
Teaching Methods	Both lectures both the tutorials are performed either in a traditional way, on the blackboard, with video projector, or with the aid of a computer. In the latter case, it is possible directly show students how to use the main software for solving management problems and perform tutorials. Most of the material is available in electronic format. Students are also encouraged to carry out case studies and propose in autonomy a project work, to be carried out individually or in small groups (with identifiable individual contribution) to be subjected to formal verification. This allows to stimulating problem solving, teamwork, autonomy in the organization of the project proposal termination using computer tools.
Methods and Criteria of Learning Assessment	The examination consists of a project work and an oral examination. The final grade is in thirtieths. The oral examination can be supported by those who have obtained the positive verification of the project work. The final grade is awarded at the end of the oral examination and also takes account of eventual works related the tutorials presented by the student. The works related to the tutorials, the project work are planned in order to assess that the student is able to understand a management problem, to propose resolutions and to assess their impact. The oral examination questions allow additional verification of learning outcomes; while the questions and any discussion about the tutorials and the project work allow for evaluating the transversal skills capacity of problem solving
Textbooks and recommended reading	"Advanced Water Distribution Modeling and Management"– Walsky Thomas M. et alii – Haestad Press "Lezioni di Acquedotti e Fognature" – G. Frega – Liguori Editore Bibliographic documents provided by teacher. Notes of Lectures
Peer review	SC/SSD 08/A1 teachers related to the CdS ENVIRONMENTAL ENGINEERING
Teaching timetable	http://diam.unical.it
Examination calendar	http://diam.unical.it
Examinatory commission	http://diam.unical.it

STUDENT WORK LOAD				
	Lectures [hours]	Exercises [hours]	Laboratory [hours]	Individual Study [hours]
Topic 1 **Introduction to issues of sustainability, use of water, integrated water systems, optimal management of water systems** **Topic 2** **Regulatory and institutional framework**	6			12
"Advanced Water Distribution Modeling and Management"– Walsky Thomas M. et alii – Haestad Press "Lezioni di Acquedotti e Fognature" – G. Frega – Liguori Editore Bibliographic documents provided by the teacher. Notes of lessons				