UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2021/2022
MASTER'S DEGREE (MSC)	ENGINEERING AND INNOVATIVE TECHNOLOGIES FOR THE ENVIRONMENT
SUBJECT	SUSTAINABLE MANAGEMENT OF WATER RESOURCES
TYPE OF EDUCATIONAL ACTIVITY	B
AMBIT	50372-Ingegneria per l'ambiente e territorio
CODE	20562
SCIENTIFIC SECTOR(S)	ICAR/02
HEAD PROFESSOR(S)	MAZZOLA MARIO ROSARIO Cultore della Materia Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	6
INDIVIDUAL STUDY (Hrs)	96
COURSE ACTIVITY (Hrs)	54
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
TERM (SEMESTER)	2° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**MAZZOLA MARIO ROSARIO** Monday 12:00 13:00 Stanza del docente 1° Piano DICAM sezione Idraulica Tuesday 12:00 13:00 Stanza del docente 1° Piano DICAM sezione Idraulica

DOCENTE: Prof. MARIO ROSARIO MAZZOLA

PREREQUISITES	Basic knowledge of hydrology, hydraulic construction and environmental engineering, expecially of reservoir regulation.
LEARNING OUTCOMES	Knowledge and capacities of understanding: The student at the end of the Course will figure out the issues concerning the configuration and the optimal management of simple and complex water systems. The student will acquire the knowledge of the evaluation principles of financial, economic and environmental costs connected to the realization, extenction and modernization of a water system. The ability to apply knowledge and understanding: The student will be able to apply the methodologies of operational research to the study of water systems and to set the cost-benefits analysis of different design alternatives. Judgment capacity: The student will have the knowledge of the issues concerning the optimal management of simple and complex water systems and the knowledge of the evaluation principles of financial, economic and environmental costs. Communication skills: The student will acquire the ability to draft a report about the iter followed for the application of operational research methodologies to the study of water systems and to prepare the cost-benefits analysis of various design alternatives, with the support of graphics, figures and charts. Learning skills: The student will be able to identify the best design and management alternative among the different water schemes from both an economic and a functional point of view.
ASSESSMENT METHODS	The student will be tested orally by three or more questions on the subjects of the course as treated in the textbooks. The final exam aims at testing the student knowledge and subject comprehension and his . skill of understanding and solving autonomously real simple cases. The student will be reach the pass mark when he proves his knowdedge and comprehension of the course subjects at least in general terms. He has also to show enough practical capacity in solving real cases and furthermore expository capacity in order to transfer his knowledge to the examiner. Under this pass mark, the exam will be considered failed. On the contrary more the student will be able to interact with the examiner by his reasoning and expository capacity, showing to be able to go into details of the subjects of the course , more the valuation will be positive . The score of the exam will be : - Excellent : 30 - 30 and praise out of 30 - Very good: 26-29 out of 30 - Good : 24-25 out of 30 - Satisfactory: 21-23 out of 30 - Sufficient: 18-22 out of 30 - Unsufficent; below the minimum of 18 out of 30; the candidate do not pas the exam
EDUCATIONAL OBJECTIVES	The course has the purpose to provide the knowledge of the issues concerning the optimal management of simple and complex water systems and the knowledge of the evaluation principles of financial, economic and environmental costs. The methodologies of operational research and cost-benefits analysis will be applied to the study of water and wastewater systems and different design alternatives, to verify their financial, economic and environmental sustainability.
TEACHING METHODS	Lectures; Classroom exercises.
SUGGESTED BIBLIOGRAPHY	D. Campisi e R. Costa - Economia applicata all'Ingegneria- Carocci Editore P.J. Ossenbruggen – System analysis for civil engineering. J. Wiley and Sons, New York. R. K. Turner, D.W. Pearce ae I. Bateman - Economia Ambientale - Il Mulino Editore L. Ortolano – Environmental regulation and impact assessment. J. Wiley and Sons, New York. D.P.Loucks and E. van Beek - Water resources systems planning and management Unesco Publishing, Delft Materiale didattico distribuito durante il corso.

SYLLABUS

Hrs	Frontal teaching
5	Basic principles of economic engineering. Method of evaluation of investments. Depreciation, taxes and cost of capital. Comparison among project alternatives. Renovations analysis. Risk analysis models. Capital rationing method. Financial cost-benefits analysis.
5	Choice of project alternatives. Public projects evaluation. Analysis of projects under uncertainty conditions. Economic considerations on the allocation of the resources.
5	Economic considerations for the analysis of environmental problems. Economic evaluation of environmental resources. Optimal levels of pollution reduction. Paretian improvements and economic cost-benefits analysis.

SYLLABUS

Hrs	Frontal teaching
5	Conceptual organization and methods for the assesment of the value of water resources. Economic evaluation of water for agricultural, industrial and energetic uses. Economic evaluation of water for civil and environmental uses. Economic control of environment. Natural resources economics.
10	Role of mathematical models in the planning and management of water resources. Water systems modeling methods. Optimization methods: linear, nonlinear and dynamic programming.
10	Simulation and optimization of the systems in stocastic environment. Montecarlo simulation and markovian models. Analysis of the uncertainties. Performance criteria. Water basin planning models. Optimal dimension and operational rules of the reservoirs. Withdrawals optimization. Identification and sizing of the floods protection systems.

Hrs	Practice
8	Exercises and examples on the application of the economy to water resources management.
12	Exercises and examples on the application of the operational research to water resources management.