UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Scienze Agrarie, Alimentari e Forestali
ACADEMIC YEAR	2022/2023
MASTER'S DEGREE (MSC)	AGRICULTURAL PRODUCTIONS AND TECHNOLOGIES
SUBJECT	WATER PROVISIONS, IRRIGATION AND DRAINAGE PLANTS
TYPE OF EDUCATIONAL ACTIVITY	C
AMBIT	21005-Attività formative affini o integrative
CODE	12573
SCIENTIFIC SECTOR(S)	AGR/08
HEAD PROFESSOR(S)	BAIAMONTE GIORGIO Professore Ordinario Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	6
INDIVIDUAL STUDY (Hrs)	90
COURSE ACTIVITY (Hrs)	60
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
TERM (SEMESTER)	2° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**BAIAMONTE GIORGIO** Monday 11:00 13:00 Dip. SAAF, Edificio 4, Ingresso E, piano 1°, stanza 126 Tuesday 11:00 13:00 Dip. SAAF, Edificio 4, Ingresso E, piano 1°, stanza 126

DOCENTE: Prof. GIORGIO BAIAMONTE

PREREQUISITES	In order to understand the content and the learning objectives of this course and to be able to carry out the practical exercises, the student must have acquired concepts of physics and mathematics (physical quantities and units systems, vector, force, work, energy, basics trigonometry) and the Agro-Hydrology and Hydraulics.
LEARNING OUTCOMES	Knowledge and understanding Acquisition of the necessary tools for planning water reservoirs, and on farm sprinkler, drip irrigation and drainage systems. Acquisition of the skills to use the technical language typical of the Course. Applying knowledge and understanding Acquisition of the necessary tools for planning water reservoirs, and sprinkler and drip irrigation systems on farms or on outdoor recreation/sport centers, by independently organizing survey and planning mechanisms and carring out elaboration needed also by using appropriate software. Making judgments Students will be able to choose among different solutions and materials in designing hydraulic structures for farms and agro-industries. Students will be able to gather data and elaborate them according to the specific methodologies of Hydraulics and Hydrology. Communication Ability to highlight the achievements of the issues related to programming and irrigation management and to irrigation and drainage systems not only with technical language, but also in a communication form. Language proficiency ability to interact with other professionals as a part of a professional team. Lifelong learning skills Ability to update with the consultation of the scientific publications of the sectors, especially with reference to the subject of development methodologies and of research, and with reference to the attending of professional training courses and /or specialization.
ASSESSMENT METHODS	Learning evaluation will be through an oral interview (or remotely)based on the discussion of the report produced during the practical applications, bound in a booklet by the student, which must be delivered to the teacher by the closing end of the Course itself so that the teacher before the examination can evaluate it. The interview is to ascertain the possession of theoretical and technical knowledge, provided by the course through the discussion of the topics covered by the program and carried out as practical applications. This in order to check a) the knowledge captured; b) the design and computing capacity with reference to the case studies developed, c) the possession of adequate scientific and technical language and display capacity. The candidate will have to answer at least three / four questions orally posed on all parties covered by the program, on the subject of the notes provided by the teacher during the course and recommended books, as well as the practical applications. The exercises carried out will be evaluated by the teacher, and therefore the evaluation of the same will affect the final judgment in the evaluation of the oral test. Grades range from 18 to 30. Minimum mark (18) is reached when student shows a general knowledge and understanding of course subjects and ability to face very simple practical cases. Below this threshold the exam is not passed. The more the student will show knowledge and understanding of the subjects and autonomy in applying them to practical cases related to professional contest, the higher the mark will be. The maximum score (30/30 cum laude) will be awarded if the student demonstrates excellent knowledge of the topics, excellent properties of language, excellent ability to apply knowledge to solve technical problems in the proposed exercises carried out during the course.
EDUCATIONAL OBJECTIVES	Objective of this Course is to provide students with essential technical tools to groundwater and surface water utilization and sustainability on farm irrigation even under limited water supply conditions, often occurring in arid and semi-arid countries. This aim is achieved by the estimation of average annual runoff volume, and by designing irrigation systems, such as the sprinkler and the drip irrigation, minimizing the amount of water needed and maximizing the water use efficiency and energy efficiency. This Course also provides the technical tools needed to design on farm drainage system(s).
TEACHING METHODS	The Course is arranged with lectures as well as with practical applications in informatics room (or remotely), for at least 20% of the classes. These applications deal with (1) elaboration of the study-case of a "Reservoir design and storage volume", with estimation of average annual runoff volume and the design of all of the reservoir's parts and (2) "The design of a sprinkler irrigation unit for a soccer field". The technical applications are jointly discussed during the Course and then individually discussed with the student during the exam. A technical visit might be arranged at the IrriTec SpA at Rocca di Capri Leone

	(Me), drip laterals and accessory manufacturer (depending on availability of funds).
SUGGESTED BIBLIOGRAPHY	Appunti delle lezioni (file pdf) che vengono inviati per email agli studenti dal Docente durante il Corso. Class notes (pdf files) delivered by the Teacher by email to students during the Course. Pumo D.: L'approvvigionamento idrico per l'agricoltura. Aracne. Capra A., Scicolone B.: Progettazione e gestione degli impianti di irrigazione. Fuentes Yague J.L.: Tecnicas de riego. Ediciones Mundi Prensa Lamm F., Ayars J., Nakayama F.: Microirrigation for crop production. Design, Operation and management. Bollettino FAO Irrigazione e Drenaggio n. 35. La meccanizzazione dell'irrigazione per aspersione. FAO, Roma. Boswell M.: Manuale per la microirrigazione. Edagricole. Chiaves C.: Drenaggio. Ed. San Marco, Trescore Balneario (BG).

SYLLABUS

Hrs	Frontal teaching
1	Description of the course and arrangement in terms of lectures, practical applications and exams. Introduction to the topics of the course.
3	Water cycle. Rainfall, Infiltration and surface and sub-surface runoff. Evapotranspiration. Determining the reference evapotranspiration by the Penman-Monteith formula. Crop coefficients. Estimation of actual and maximum evapotranspiration of crops. Water balance equation. Types of water resources. Direct and Indirect study for the determination of the annual runoff volume.
3	Using surface water. Hydraulic Structures for Flow Diversion and Storage. Flow duration curves. River flow regulation. Reservoir storage volume. Conti's method. Methods to determine average annual runoff coefficient.
4	Collection and elaboration of rainfall and discharge data. Stormwater discharge. Direct and Indirect study for the determination of the peak discharge at a basin outlet. Accessories of water reservoir. Spillway, Surface outlet and Low level outlet, filter.
3	Groundwater. Gravity Springs: depression springs; contact springs; and fracture or tubular springs. Artesian Springs. Spring collection system, Spring box and pipe arrangement, Drilled wells and dug wells. Testing Well Yield.
3	Water quality for irrigation. Irrigation with saline water(s). Salinity and sodicity. Salt crop tolerance. Effect of irrigation with saline-sodic waters on the structural and hydrological characteristics of soil.
11	On farm irrigation systems. Traditional irrigation systems. Sprinkler irrigation: sprinklers' type and arrangement. Irrigation efficiency. Infiltration of water in soil, selection of rainfall intensity based on soil hydrologic characteristics. Designing a sprinkler irrigation system. Drip irrigation. Irrigation components, layouts and different drip irrigation emitters. Emitters' Pressure Head-flow rate relationships. Water distribution uniformity. Designing drip irrigation systems. Simplified methods to design drip irrigation systems. Sub-irrigation systems.
4	Water filtration systems. Fertigation systems. Types of Pumps. Pump characteristic curves. System Curve and Pump Performance Curve.
4	Machines for irrigation. Pivot, linear, rolling wing, self-propelled irrigation.
4	On-farm drainage. Objectives, concepts and application of drainage. Equation governing flow of water in saturated soil. Hydraulic parameters needed for designing drainage systems. Steady-state flow, unsteady-state flow. Checking and designing drainage systems. Artifacts, materials, building criteria and maintenance of drainage systems.

Hrs	Practice
10	Study-case Reservoir design and storage volume.
10	Study-case Design of a sprinkler irrigation unit for a soccer field.