



# UNIVERSITÀ DEGLI STUDI DI PALERMO

<b>DEPARTMENT</b>	Scienze Agrarie, Alimentari e Forestali		
<b>ACADEMIC YEAR</b>	2022/2023		
<b>MASTER'S DEGREE (MSC)</b>	AGRICULTURAL PRODUCTIONS AND TECHNOLOGIES		
<b>SUBJECT</b>	IRRIGATION AND DRAINAGE		
<b>TYPE OF EDUCATIONAL ACTIVITY</b>	C		
<b>AMBIT</b>	21005-Attività formative affini o integrative		
<b>CODE</b>	04011		
<b>SCIENTIFIC SECTOR(S)</b>	AGR/08		
<b>HEAD PROFESSOR(S)</b>	ALAGNA VINCENZO	Ricercatore a tempo determinato	Univ. di PALERMO
<b>OTHER PROFESSOR(S)</b>			
<b>CREDITS</b>	6		
<b>INDIVIDUAL STUDY (Hrs)</b>	90		
<b>COURSE ACTIVITY (Hrs)</b>	60		
<b>PROPAEDEUTICAL SUBJECTS</b>			
<b>MUTUALIZATION</b>			
<b>YEAR</b>	2		
<b>TERM (SEMESTER)</b>	1° semester		
<b>ATTENDANCE</b>	Not mandatory		
<b>EVALUATION</b>	Out of 30		
<b>TEACHER OFFICE HOURS</b>	<b>ALAGNA VINCENZO</b> Monday 11:00 13:00 Viale delle Scienze, Ed. 4, Ingr. E, piano terra, studio 10. Si prega, in ogni caso, di prendere appuntamento via e-mail. Eventualmente disponibile al termine della lezione.  Thursday 15:00 17:00 Viale delle Scienze, Ed. 4, Ingr. E, piano terra, studio 10. Si prega, in ogni caso, di prendere appuntamento via e-mail. Eventualmente disponibile al termine della lezione.		

<b>PREREQUISITES</b>	The student must have acquired concepts of Agro-Hydrology and Hydraulics taught in the "Agricultural Hydraulics" Course held in the Bachelor Degree "Scienze e Tecnologie Agrarie". Knowing how to use the Microsoft Office (Word and Excel).
<b>LEARNING OUTCOMES</b>	<p>Knowledge and understanding</p> <ul style="list-style-type: none"><li>• Knowledge of principles of irrigation with specific focus on sustainable irrigation management and irrigation scheduling.</li><li>• Design and management of on-farm drip irrigation systems.</li><li>• Knowledge of principles of land reclamation and design of on-farm drainage systems.</li></ul> <p>Applying knowledge and understanding</p> <ul style="list-style-type: none"><li>• Students will be able to setup an irrigation schedule with the aim to optimize water resources also in relation high levels of salinity,</li><li>• Ability to plan and design a on-farm irrigation and drainage system.</li></ul> <p>Making judgements</p> <ul style="list-style-type: none"><li>• Students will be able to choose among different solutions for on-farm irrigation and drainage systems.</li><li>• Ability to find data and to process them in order to design irrigation scheduling.</li></ul> <p>Communication</p> <ul style="list-style-type: none"><li>• Students will be able to work as part of a team and to present the results in a professional way to other experts in the field of Irrigation and Drainage.</li><li>• Ability to express knowledge in a technical report but also in a communication form with technical language</li></ul> <p>Lifelong learning skills</p> <ul style="list-style-type: none"><li>• Students will be able to attend specialist courses in the field of Agricultural Engineering, to keep u-to-date by examining the scientific literature of the specific sector and attending post-graduate courses.</li></ul>
<b>ASSESSMENT METHODS</b>	Final exam consists of an oral interview based on the issues addressed during the course with particular focus on the practical applications. The technical report with the practical applications must be delivered to the teacher at least 10 days before the examination and it will be evaluated. This assessment will be taken into account in the final mark attributed to the student. A minimum of three/ four questions will be posed to assess student's ability and autonomy in solving practical cases. 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.
<b>EDUCATIONAL OBJECTIVES</b>	The Course of "Irrigation and Drainage" will provide students with essential technical tools to be used for sustainable on-farm irrigation planning and management even under limited water supply conditions and/or poor quality irrigation water with high levels of salinity. This aim is achieved by irrigation scheduling based on water transport in the soil-plant-atmosphere system, and by designing a drip irrigation system, thus minimizing the amount of water needed and maximizing the "water use efficiency". This Course also provides the technical tools needed to design on-farm drainage systems aimed at maintaining a fixed cultivation franc or to be used to perform salt-leaching. An integral part of the training objectives is to lead the students to the drawing up of a Report illustrating the applications carried out as part of the study case developed during the course.
<b>TEACHING METHODS</b>	The course includes frontal lessons and practical applications aimed at understanding the topics covered during lectures as well as solving a case study. The applications will be carried out through the use of Excel spreadsheets. The case study entitled "Drip irrigation and drainage in a Sicilian vineyard irrigated with saline water", with irrigation scheduling (part I), design a drip irrigation system (part II) and design of a drainage sistem (part III). The practical applications must be accompanied by technical reports drawn up individually or in groups by the students, which will be reviewed during the Course. The final technical report containing both the worksheets, the tables and the figures, will be delivered to the teacher by the closing date of the course. The final report will be discussed with the student during the oral exam, and will also be evaluated by the teacher before the exam. The Report, once delivered, will be considered definitive.
<b>SUGGESTED BIBLIOGRAPHY</b>	<p>Appunti delle lezioni a cura del Docente (file pdf) che vengono inviati agli studenti durante il Corso, via via o con anticipo rispetto alle lezioni svolte.</p> <p>Testi per la consultazione:</p> <ul style="list-style-type: none"><li>• CAPRA A., SCICOLONE B. 2007. Progettazione e gestione degli impianti di</li></ul>

	<p>irrigazione. Criteri di impiego e valorizzazione delle acque per uso irriguo. 2a edizione: 2016, Edagricole. ISBN 978-88-506-5494-9</p> <ul style="list-style-type: none"> <li>• Allen, R. G., Pereira, L. S., Raes, D., &amp; Smith, M. (1998). Crop evapotranspiration-Guidelines for computing crop water requirements-FAO Irrigation and drainage paper 56. Fao, Rome, 300(9), D05109.</li> <li>• Bollettino FAO Irrigazione e Drenaggio n. 35. La meccanizzazione dell'irrigazione per aspersione. FAO, Roma.</li> <li>• Lamm F., Ayars J., Nakayama F. Microirrigation for crop production. Design, Operation and Management.</li> <li>• Boswell M. Manuale per la microirrigazione. Edagricole.</li> <li>• Chiaves C. Drenaggio. Ed. San Marco, Trescore Balneario (BG).</li> </ul>
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## SYLLABUS

Hrs	Frontal teaching
2	Description of the course arrangement in terms of lectures, practical applications and exams. Description of the course: irrigation, land reclamation and drainage as production tools. Illustrating the study-case: "On-farm drip irrigation and drainage systems in the Mediterranean environment". Sources of water for irrigation. Irrigation purposes. Irrigation arrangement. Traditional irrigation systems. Drip and sprinkler irrigation. Sources of water for irrigation. Irrigation purposes. Irrigation arrangement. Traditional irrigation systems. Drip and sprinkler irrigation. Illustrating the study-case: "Drip irrigation and drainage in a sicilian vineyard irrigated with saline water".
12	Soil water balance: Theoretical approach, easily available water, actual evapotranspiration. Selection of the optimal and minimum irrigation thresholds, also under limited water supply conditions. Precision irrigation. Deficit irrigation. Scheduling deficit irrigation. Evaluation of the yield reduction due to water stress and to saline stress. Evaluation of the leaching requirement.
8	Drip irrigation: irrigation components, layout and different drip irrigation emitters. Flow rate-pressure head relationship. Water distribution uniformity. Water filtration systems. Fertigation systems. Designing a drip irrigation system: design of drip lines, manifold, main and sub-main lines.
4	Irrigation with saline waters. Criteria for evaluating water quality. Maas and Hoffman model for predicting yield reductions due to salinity. Leaching requirement. Blending or cycling strategies aimed at controlling soil salinization.
6	Sprinkler irrigation: sprinklers' type and arrangement. Irrigation efficiency. Designing a sprinkler irrigation system. Infiltration of water in soil, selection of infiltration rate based on soil characteristics. Machines for irrigation. Centre pivot. Linear/lateral irrigation machine. Wheel line and reel rain traveler irrigation.
8	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 "Drip irrigation and drainage in a sicilian vineyard irrigated with saline water": I Part: Irrigation scheduling. Technical report.
5	Study-case, II part": Designing the system, the drip lines, the manifold. Technical report.
5	Study-case, III part: Design of on-farm drainage system. Technical report.