

<b>DEPARTMENT</b>	Scienze Agrarie e Forestali
<b>ACADEMIC YEAR</b>	2014-2015
<b>DEGREE STUDY PROGRAM</b>	<b>MSc AGRO-INGEGNERIA</b>
<b>COURSE</b>	Management of unconventional water for irrigation
<b>PARTITION IN MODULES</b>	NO
<b>NUMBER OF MODULES</b>	1
<b>SCIENTIFIC SECTOR</b>	AGR/08
<b>TEACHER</b>	Massimo Iovino Associate Professor Università di Palermo
<b>NUMBER OF CREDITS</b>	6
<b>NUMBER OF INDIVIDUAL STUDY HOURS NECESSARY TO ACHIEVE FULL LEARNING</b>	90
<b>NUMBER OF TEACHING HOURS</b>	60
<b>PREREQUISITES</b>	None
<b>STUDY PROGRAM YEAR</b>	Second
<b>LOCATION</b>	Indicated in the Class schedule
<b>TEACHING ORGANISATION</b>	Lectures, Practical exercises
<b>ATTENDANCE</b>	Optional
<b>EVALUATION METHOD</b>	Oral: discussion of the subjects studied during the course with specific consideration of the practice exercises
<b>EVALUATION RESULT</b>	Mark ranging between 18 and 30
<b>SEMESTER</b>	First semester
<b>AGENDA OF TEACHING ACTIVITIES</b>	According to the calendar published before the course begins
<b>TIMETABLE OF STUDENT RECEPTION</b>	Thursday 9-13. Appointment can be required at <a href="mailto:massimo.iovino@unipa.it">massimo.iovino@unipa.it</a>

#### EXPECTED LEARNING OUTCOME

The course aims to give the basic tools to monitor the agro-hydrological processes and to manage irrigation with unconventional waters, i.e saline waters and wastewaters. After recalling the irrigation water management notions already studied in the former courses of Irrigation and Soil Hydrology, the students will be introduced to the environmental problems related to wastewater reuse with specific reference to the commonly applied treatment processes for urban and agro-industrial wastewaters. The course is supplemented by practical exercises on agro-meteorological data processing and determination of the irrigation water requirements as well as laboratory and field lessons on the soil hydraulic characterization methods.

<b>Scheduled hours</b>	<b>TOPICS</b>
2	<b>Course introduction.</b> Overview on soil and water pollution. Wastewater purification processes and water treatment plants.
6	<b>Soil hydrology.</b> Soil. Relationships among soil phases. Soil texture and structure. Soil water content and potential. Water retention curve and saturated/unsaturated soil hydraulic conductivity. Modelling of water transfer in unsaturated soil. Infiltration, redistribution and evaporation. Solute transport.
6	<b>Measurement and monitoring of soil variables.</b> Soil moisture and water potential. Soil hydraulic conductivity measurement.

6	<b>Evapotranspiration and plant water requirement.</b> Reference evapotranspiration. Crop coefficient. Crop evapotranspiration under standard and non-standard conditions. Energy and mass balance for soil water. Empirical and physical relationship for estimating reference evapotranspiration.
4	<b>Water quality for irrigation.</b> Salinity and alkalinity. Concentration, electrical conductivity, SAR. Solid content. Suspended and dissolved solids. Organic content. BOD and COD. Nutrients. Agricultural management of low quality waters.
8	<b>Wastewater treatment processes.</b> Sedimentation. Activated sludge treatment. Sludge stabilization, Advanced treatment: filtration, membrane bioreactors, disinfection.
2	<b>Management of a wastewater treatment plant.</b>
2	<b>Wastewater reuse guidelines and restrictions.</b>
4	<b>Analysis of wastewater potential reuse.</b> A case study for Sicily. Irrigation districts, available resources and irrigation requirements. Economic analysis of wastewater reuse.
20	<b>Exercises:</b> Field and laboratory practical exercises on the measurement of physical and hydraulic properties of soil. Processing of agrometeorological data and estimation of irrigation water requirements.
Total 60	
<b>Suggested books</b>	<p>V. Bagarello, M. Iovino. Conducibilità idraulica del suolo: metodi di misura per applicazioni idrologiche. Hoepli, Milano.</p> <p>Lecture notes.</p>