

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

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 agrometeorological data processing and determination of the irrigation water requirements as well as laboratory and field lessons on the soil hydraulic characterization methods.

Scheduled hours	TOPICS
2	Course introduction. Overview on soil and water pollution. Wastewater purification processes and water treatment plants.
6	Soil hydrology. 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	Measurement and monitoring of soil variables. Soil moisture and water potential. Soil

	hydraulic conductivity measurement.
6	Evapotranspiration and plant water requirement. 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	Water quality for irrigation. 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	Wastewater treatment processes. Sedimentation. Activated sludge treatment. Sludge stabilization, Advanced treatment: filtration, membrane bioreactors, disinfection.
2	Management of a wastewater treatment plant.
2	Wastewater reuse guidelines and restrictions.
4	Analysis of wastewater potential reuse. A case study for Sicily. Irrigation districts, available resources and irrigation requirements. Economic analysis of wastewater reuse.
20	Exercises: 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	
Suggested books	V. Bagarello, M. Iovino. Conducibilità idraulica del suolo: metodi di misura per applicazioni idrologiche. Hoepli, Milano. Lecture notes.