DEPARTMENT	Scienze Agrarie e Forestali
ACADEMIC YEAR	2014-2015
DEGREE STUDY PROGRAM	**MSc AGRO-INGEGNERIA**
COURSE	Irrigation plants
PARTITION IN MODULES	NO
NUMBER OF MODULES	1
SCIENTIFIC SECTOR	AGR/08
TEACHER	Giuseppe Provenzano Associate Professor Università di Palermo
NUMBER OF CREDITS	9
NUMBER OF INDIVIDUAL HOURS NECESSARY TO ACHIEVE FULL LEARNING	135
NUMBER OF TEACHING HOURS	90
PREREQUISITES	None. It is recommended to have knowledge of hydraulic and basic knowledge of on farm irrigation systems
STUDY PROGRAM YEAR	First
LOCATION	Indicated in the Class schedule
PREREQUISITES	Lectures, Practical exercises, Technical visits (according to economic resources availability)
ATTENDANCE	Recommended
EVALUATION METHOD	Oral-Discussion of exercises carried out during the course
EVALUATION RESULT	Mark ranging between 18 and 30
SEMESTER	Second semester
AGENDA OF TEACHING ACTIVITIES	According to the calendar published before beginning the course
TIMETABLE OF STUDENT RECEPTION	Monday and Wednesday 11-13. Appointment can be required at giuseppe.provenzano@unipa.it

EXPECTED LEARNING OUTCOMES

Knowledge and understanding skills
Acquiring the ability to retrieve and process the necessary data to design the various parts of an irrigation system. Ability to use the own specific language of the discipline.
Ability to apply knowledge and comprehension
To be able to organize surveys and to process the necessary information aimed to design even complex irrigation systems
Ability to judge
To be able to judge technical and economic implications of the decisions aimed to design collective and on farm irrigation systems.
Ability to communicate
To be able to present the results of the work and to discuss, with competence and appropriate technical language, about the adopted decisions.
Ability to learn
Being able to consult available scientific and technical publications.

OBJECTIVES

Providing the necessary details aimed to design and manage simple and complex collective and on-farm irrigation systems, with reference to the systems components, their management and maintenance. Knowing irrigation machines and their potentiality, in order to make an informed choice. Knowing the main parameters related to on-farm irrigation scheduling and management. Provide the necessary information for land reclamation and to design drainage systems.

Scheduled hours	TOPICS
1	*Introduction*: Topics and aim of the course. Procedure for the final exam.
4	On Turn and On demand distribution systems. Parameters related to distribution systems. Irrigation districts. Discharges in the tram of an on turn irrigation networks. Clement's formulas. Evaluation of discharges in an on demand irrigation network. Design of irrigation networks. Materials for pipes and channels.
4	Pumping plants. Design of pumping systems. Pump and system performance curves and working conditions. Cavitation. Pump selection. Parallel pumps for varying demand. Pump suction performances (NPSH). Evaluation of pump's efficiency. Energy consume and energy efficiency opportunities. Mention of transient analysis, water hummer and its prevention.
1	Evaluation of crop water requirement and irrigation strategies. Soil and crop parameters and irrigation scheduling. Agronomic design of irrigation plants.
15	Sources of irrigation water. Farm dams collecting surface water withdrawn from rivers. Evaluation of annual and maximum runoff in small watersheds. Design of water reservoirs, lockpipe and spillway. Using groundwater for irrigation.
10	On-farm irrigation. Mention of on-farm systems and on their design. Characteristics of subsurface drip irrigation systems. Similarities and differenced with traditional microirrigation systems. Hydraulic analysis of microirrigation systems. Command and control equipment: valves and tools to measure flow rates and pressure heads. Technical characteristics and hydraulic design of filtration systems. Water fertigation.
3	On-farm irrigation systems performance evaluation. Coefficients of uniformity to evaluate field water distribution. Influence of emitter quality, number of emitter per plant and emitter occlusion on distribution uniformity.
5	Irrigation machines. Advantages and disadvantages of using irrigation machines. Centre Pivot: Electrical and hydraulic equipment. Equipment for water distribution. Influence of rotation speed on water application intensity. Evaluation of distribution uniformity. Linear/lateral move irrigation machine and its equipment. Wheel line and reel rain traveller irrigator. Design irrigation machines according to agronomic and hydraulic parameters.
10	Management of on-farm irrigation systems. Evaluation of maximum and actual crop evapotranspiration. Climatic variables influencing crop evapotranspiration and crop coefficients. Management strategies based on agro-hydrological balance on monitoring soil water content and on crop water status. Crop water deficit indicators. Irrigation under regulated water deficit.
1	Mention on economic implications of irrigation. Fixed and variable costs in the farm. Cost-benefit analysis related to irrigation.
8	Land reclamation for agriculture. Methods of reclamation. Connection between networks for land reclamation and drainage systems. Design of networks for land reclamation of flat areas.
Practical applications 30	Design of a small on-demand irrigation network Design of a pumping plant and evaluation of electrical consumes. Application of agro-hydrological FAO 56 model to evaluate crop water requirements. Design of a drainage network.
Suggested references	FAO Irrigation and Drainage Paper n.56, FAO Rome. INEA. Apparecchiature idrauliche per impianti irrigui a pressione (in Italian) J.L. Fuentes Yague: Tecnicas de riego. Ediciones Mundi Prensa (in Spanish) J.M.Tarjuelo Martin-Benito:El riego per aspersiòn y su tecnologia. Ediciones Mundi Prensa 8in Spanish) Lecture notes