Universidad Zaragoza

Year : 2018/19

28935 - Irrigation and drainage systems in horticulture and fruit farming

Syllabus Information

Academic Year:	2018/19
Subject:	28935 - Irrigation and drainage systems in horticulture and fruit farming
Faculty / School:	201 -
Degree:	437 - Degree in Rural and Agri-Food Engineering
ECTS:	6.0
Year:	
Semester:	First semester
Subject Type:	Compulsory
Module:	---

General information

Aims of the course

In this course, knowledge is provided for the design, calculation and management of irrigation and drainage systems.

The particular training objectives to be achieved upon completion of this course are the following:

- Knowing how to determine the water needs and irrigation schedule of horticultural and fruit crops.
- Knowing how to project and manage irrigation systems located on a plot.
- Knowing how to project and zonal and parcel drainage systems.
- Knowing how to dimension and project small hydraulic works (rafts, ditches, drains, collectors, etc.).

Context and importance of this course in the degree

Almost all horticultural production requires the application of irrigation to cover the water needs of vegetables and fruit trees.

Some of the main fields of work of the graduates in Rural and Agri-Food Engineering are the realization of technical projects within their professional competences, which include the calculation of irrigation and drainage systems, as well as the management of water resources in Irrigation Communities, Hydrographic Confederations and the rest of the Administration.

The concepts and calculation methods explained in this course are based on the concepts presented in previous courses in subjects such as Geology, Edaphology and Climatology, Plant Science and Hydraulics. In turn, it serves as the basis for the Irrigation Networks course.

Recommendations to take this course

Having pursued the *Chemistry*, *Physics*, *Mathematics*, *Geology, Edaphology and Climatology*, *Plant Science* and *Hydraulics* courses in the first, second and third year of this Degree is strongly recommended.

Likewise, learning performance will certainly profit from investing time in the study of the subject and from attending all sessions, both theoretical and practical.

Learning goals

Competences

The students who pass this course will have developed the following competences:

Generic or transversal competences:

- Apply their knowledge to their work or vocation in a professional manner and equip themselves with the skills that are typically demonstrated through the devise and defense of arguments and the solving of problems within their field of study.
- Be able to gather and interpret relevant data (usually within their field of study) that would allow them to make judgments that include reflections on relevant social, scientific or ethical issues.

Specific competences:

- Know, understand and use the principles of engineering of green areas, sports spaces and horticultural farms: irrigation and drainage.
- Acquisition of knowledge and systematics for the design, calculation and management of irrigation and drainage facilities.

Learning goals

The student, in order to pass this course, should be able to:

- Describe and synthesize the current state of irrigation and discuss its possible future evolution.
- Interpret water legislation.
- Identify and evaluate the most relevant properties of soil and water to determine their suitability for irrigation.
- Select the most appropriate method to estimate the evapotranspiration of the plants, based on the available data and apply it.
- Predict the water needs of the different crops to set the design flow of an irrigation system and plan the most appropriate irrigation schedule for each crop.
- Calculate the balance of water in the soil.
- Describe and understand the basics of surface irrigation.
- Describe the elements of pressurized irrigation networks, classify the different sprinkler irrigation systems in a plot and compare them.
- Understand the fundamentals of irrigation by localized and use them for the agronomic and hydraulic design of practical cases.
- Explain and express the principles of water movement in the soil. Solve the equations and quantify the uncertainty of data and results. Project parcel and zonal drainage systems.
- Interpret the principles of water behavior on the surface to project small hydraulic works.

Importance of learning goals

In order to be able to apply the methods of calculation, dimensioning and management of irrigation and drainage installations, of vital importance in the professional career of the graduates in Rural and Agri-Food Engineering.

Assessment (1st and 2nd call)

Assessment tasks (description of tasks, marking system and assessment criteria)

The student must demonstrate that he/she has achieved the intended learning outcomes through the following evaluation activities:

Completion of a final exam at the end of the semester according to the syllabus of the subject (theoretical sessions and problems) and according to the date scheduled in the Center's official examination calendar for the two official calls.

This final exam will be a written test consisting of two different blocks of limited duration.

- *Block 1*: 10 questions about theoretical-practical contents, to be answered without the support of any documentation.
- Block 2: resolution of 3-4 problems related to irrigation systems, drainage and hydraulic works, in which the students may make use of printed documentation.

Evaluation criteria:

The written test will be favorably graded if the chosen approach, the results, the order, the presentation and the interpretation are correct. The two parts of the exam will be graded on a 10 point scale and will account for 30% (block 1) and 70% (block 2) of the final grade.

Requirements to pass and to weight the various evaluation activities:

If the grade in one of the two blocks is below 5.0, the student will fail. The grade obtained in any of the two blocks will not be saved for subsequent calls.
If the grade in the two blocks is higher than 5.0, the final grade over 10 points will be obtained by applying the following formula:

Final grade (FG) = (0.3 * block 1 score) + (0.7 * block 2 score)

In the event that the above requirements are not met, the final grade will be obtained as follows:

- If FG >= 4.0, the final grade will be: fail (4.0)
- If FG < 4.0, the final grade will be: fail (FG)

Methodology, learning tasks, syllabus and resources

Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives. Although a wide range of teaching and learning tasks are implemented, the learning process designed for this course is mainly based on the following teaching modalities:

- *Theoretical sessions*. Face-to-face modality in which the contents of the proposed topics will be developed. It comprises the lectures (master classes) and debate.
- *Practical sessions focused on engineering problems solving*. Modality in which problems related to the contents of the subject will be solved, applying fundamental concepts from the theoretical sessions and using numerical methods.

Learning tasks

This is a 6 ECTS course. The program that the student is offered to help him/her achieve the expected results includes the following activities:

- *Theoretical sessions*: at the beginning of each session, the theoretical content that the teacher will cover in the class will be described. So as to develop reasoning abilities and in order to extend the study conditions, during these classes the students will also participate in the resolution of the issues raised and not explained by the teacher.
- *Problem-solving sessions*: a collection of exercises and problems will be provided for each of the topics covered in the syllabus. Some of those engineering problems will be solved in the classroom, leaving the rest for the autonomous work of the student. The proposed problems will address issues aimed at facilitating the learning of the theoretical foundations explained in the theoretical sessions and also different aspects representative of the engineering problems that occur during the development of a real irrigation, drainage or hydraulic project.

Syllabus

The course will address the following topics:

Theoretical contents:

1. Introduction
2. Soil and water properties related to irrigation
3. Fundamental principles of irrigation
4. Surface irrigation
5. Spray irrigation
6. Localized irrigation
7. Drainage
8. Design of small scale hydraulic infraestructures

Practical contents:

1. Practice on water flow measurement.
2. Practice on water infiltration in the soil.

Course planning and calendar

Schedule of face-to-face sessions

1st semester	Theoretical sessions		Problem-solving sessions		Modules / Topics	
	F2F	AW	F2F	AW		
1st week	2	3	2	3	1-2	
2nd week	2	3	2	3	2	
3rd week	2	3	2	3	2	
4th week	2	3	2	3	3	
5th week	2	3	2	3	3	
6th week	2	3	2	3	4-5	
7th week	2	3	2	3	6	

8th week	2	3	2	3	6	
9th week	2	3	2	3	6	
10th week	2	3	2	3	7	
11th week	2	3	2	3	7	
12th week	2	3	2	3	7	
13th week	2	3	2	3	8	
14th week	2	3	2	3	8	
15th week	2	3	2	3	8	
Total (hours)	30	45	30	45		

F2F: face-to-face sessions

AW: Non-contact hours in which the student will conduct autonomous work and study.

The theoretical sessions will be conducted in the classroom for the entire teaching group. Students will have photocopies as support material for the follow-up of the course. The photocopies will be provided through the reprography service and Moodle. It is also advisable that they take notes during the sessions.

In the problem-solving sessions, the Professor will pose diverse problems to be solved, and after a deliberation with the students, their results will be solved and discussed.

The final exam will be conducted on the date appointed by Higher Technical School of Huesca Board, according to the official examination schedule. Further details on the timetable, classroom, office hours, and other details regarding this course will be provided on the first day of class.

Bibliography and recommended resources

BB	Agua y agronomía / Obra dirigida y coordinada por Francisco Martín de Santa Olalla Mañas, Prudencio López Fuster, Alfonso Calera Belmonte . Madrid : Mundi-Prensa, 2005
BB	Crop evapotranspiration : guidelines for computing crop water requirements / by Richard G. Allen ...[et al.] . Rome : FAO, 1998
BB	Drainage Principles and Applications / H.P. Ritzema (editor-in-chief) . 2nd.ed[completely revised] Wageningen (Netherlands): ILRI,|C1994
BB	Martinez Beltran, Julián. Drenaje agrícola / Julián Martínez Beltrán . [Madrid] : Secretaría General Técnica, Ministerio de Agricultura, Pesca y Alimentación, 1986
BB	Paco López-Sánchez, José Luis de. Fundamentos del cálculo hidraúlico en los sistemas de riego y drenaje / José Luis de Paco López-Sánchez . Madrid : Mundi-Prensa : MAPA-IRYDA, D.L. 1993
BB	Pizarro Cabello, Fernando. Drenaje agrícola y recuperación de suelos salinos / Fernando Pizarro . 2a ed. Madrid : Agrícola Española, 1985
BB	Riego localizado / J. Rodriguez López...[et al.] . Madrid : IRYDA : Mundi-Prensa, D.L.1992
BC	Castañón Lión, Guillermo. Ingeniería del riego : utilización racional del agua / Guillermo Castañón . Madrid : Paraninfo, D.L.2000
BC	Chow, Ven Te. Hidraúlica de canales abiertos / Ven Te Chow ; traducción , Juan G. Saldarriaga ; revisión técnica, Antonio Zuluaga Angel . [1a. ed.] Santafé de Bogotá : McGraw-Hill, cop. 1994
BC	Escribá Bonafé, Domingo. Hidraúlica para ingenieros / Domingo Escribá Bonafé . [1a. ed.] Madrid : Belliso, 1988
BC	Fertirrigación : cultivos hortícolas, frutales y ornamentales / obra colectiva dirigida y coordinada por Carlos Cadahía . 3ª ed. rev., act. y ampl. Madrid [etc.] : Mundi-Prensa, 2005
BC	Gómez Pompa, Pedro. Instalaciones de bombeo para riego y otros usos / Pedro Gómez Pompa . Madrid : Agrícola Española, D.L.1993
BC	Losada Villasante, Alberto. El riego. II, Fundamentos de su hidrología y de su práctica / A. Losada Villasante . Madrid : Mundi-Prensa, 2005
BC	Moya Talens, Jesús Antonio. Riego localizado y fertirrigación / Jesús Antonio Moya Talens ; esquemas y dibujos Pedro Sanz Roselló, Mª Jesús Moya Carpio, Michèle Drummond. . - 3ª ed. rev. y amp. Madrid : Mundi-Prensa, 2002
BC	Tarjuelo Martín-Benito, José Mª. El riego por aspersión y su tecnología / José Mª Tarjuelo Martín-Benito . 3ª ed. rev. y amp.

Madrid [etc.] : Mundi-Prensa, 2005

The updated recommended bibliography can be consulted in:
http://psfunizar7.unizar.es/br13/egAsignaturas.php?id=8096