

28945 - Irrigation and drainage systems

Syllabus Information

Academic Year: 2019/20

Subject: 28945 - Irrigation and drainage systems

Faculty / School: 201 - Escuela Politécnica Superior

Degree: 437 - Degree in Rural and Agri-Food Engineering
583 - Degree in Rural and Agri-Food Engineering

ECTS: 6.0

Year: 4

Semester: First semester

Subject Type: Optional

Module: ---

1.General information

1.1.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 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.).

SDGs alignment:

Aforementioned goals are aligned with the following [UN Sustainable Development Goals](#) (SDGs):

- [SDG 2](#): Zero Hunger
- [SDG 6](#): Ensure access to water and sanitation for all

and, in particular, with the following targets:

- *Target 2.4*: By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality.
- *Target 6.4*: By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity

1.2.Context and importance of this course in the degree

Almost all agricultural production requires the application of irrigation to cover the water needs of the crops.

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.

1.3.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.

2.Learning goals

2.1.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 engineering principles of agricultural farms: irrigation and drainage systems and technology.
- Acquisition of knowledge and systematics for the design, calculation and management of irrigation and drainage facilities.

2.2.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.

2.3.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.

3.Assessment (1st and 2nd call)

3.1.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:

$$\text{Final grade (FG)} = (0.3 * \text{block 1 score}) + (0.7 * \text{block 2 score})$$

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

- If $FG \geq 4.0$, the final grade will be: fail (4.0)
- If $FG < 4.0$, the final grade will be: fail (FG)

4. Methodology, learning tasks, syllabus and resources

4.1. 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:

- *Lectures.* Face-to-face modality in which the contents of the proposed topics will be developed. It comprises the lectures (master classes) and debate.
- *Practice 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.

4.2. 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:

- *Lectures:* 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.

4.3. 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 infrastructures

Practical contents:

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

4.4. Course planning and calendar

Schedule of face-to-face sessions

	Theoretical sessions	Problem-solving sessions	
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1 st semester					Modules / Topics
	F2F	AW	F2F	AW	
1 st week	2	3	2	3	1-2
2 nd week	2	3	2	3	2
3 rd week	2	3	2	3	2
4 th week	2	3	2	3	3
5 th week	2	3	2	3	3
6 th week	2	3	2	3	4-5
7 th week	2	3	2	3	6
8 th week	2	3	2	3	6
9 th week	2	3	2	3	6
10 th week	2	3	2	3	7
11 th week	2	3	2	3	7
12 th week	2	3	2	3	7
13 th week	2	3	2	3	8
14 th week	2	3	2	3	8
15 th 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 lectures 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. Photocopies will be provided through the reprography service and the Moodle web-based platform. It is also advisable that students take notes during the sessions.

In the problem-solving sessions, the Professor will pose diverse problems to be solved, and after deliberation with the students, will proceed to a step-by-step explanation and discussion.

The final exam will be conducted on the date appointed by the 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.

4.5. 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** Martínez Beltrán, 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 hidráulico 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. Rodríguez 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. Hidráulica 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. Hidráulica 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?codigo=28945&Identificador=14211>