Universidad Zaragoza

Academic Year/course: 2021/22

28921 - Hydraulics

Syllabus Information

Academic Year: 2021/22
Subject: 28921 - Hidráulica
Faculty / School: 201 - Escuela Politécnica Superior
Degree: 583 - Degree in Rural and Agri-Food Engineering
ECTS: 6.0
Year: 3
Semester: First semester
Subject Type: Compulsory
Module:

1. General information

1.1. Aims of the course

The overall goal of the Hydraulics course is simply to give students a sound foundation in hydraulics, a discipline which is absolutely essential for certain areas of the work of graduates in agricultural engineering and the rural environment.

1.2. Context and importance of this course in the degree

This course, which takes place in the first term of the third year of the degree, makes use of what students have learned in Physics I and Mathematics I and II to ensure students have a good understanding of free surface flow hydraulics and pressurised flow hydraulics, which will prepare them for more in-depth studies of irrigation and drainage (in the special subjects of Farming or Horticulture and Gardening) or for designing and managing hydraulic installations (a specialisation in Agro-Food Industries).

The course includes competencies and activities related to the Sustainable Development Goals 6 and 7 (SDG6 and SDG7) of the United Nations (UN):

SDG6 - Ensure availability and sustainable management of water and sanitation for all.

SDG7 - Ensure access to affordable, reliable, sustainable and modern energy for all.

1.3. Recommendations to take this course

You are strongly recommended to have acquired the Fluid Mechanics skills taught in Physics I, and all the skills in Mathematics I and Mathematics II.

Students who want to pass the subject with continuous assessment must spend an estimated six hours a week on coursework and personal study over the term, as well as attending scheduled classroom sessions (theory, problems, laboratory work, computer work, etc.).

In all cases, attending classroom activities is strongly recommended.

2. Learning goals

2.1. Competences

Knowing, understanding and using the principles of engineering in the rural environment: hydraulics.

Understanding the basis of hydraulics in irrigation and drainage.

Applying in practice the foundations of hydraulics for irrigation and drainage.

Making basic use of hydraulics software for irrigation and drainage.

Basic management of hydraulic installations.

Applying this knowledge to their work in a professional manner and having skills that can be demonstrated by preparing and defending an argument and resolving problems within their area of study.

Compiling and interpreting relevant information (normally in their area of study) in order to express opinions that include a consideration of relevant social, scientific and ethical subjects.

2.2. Learning goals

Understanding and applying the basic principles of Hydraulics in both free surface flow and pressurised flow.

Ensure efficient use of water resources and ensure sustainability in the extraction and supply of fresh water (in line with SDG6).

Achieve energy efficiency in pumping systems, using affordable, reliable and modern energy services, based on renewable energies as far as possible (in line with SDG7).

Designing and analysing basic hydraulic installations, in both free surface flow and pressurised flow, taking into account SDG6 and SDG7.

Basic use of hydraulic simulation software.

2.3. Importance of learning goals

The planned learning results serve as a foundation for more in-depth studies of irrigation and drainage (in the special subjects of Farming or Horticulture and Gardening) or for designing and managing hydraulic installations (a specialisation in Agro-Food Industries).

In particular, the study of hydraulics must enable graduates to perform their professional work relating to capturing and transporting water, its application to a field or crop (irrigation), and drainage. Also, graduates can use the skills they have acquired to design and manage hydraulic installations in the agro-food industry.

3. Assessment (1st and 2nd call)

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

This course can be taken in **continuous assessment** mode, basically consisting of a objective assessment test at the end of block 1 (free surface flow). Both continuous assessment tests consist of a theory and practice test and a second part with written practical exercises.

There will also be **overall tests** corresponding to the two main exam periods of the academic year. An overall test will be in two parts: one relating to the free surface flow block and the other relating to the pressurised flow block. Each of them will consist of a theory and practice test and a second part with written practical exercises.

The content to be evaluated in the assessments will be all the content taught and indicated in all the classroom-based activities in the subject: theory, problems, computer work, laboratory work and special practical work.

Assessment Criteria.

To pass either of the two subject blocks students will need a mark of five points or more in the corresponding assessment test.

To pass the subject they must pass each of the two blocks. In this case the mark will be the average of the marks obtained in each block.

Otherwise the subject will be considered not to have been passed, and the mark will be the average of the marks obtained for each block, unless that value is higher than the pass mark, in which case the mark given will be the lower of the two blocks.

In an overall exam, when students have previously passed the assessment for a single block, they may take the exam for the other block only, always in the same academic year. They can also take an overall exam after passing both blocks in continuous assessment, in order to improve their marks.

As indicated above, the test for each of the two subject blocks, whether in continuous assessment or the overall exam, will consist of a theory and practice test and a second part with written practical exercises.

The **theory and practice test** will be taken without study material and with a non-programmable calculator, and is a qualifying exam: it must be passed for the written practical exercises to be marked. Wrong answers in the test may lower the mark. The test questions are designed to evaluate the level of understanding of the theoretical and practical content of the subject, not the students' memorising skills.

The **written practical exercise** will consist of a set of practical problems which can be resolved with the study materials the student considers appropriate. When a problem or one of its sections requires a numerical answer, the student must include the working out. A problem or section will be considered to be passed if the value is within a margin of ±5% of the correct result, and the mark will be adjusted according to the clarity of the explanations and the scientific rigour used to obtain the result.

The mark for the block will be that of the theory and practice test if failed, and the the weighted average of the theory and practice test (40%) and the written practical exercises (60%) if passed.

As part of the evaluation of the subject, the evaluation of competences and theoretical-practical learning related to SDG6 and SDG7 will be taken into account.

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

This is a foundational course. The skills acquired in the course will form the basis for later studies relating to irrigation and drainage, or to hydraulics in the agro-food industry.

For this reason, the learning process is based on theoretical content accompanied by written practical exercises, which will serve as a starting point for later, more specific skills: the design and analysis of irrigation systems and hydraulic installations in general.

The learning process is completed by laboratory work with basic hydraulic installations (hydrodynamic channel, valve bank, pump bank), and computer work, where students will familiarise themselves with some of the leading hydraulic simulation software for irrigation and the rural environment (Gestar, HecRas, and WinSRFR).

4.2. Learning tasks

The course includes the following learning tasks:

- Lectures on theory and problems (28 classroom hours).
- Problem-solving and case studies (15 classroom hours).
- Laboratory and computer work (12 classroom hours).
- Special practical work (5 classroom hours).
- Study (78 non-classroom hours).
- Assessment (12 classroom hours).

The learning activities include theoretical and practical activities related to sustainable water management (SDG6) and energy efficiency and renewable energy (SDG7).

4.3. Syllabus

The course will address the following topics:

- Section 1. Free surface flow
    - Introduction and preliminary concepts
    - Hydrostatics.
    - Free surface flow.
    - Measurement devices.
- Section 2. Pressurized flow.
    - Flow in pipes.
    - Head losses.
    - Pipes with en-route service.
    - Hydraulic pumping.
    - Water hammer.

4.4. Course planning and calendar

The following table shows the suggested weekly organization *for this subject. B1 means Block 1 (free surface flow) and* B2 means Block 2 (pressurized flow). You will see that in the middle of the term there is an assessment test for block 1, and at the end of the term, an assessment test for block 2.

The last column shows the total hours students should spend on each activity.

Please note: this outline is subject to changes, which will be announced in a timely manner.

The subject content is divided into two major blocks: free surface flow and pressurized flow. When each block is completed there will be a continuous assessment test. That means that about halfway through the term there will be an assessment test on free surface flow, and at the end of the course, there will be an assessment test on pressurized flow, as shown in more detail in the Assessment section.

Each block will combine different types of classroom-based activities in order to achieve the desired learning results.

Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTAL
Theory	B1 2h	B1 2h	B1 2h	B1 2h	B1 2h	B1 2h	B1 2h		B2 2h	B2 2h	B2 2h	B2 2h	B2 2h	B2 2h	B2 2h	28 h
Practice		B1 2h	B1 5h						B2 2h	B2 2h	B2 2h	B2 2h				15 h
Laboratory				P1 2h	P1 2h	P1 2h						P2 2h	P2 2h	P2 2h		12 h
Field practice							B1 5h									5 h
Total presential activities																*60 h*
Personal work	B1 6h	B1 6h	B1 6h	B1 6h	B1 6h	B1 6h	B1 6h	B1 6h	B2 6h	B2 6h	B2 6h	B2 6h	B2 6h	B2 6h	B2 6h	90 h
Total non presential activities																*90 h*
TOTAL ACTIVITIES																**150 h**

4.5. Bibliography and recommended resources

BB Losada Villasante, Alberto. El riego : fundamentos hidráulicos / A. Losada Villasante . 4ª ed. corr. Madrid [etc.] : Mundi-Prensa, 2009

BC Arviza Valverde, Jaime. Ingeniería rural : hidráulica / Jaime Arviza Valverde, Cristina Santamarina Siurana . Valencia : Universidad Politécnica, Servicio de Publicaciones, D.L.1995

BC Arviza Valverde, Jaime. Problemas de hidráulica / Jaime Arviza Valverde, Iban Balbestre Peralta . Valencia : Editorial de la UPV, D. L. 2008

BC 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

BC Problemas de hidráulica para riegos / José Roldán ... [et al.] . 2ª ed. corr. Córdoba : Servicio de Publicaciones de la Universidad de Córdoba, D.L. 2004

The updated recommended bibliography can be consulted in:
http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=28921