Universitat de Lleida

DEGREE CURRICULUM

EXTENSION OF IRRIGATION

Coordination: COTS RUBIO, LLUIS

Academic year 2022-23

EXTENSION OF IRRIGATION 2022-23

Subject's general information

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<tr><td>Subject name</td><td>EXTENSION OF IRRIGATION</td></tr>
<tr><td>Code</td><td>102575</td></tr>
<tr><td>Semester</td><td>2nd Q(SEMESTER) CONTINUED EVALUATION</td></tr>
<tr><td>Typology</td><td>
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<tr><th>Degree</th><th>Course</th><th>Character</th><th>Modality</th></tr>
<tr><td>Bachelor's Degree in Agricultural and Food Engineering</td><td>3</td><td>COMPULSORY</td><td>Attendance-based</td></tr>
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<tr><td>Course number of credits (ECTS)</td><td>6</td></tr>
<tr><td>Type of activity, credits, and groups</td><td>
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<tr><th>Activity type</th><td>PRACAMP</td><td>PRALAB</td><td>PRAULA</td><td>TEORIA</td></tr>
<tr><th>Number of credits</th><td>0.5</td><td>0.2</td><td>2.2</td><td>3.1</td></tr>
<tr><th>Number of groups</th><td>1</td><td>1</td><td>1</td><td>1</td></tr>
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<tr><td>Coordination</td><td>COTS RUBIO, LLUIS</td></tr>
<tr><td>Department</td><td>AGRICULTURAL AND FOREST ENGINEERING</td></tr>
<tr><td>Teaching load distribution between lectures and independent student work</td><td>Lecturers (Contact hours): 60
Independent student work (non-contact hours): 90</td></tr>
<tr><td>Important information on data processing</td><td>Consult this link for more information.</td></tr>
<tr><td>Language</td><td>Catalan: 60%
Spanish: 40%</td></tr>
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EXTENSION OF IRRIGATION 2022-23

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
COTS RUBIO, LLUIS	lluis.cots@udl.cat	3,6	
LOPEZ ALONSO, RAUL	raul.lopez@udl.cat	2,4	

Subject's extra information

Subject / subject in the whole curriculum

The subject that is presented as an extension of the knowledge of irrigation acquired by the students of the specialty of Rural and Environmental Engineering in previous subjects like the one of Irrigation studied during the first semester also of third course, and in knowledge acquired in the subjects of Fundamentals of Rural Engineering, Earth Sciences, Plant Physiology, Physics and Mathematics.

Recommendations

As prior knowledge it is convenient to have completed and correctly understood the subjects of Fundamentals of Rural Engineering of the second year, as well as the subject of Irrigation of the third year taken in the first semester.

Warnings

The recording of voice and image during the course of the classes with any medium is totally prohibited.

Mobile phones, digital watches, tablets and computers will remain closed as long as the teachers do not indicate otherwise to carry out any activity in the classroom that requires it. In the exams they are totally prohibited.

Covid-19

Due to causes derived from the health crisis caused by Covid-19, activities in face-to-face mode can be substituted by other equivalent ones in distance mode.

Learning objectives

The objectives to be achieved include:

• RA1: Calculate the surface runoff of a basin

• RA2: Determine the maximum flow for the design of surface drainage networks

• RA3: Know how to size channels based on flow, slope and geometry

• RA4: Know how to apply flow measurement devices

• RA5: Determine the hydraulic conductivity of the soil

• RA6: Calculate the salt washing needs

• RA7: Dimension the drainage network: diameter of drains and separation between drains

• RA8: Determine the hydraulic parameters of an aquifer from a pumping test

• RA9: Schedule the exploitation of a well

• RA10: Design an irrigation system with irrigation cannons and pivot irrigation machines.

• RA11: Know different methodologies for the hydraulic design of localized irrigation systems

• RA12: How to save water and energy in irrigation management

Competences

CB1. That students have demonstrated to possess and understand knowledge in an area of study that starts from the base of general secondary education, and is usually found at a level that, although supported by advanced textbooks, also includes some aspects that imply knowledge from the forefront of your field of study.

CB2. That students know how to apply their knowledge to their work or vocation in a professional way and possess the competencies that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study.

CB3. That students have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include reflection on relevant issues of a social, scientific or ethical nature.

CB4. That students can transmit information, ideas, problems and solutions to both specialized and non-specialized audiences.

CB5. That students have developed those learning skills necessary to undertake further studies with a high degree of autonomy.

CG1. Capacity for the prior preparation, conception, drafting and signing of projects that have as their object the construction, reform, repair, conservation, demolition, manufacture, installation, assembly or exploitation of movable or immovable property that due to its nature and characteristics are included in the own technique of agricultural and livestock production (facilities or buildings, farms, infrastructures and rural roads), the agrifood industry (extractive, fermentation, dairy, canning, fruit and vegetable, meat, fishing, salting industries and, in general, any other dedicated to the elaboration and / or transformation, conservation, handling and distribution of food products) and gardening and landscaping (urban and / or rural green spaces, parks, gardens, nurseries, urban trees, etc., public or private sports facilities and environments subjected to landscape restoration).

CG3. Ability to direct the execution of the works object of the projects related to agrifood industries, agricultural operations and green spaces and their buildings, infrastructures and facilities, the prevention of risks associated with this execution and the management of multidisciplinary teams and human resource management, in accordance with deontological criteria.

CG7. Knowledge of basic, scientific and technological subjects that allow continuous learning, as well as an ability to adapt to new situations or changing environments.

CG8. Ability to solve problems with creativity, initiative, methodology and critical reasoning.

CEMCR4. Ability to know, understand and use the principles of: Facilities engineering. Rural electrification. Irrigation and drainage technology. Hydraulic works and installations. Facilities for animal health and welfare.

CEMC10. Ability to know, understand and use the principles of: Technology transfer, understand, interpret, communicate and adopt advances in the agricultural field.

EXTENSION OF IRRIGATION 2022-23

Subject contents

Program of classes

UNIT 1. Calculation of surface runoff and maximum flows. Soil Conservation Service (SCS) curve number method. Rational method: instruction 5.2-IC on surface drainage (Professor R. López).

UNIT 2. Channel hydraulics. Permanent and uniform flow: Manning and Darcy-Weisbach formulas. Critical regime. Permanent and gradually varied flow: calculation of backwater curves. (Professor R. López).

UNIT 3. Hydrometry in free sheet. Gauging structures: weirs, orifices and gates. Gauges based on the measurement of speed distribution. (Professor R. López).

UNIT 4. Equations of continuity, energy and Darcy's law in the saturated and unsaturated porous medium. (Professor Ll.Cots)

UNIT 5. Balance of water and salts. (Professor Ll.Cots)

UNIT 6. Calculation of underground drainage: permanent and variable regime. (Professor Ll.Cots)

UNIT 7. Aquifers. Interpretation of pumping tests. Well functions and well exploitation. (Professor Ll.Cots)

UNIT 8. Irrigation machines: irrigation cannons and pivots. (Professor Ll.Cots)

UNIT 9. New methodologies for hydraulic design in localized irrigation. Saving water and energy in irrigation management.

Practical activities

It is compulsory to attend all practical activities as well as the delivery of the corresponding report for each one.

Laboratory / field practices (2 h)

Practice 1. Determination of the hydraulic conductivity of the soil (1 h)

Practice 2. Practices in flow measurement hydrometry (0.5 h)

Practice 3. Gradually varied flow in channels (0.5 h)

Technique visit (5 h)

Practice 4: Visit an irrigated area near Lleida where instruments for measuring flows, irrigation and drainage systems, and underground water exploitation will be seen.

From the laboratory and field practices, as well as from the technical visit, the student will have to present a final report.

Methodology

Observations

The subject will be developed in 31 hours of theoretical sessions, corresponding to the 9 topics in which the agenda is structured. The theoretical sessions are complemented by four types of practical activities: a) classroom sessions (22 hours) focused on solving problems and cases; b) 1 Laboratory and field practice (2 hours), aimed at determining the hydraulic conductivity of the soil and the hydrometry applied to the measurement of flows and the study of the gradually varied flow in channels; and c) 1 visit (5 hours) to an irrigation area where the water transport and distribution infrastructures and the irrigation and drainage systems will be seen.

Learning activities

Type of activity	Description	Student face-to-face activity		Non-face-to-face activity Student		Total time	
		Goals	Hours	Student work	Hours	Horas	ECTS
Master lesson	Master class (Classroom. Large group)	Explanation of the main concepts	31	Study: Know, understand and synthesize knowledge	40	71	2,84
Problem and cases	Participatory class (Classroom. Large group)	Application of the theoretical concepts explained in the lectures	22	Solve problems and cases	38	60	2,4
Field Laboratory	Laboratory Practice (Small Group)	Execution of the practice: understand, measure...	2	Make a memory (report) of the activity	6	8	0,32
Technical visit	Practical Activity (Large Group)	Visit to companies and / or farms	5	Make a memory (report) of the activity	3	8	0,32
TOTAL			**60**		**90**	**150**	**6**

Observations: 25 hours of total activity have been considered for ECTS credit.

Development plan

Development plan

Type of activity	Content	Goals	Contact hours	Cumulative hours	
Master lesson	Unit 1	RA1 & 2	5	5	
Problems and cases	Unit 1	RA1 & 2	3	8	
Master lesson	Unit 2	RA 3	5	13	
Problems and cases	Unit 2	RA 3	3	16	
Master lesson	Unit 3	RA 4	5	21	

Problems and cases	Unit 3	RA 4	3	24	
Master lesson	Unit 4	RA5	1	25	
Problems and cases	Unit 4	RA5	1	26	
Laboratory / field practice	Practice 1 & 2	RA 3, 4 and 5	2	28	
Master lesson	Unit 5	RA6	3	31	
Problems and cases	Unit 5	RA6	2	33	
Master lesson	Unit 6	RA7	4	37	
Problems and cases	Unit 6	RA7	4	41	
Master lesson	Unit 7	RA8 & 9	3	44	
Problems and cases	Unit 7	RA8 & 9	3	47	
Master lesson	Unit 8	RA10	3	50	
Problems and cases	Unit 8	RA10	3	53	
Master lesson	Unit 9	RA11 and 12	2	55	
Technical visit	Practice 3	All in general	5	60	
Totals			**60**	**60**	

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• RA11: Know different methodologies for the hydraulic design of localized irrigation systems

• RA12: How to save water and energy in irrigation management

Evaluation

Activities

Activity type	Content	Evaluation System	Teacher	Note weight (%)

T1-T2-T3	Master lesson + Problems	Written exam (2)	R López	40
T4 a T9	Master lesson + Problems	Questions in class about problems and cases	Ll Cots	7
T4 a T9	Master lesson + Problems	Written exam (1)	Ll Cots	50
All	Laboratory / Field + Technical visit	Give memory	Ll Cots	3

Observations

The evaluation will be continuous and for the purposes of the final grade to pass the subject, an average grade of the two blocks greater than or equal to 5 will be necessary, as well as having carried out and presented the practices.

Block is understood as each of the groupings of the topics that comprise the subject, thus block 1 is made up of topics 1, 2 and 3, and block 2 the rest of topics from 4 to 9.

The different blocks will be compensated if a mark greater than or equal to 3 is obtained from block 1 and a mark greater than or equal to 4 is obtained from the exam(s) of block 2. In the case of not exceeding any of the blocks, you will have to go to the relevant recovery.

Bibliography

Basic bibliography

Barragán, J.; Cots, LL. 2002. Algunos temas sobre: Hidrología y drenaje agrícola. E.T.S.E.A. Universitat de Lleida.

López, Raúl. 2001. Temas de ingeniería hidrológica para forestales. Paperkite Editorial. Lleida.

López, Raúl. 2020. Problemas resueltos de hidráulica de canales abiertos. Universitat de Lleida. Lleida

Pizarro, F. 1985. Drenaje agrícola y recuperación de suelos salinos. Ed. Agrícola Española, SA.

Tarjuelo, JM. 2005. El riego por aspersión y su tecnología. 3ª ed. Madrid etc.: Mundi-Prensa

Further reading

ACA. 2003. Guia Tècnica: Recomanacions tècniques per als estudis d'inundabilitat d'àmbit local. Agència Catalana de l'Aigua.

Barragán, J. 1997. Algunos temas sobre riego por aspersión y goteo. E.T.S.E.A. Universitat de Lleida.

Custodio. E; Llamas, M.R. (eds.). 1983. Hidrología Subterránea. Vol. I y II. 2ª edición. Omega. Barcelona.

Martínez Beltrán, J. 1986. Drenaje agrícola. Volumen I. Madrid: Secretaria General Técnica. Ministerio de Agricultura, Pesca y Alimentación. Instituto Nacional de Reforma y Desarrollo Agrario. (Series de Ingeniería Rural y Desarrollo Agrario. Manual Técnico nº 5).

Martínez, P.E.; Martínez, P.; Castaño, S. 2005. Fundamentos de hidrogeología. Mundi-Prensa. Madrid.

Ritzema, H.P. (ed). Drainage Principles and Applications. 2ª ed. [Holanda]: International Institute for Land Reclamation and Improvement (ILRI). 1125 pp.