Course guide
250256 - INSTASSOH - Instrumentation and Testing in Hydraulic Works

Last modified: 01/10/2023

Unit in charge: Barcelona School of Civil Engineering
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering.

Degree: BACHELOR'S DEGREE IN PUBLIC WORKS ENGINEERING (Syllabus 2010). (Optional subject).

Academic year: 2023 **ECTS Credits:** 4.5 **Languages:** Catalan

LECTURER

Coordinating lecturer: CARLES FERRER BOIX

Others: CARLES FERRER BOIX, GONZALO JAVIER OLIVARES CERPA, MARTI SANCHEZ JUNY, JACKSON DAVID TELLEZ ALVAREZ

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
3090. Knowledge and understanding of supply and treatment systems, and of how to dimension, construct and conserve them

Generical:
3105. Students will learn to identify, formulate and solve a range of engineering problems. They will be expected to show initiative in interpreting and solving specific civil engineering problems and to demonstrate creativity and decision-making skills. Finally, students will develop creative and systematic strategies for analysing and solving problems.
3106. Students will learn to assess the complexity of the problems examined in the different subject areas, identify the key elements of the problem statement, and select the appropriate strategy for solving it. Once they have chosen a strategy, they will apply it and, if the desired solution is not reached, determine whether modifications are required. Students will use a range of methods and tools to determine whether their solution is correct or, at the very least, appropriate to the problem in question. More generally, students will be encouraged to consider the importance of creativity in science and technology.
3107. Students will learn to identify, model and analyse problems from open situations, consider alternative strategies for solving them, select the most appropriate solution on the basis of reasoned criteria, and consider a range of methods for validating their results. More generally, students will learn to work confidently with complex systems and to identify the interactions between their components.
3111. Students will learn to plan, design, manage and maintain systems suitable for use in civil engineering. They will develop a systematic approach to the complete life-cycle of a civil engineering infrastructure, system or service, which includes drafting and finalising project plans, identifying the basic materials and technologies required, making decisions, managing the different project activities, performing measurements, calculations and assessments, ensuring compliance with specifications, regulations and compulsory standards, evaluating the social and environmental impact of the processes and techniques used, and conducting economic analyses of human and material resources.
3112. Students will develop an understanding of the different functions of engineering, the processes involved in the life-cycle of a construction project, process or service, and the importance of systematising the design process. They will learn to identify and interpret the stages in preparing a product design specification (PDS), draft and optimise specifications and planning documents, and apply a systematic design process to the implementation and operation phases. Students will learn to write progress reports for a design process, use a range of project management tools and prepare final reports, and will be expected to show an awareness of the basic economic concepts associated with the product, process or service in question.
3113. Students will learn to identify user requirements, to draft definitions and specifications of the product, process or service in question, including a product design specification (PDS) document, and to follow industry-standard design management models. Students will be expected to show advanced knowledge of the steps involved in the design, execution and operation phases and to use the knowledge and tools covered in each subject area to the design and execution of their own projects. Finally, students will assess the impact of national, European and international legislation applicable to engineering projects.

Transversal:
586. ENTREPRENEURSHIP AND INNOVATION - Level 2. Taking initiatives that give rise to opportunities and to new products and solutions, doing so with a vision of process implementation and market understanding, and involving others in projects that have to be carried out.
589. SUSTAINABILITY AND SOCIAL COMMITMENT - Level 2. Applying sustainability criteria and professional codes of conduct in the design and assessment of technological solutions.
594. TEAMWORK - Level 3. Managing and making work groups effective. Resolving possible conflicts, valuing working with others, assessing the effectiveness of a team and presenting the final results.
584. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.

TEACHING METHODOLOGY

The course consists of 1.8 hours per week of classroom activity (large size group) and 0.5 hours weekly with half the students (medium size group).

The 1.8 hours in the large size groups are devoted to theoretical lectures, in which the teacher presents the basic concepts and topics of the subject, shows examples and solves exercises.

The 0.5 hours in the medium size groups is devoted to solving practical problems with greater interaction with the students. The objective of these practical exercises is to consolidate the general and specific learning objectives.

The rest of weekly hours devoted to laboratory practice.

Support material in the form of a detailed teaching plan is provided using the virtual campus ATENEA: content, program of learning and assessment activities conducted and literature.

Although most of the sessions will be given in the language indicated, sessions supported by other occasional guest experts may be held in other languages.

LEARNING OBJECTIVES OF THE SUBJECT

STUDY LOAD

Type	Hours	Percentage
Self study	63,0	56.00
Hours small group	9,0	8.00
Hours medium group	18,0	16.00
Guided activities	4,5	4.00
Hours large group	18,0	16.00

Total learning time: 112.5 h

CONTENTS

Pressure Sensors

Description:
- Water Column (barometer, piezometer, piezometer water column, the column of mercury differential manometer, inclined manometer)
- Mechanical: (Bourdon tube, diaphragm, spring).
- Electro-Mechanical
- Electronics (gauges, piezorresistiu, ceramic. Piezoelectric, piezoelectric effect, capacitive)
- Differences between relative and absolute pressure sensor, operation and use.

Full-or-part-time: 7h 11m
Theory classes: 2h
Laboratory classes: 1h
Self study : 4h 11m

Level Sensors - draft

Description:
- Difference between level and depth
- Ruler limnimètric.
- Recording stage gauges (mechanical hand, mail).
- Recording stage gauges tire.
- Sensors wells level (level sensors)
- Ultrasonic sensors (temperature compensation, bar)
- Rada sensors.

Full-or-part-time: 7h 11m
Theory classes: 2h
Laboratory classes: 1h
Self study : 4h 11m

Speed sensors

Description:
- Pitot tube
- Pinwheel (operation, equations grinder)
- Ultrasound (Cross as the liquid sheet and interest-free installation and piping)
- Ultrasonic (Doppler effect, on pipes, limitations))
- Electromagnetic (Faraday's law, used in pipes and sheet free, limitations).
- Grinders with Doppler and electromagnetic.
- Hot thread and temperature differences.
- Vortex Effect
- Laser.

Full-or-part-time: 7h 11m
Theory classes: 2h
Laboratory classes: 1h
Self study : 4h 11m

Flow sensors

Description:
- Rotàmeter (rotàmeters with spring).
- Turbins.
- Accountants (Wollman, turbine).
- Flowmeters (venturímeter, diaphragms, nozzles)

- Weirs
- Pared thick.
- Flumes, (Parshall).
- Current meter gauging.
- Gauging, Limnigrama hydrograph.
- Chemical injection.

Full-or-part-time: 14h 23m
Theory classes: 4h
Laboratory classes: 2h
Self study : 8h 23m

Measurements of water quality, meteorològuiques. Data Collection

Description:
Water Quality Measures:
- Mostrajadors.
- Probes
Measurements of precipitation:
- Rain gauges (siphon, single bowl, bowls)
- Radar
Meteorològuiques Measures:
- Relative humidity.
Temperature-friendly.
- Wind (direction, speed).
- Solar radiation.
Data Collection:
- Datalogger, Computer.
- Telemetry and control systems (telephone, radio, satellite)
- Ways of collecting data.
-Basic scheme of a measuring station.

Full-or-part-time: 7h 11m
Theory classes: 2h
Laboratory classes: 1h
Self study : 4h 11m

Hydraulic Valves

Description:
Opening-closing, regulation, air purge, against sobrepressions, retention, reducing pressure.

Full-or-part-time: 7h 11m
Theory classes: 2h
Laboratory classes: 1h
Self study : 4h 11m

Hydraulic pumps

Description:
- Peristàltics pumps,
- Centrifugals pumps (horizontal, submersible, axial flow)
- Vertical
- Specials

Full-or-part-time: 14h 23m
Theory classes: 2h
Laboratory classes: 4h
Self study : 8h 23m

Instrumentation channels

Description:
Explanation, expansion of theme

Full-or-part-time: 7h 11m
Theory classes: 3h
Self study : 4h 11m

Instrumentation in dams

Description:
- Types of dams
- Variables to be measured (deformations, stresses, pressures ,....)
- Inverted Pendulum
- Sliding micrometer
- Pendulum Live
- Extensiòmetres
- Oscillatory phenomena.

Full-or-part-time: 7h 11m
Theory classes: 3h
Self study : 4h 11m

Practices

Description:
Theoretical explanation of the practice.
- Calculation of a coefficient of drain tank
- Capacity of a channel

Differential equation for calculating the drain of a stock
Hydraulic laboratory practice.
Calculation of a coefficient of drain tank
Practice laboratory
Seating is on a channel

Full-or-part-time: 21h 36m
Practical classes: 9h
Self study : 12h 36m

Review

Full-or-part-time: 7h 11m
Laboratory classes: 3h
Self study : 4h 11m

GRADING SYSTEM

Each student must do the following tasks:
I. Lab work (groups of 3 or 4 students)
II. Individual Report of Lab work
III Numerical simulation work in HECRAS and IBER
IV. Individual Report on numerical work
V. Oral presentation of all the tasks
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The course consists of two different parts, each of which corresponds to 50% of the semester.

a) Lab work:
There will be a previous session in the classroom in which the objectives, the methodology to be followed and the risk prevention mechanisms to be considered will be explained. Specifically, two Lab works are proposed to address different aspects of open channel flow (gradually varied flow, rapidly varied flow, flow capacity, 1D and 2D flow).
There will be two or three sessions in the classroom to analyze the data taken in the laboratory and raise the main doubts that arise from the treatment of those data.
In all sessions the professor will assess the student's participation during it.
Each student must prepare an individual report for each of the Lab works following the script that will be provided for its elaboration.
b) Numerical simulation work
The two works performed in the laboratory will be reproduced numerically. With the 1D HECRAS model and later with the 2D IBER model.
The sessions will take place in the computer room. The professor will indicate the steps to follow to achieve each goal.
In all sessions the professor will assess the student's participation during it.
Each student must prepare an individual report for each of the practices following the script that will be provided for its elaboration.

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The global assessment of the subject will be done following the following weighting:

Final Grade = 0.9 · (Average of the 4 individual reports) +0.10 · (Individual assessment of class participation)

Criteria of qualification and of admission to the re-evaluation: The students suspended in the ordinary evaluation that have presented regularly to the proofs of evaluation of the asignatura suspended will have option to realize a proof of reevaluation in the period fixed in the academic calendar. Students who have already passed it or the students qualified as not presented will not be able to take the re-evaluation test of a subject. The maximum grade in the case of taking the re-assessment exam will be five (5.0). The non-attendance of a student summoned to the re-evaluation test, held in the fixed period may not result in another test being held at a later date. Extraordinary evaluations will be performed for those students who due to accredited force majeure have not been able to perform any of the continuous evaluation tests.

EXAMINATION RULES.

Failure to perform a laboratory or continuous assessment activity in the scheduled period will result in a mark of zero in that activity.

BIBLIOGRAPHY

Basic:
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- Herschy, R. New technology in hydrometry : developments in the acquisition and management of streamflow data. Bristol [etc.]: A. Hilger, 1986. ISBN 0852745583.
- Monpín, J.. Transductores y medidores electrónicos. 2a ed. Barcelona: Marcombo, 1982. ISBN 8426704727.
- Mataix, C. Mecánica de fluidos y máquinas hidráulicas. 2a ed., ampl. y act., rev. y redact. en el SI. Madrid: Ediciones del Castillo, 1982. ISBN 8421901753.
- Kumar, D.S. Mechanical measurements & control. 4th rev. and enlarged ed. New Delhi: Metropolitan Book, 2006. ISBN 812000423X.