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250430 - HIDURB - Urban Hydrology

Coordinating unit: 250 - ETSECCPB - Barcelona School of Civil Engineering

Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering

Academic year: 2015

Degree: MASTER'S DEGREE IN CIVIL ENGINEERING (PROFESSIONAL TRACK) (Syllabus 2012). (Teaching unit Optional)
MASTER'S DEGREE IN CIVIL ENGINEERING (RESEARCH TRACK) (Syllabus 2009). (Teaching unit Optional)

ECTS credits: 5 Teaching languages: English

Teaching staff

Coordinator: MANUEL GOMEZ VALENTIN

Others: JORGE CABOT PLE, MANUEL GOMEZ VALENTIN

Opening hours

Timetable: Friday afternoon, from 16 to 20 h
Building D1, room 205

Degree competences to which the subject contributes

Specific:

8230. The ability to plan, dimension, construct and maintain hydraulic works.

8231. The ability to plan, evaluate and regulate the use of surface water and groundwater resources.

Teaching methodology

The course consists of 1,8 hours per week of classroom activity (large size group) and 0,8 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 0,8 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.

Learning objectives of the subject

Specialization subject in which knowledge on specific competences is intensified.

Knowledge and skills at specialization level that permit the development and application of techniques and methodologies at advanced level.

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Contents of specialization at master level related to research or innovation in the field of engineering.

Provide a detailed knowledge of the main processes in urban areas during rain events, design storms, losses, inlet systems, hydraulic calculus and CSO problems, and the tools to develop a project of a sewer system emphasizing the hydrologic and hydraulic behaviour

Study load

Total learning time: 125h	Theory classes:	19h 30m	15.60%
	Practical classes:	9h 45m	7.80%
	Laboratory classes:	9h 45m	7.80%
	Guided activities:	6h	4.80%
	Self study:	80h	64.00%

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Content

Urban Drainage: Introduction

Learning time: 2h 24m
Theory classes: 1h
Self study : 1h 24m

Description:
To introduce the concept of Urban Drainage and the objectives associated to the drainage system: the rainfall data, the urban environments, a sewer system, a collecting system and the overflows t oreceiving waters and the impacts associated.

Design Criteria

Learning time: 14h 23m
Theory classes: 4h
Practical classes: 2h
Self study : 8h 23m

Description:
In this session we introduce the main design criteria used in drainage systems: type of sections, maximum and minimum velocities, etc
Risk criteria in sewer systems: hazard and risk. Return period. Concept of hazard and risk. Economic assessment

Design rainfall in different cities around the world: Exercise

Specific objectives:
Provide to the students the concepts of return period associated to the sewer design, and the concepts of hazard and risk, and the use in new sewer systems or rehabilitation of existing sewers
To compare the design criteria of different cities, differences and similarities

Rainfall data: design storms and rainfall patterns

Learning time: 7h 11m
Theory classes: 2h
Practical classes: 1h
Self study : 4h 11m

Description:
In this sessions, rainfall data needed to perform a detailed hydrologic study in urban areas is presented. IDF real or synthetic are presented. Design storms used in the professional practice are introduced
Design Storms Examples and applications

Losses in urban areas

Learning time: 2h 24m
Practical classes: 1h
Self study : 1h 24m

Description:
Description of the different loss processes in urban environment

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Street flow: risk criteria

Learning time: 14h 23m

Theory classes: 3h
Practical classes: 3h
Self study : 8h 23m

Description:
Hydraulic analysis of grate inlets. Experimental procedures. Concept of efficiency. Carry over flow.
Street network and street flow. Maximum flow in a street. Risk criteria in terms of maximum flow, water level, velocity, etc.
Calculation of the best distance between consecutive inlets
Test case:design of optimal location of inlets.Visit to the laboratory to observe a hydraulic test of a single inlet

Specific objectives:
Provide to the student the concepts of the hydraulic behaviour of a single grate inlet. Explain how to characterize with a power function the efficiency values of any inlet
Provide to the student the concept of surface flow along the street network during a rain event. Estimation of the maximum acceptable flow in a street. Definition of risk criteria associated to street flow
Apply the concepts of risk flow, hydraulic parameters of an inlet, to define the best location for inlets at any street

SUDS Sustainable Urban Drainage Systems

Learning time: 4h 48m

Theory classes: 2h
Self study : 2h 48m

Description:
SUDS. Retention and infiltration. Porous pavements. Infiltration trench. Other techniques

Specific objectives:
Provide to the student the vision of the "soft" techniques, trying to reduce the runoff during rain events

Assessment

Learning time: 9h 36m

Laboratory classes: 4h
Self study : 5h 36m

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Hydraulic behaviour of sewer systems

Learning time: 14h 23m

Theory classes: 3h
Laboratory classes: 3h
Self study : 8h 23m

Description:
Hydraulic behaviour of sewer systems. Steady and unsteady flow approaches.
Detention basins. Hydraulic behaviour. Inlet and outlet. Design criteria. Maintenance and operation
Visit to the detention basins located in Cornellá

Specific objectives:
Introduce to the specific aspects of the hydraulic behaviour of sewer networks: free surface and pressure flow, front waves, hydraulic jumps, trapped air, etc
Introduce to the student the concept of a detention basin. Advantages and disadvantages. Dimensions and other elements for inlet and outlet. Cleaning and maintenance criteria.
Observe through two different examples the benefits and operation and maintenance of real detention basins

CSO problems. Quality aspects of receiving waters

Learning time: 7h 11m

Theory classes: 3h
Self study : 4h 11m

Description:
Concept of CSO and SSO. Water quality aspects. Organic and inorganic matter. CSO components. Simulation and real measurements
CSO test case

Specific objectives:
Introduce the CSO concepts and the risk to receiving waters in wet weather conditions
To show and example of CSO problem

Commercial codes available

Learning time: 14h 23m

Theory classes: 1h
Practical classes: 5h
Self study : 8h 23m

Description:
Commercial codes most used: SWMM5, InfoWorks, Mike-Urban and others
SWMM5 code. Introduction and test cases
Coursework on sewer system analysis. Rehabilitation of a network with SWMM5

Specific objectives:
Present to the student the main commercial coeds available to the practitioner to use in urban drainage
Introduce a public domain code SWMM5 developed by the EPA, and their possibilities

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Pilot catchments	Learning time: 2h 24m Laboratory classes: 1h Self study : 1h 24m

Description:
Concept of pilot catchment. Selection criteria. Rain gages. Flow gauges. Measurements of pollutans

Qualification system

The mark of the course is obtained from the ratings of continuous assessment and their corresponding laboratories and/or classroom computers.

Continuous assessment consist in several activities, both individually and in group, of additive and training characteristics, carried out during the year (both in and out of the classroom).

The teachings of the laboratory grade is the average in such activities.

The evaluation tests consist of a part with questions about concepts associated with the learning objectives of the course with regard to knowledge or understanding, and a part with a set of application exercises.

Test1, Test2 and Courseworks, mark from 0 to 10
Nota final: 0.5(0.5*Test1+0.5Test2) + 0.5 Courseworks

Regulations for carrying out activities

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

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Bibliography

Basic:

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Gómez Valentín, M. Curso de hidrología urbana. Barcelona: Escola Tècnica Superior d'Enginyers de Camins, Canals i Ports. Universitat Politècnica de Catalunya (UPC), 2008. ISBN 978-84-612-1514-0.

Larry Mays. Stormwater Collection systemsdesign Handbook. New York: McGraw-Hill, 2001. ISBN 0-07-135471-9.

M. Gómez. Curso de depósitos de retención de aguas pluviales.. Barcelona: Ed. Alfambra., 2009. ISBN 978-84-613-7101-3.

M. Gómez. Curso de Análisis y Rehabilitación de Redes de Alcantarillado.. Barcelona.: Ed. Alfambra, 2007. ISBN 978-84-611-7817-9..

Complementary:

Hormoz Pazwash. Urban Storm Water Management. CRC Press, 2011. ISBN 978-1439810354.

A. Osman Akan, Robert J. Houghtalen. Urban Hydrology, Hydraulics, and Stormwater Quality: Engineering Applications and Computer Modeling. New York: J. Wiley, 2003. ISBN 978-0471431589.

Kiran Tota-Maharaj. Permeable Pavements for Urban Stormwater Runoff Enhancement and Reuse. VDM Verlag Dr. Müller, 2011. ISBN 978-3639365061.

Martin P. Wanielista, Yousef A. Yousef. Stormwater Management. New York: Wiley-Interscience, 1992. ISBN 978-0471571353.

Centro de Estudios Hidrográficos. GUíA TéCNICA SOBRE REDES DE SANEAMIENTO Y DRENAJE URBANO. Madrid: Centro de Estudios Hidrográficos, 2009. ISBN 9788477904915.