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250135 - ENGAMB - Environmental Engineering

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

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

Academic year: 2018

Degree: BACHELOR'S DEGREE IN CIVIL ENGINEERING (Syllabus 2010). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN CIVIL ENGINEERING (Syllabus 2017). (Teaching unit Compulsory)

ECTS credits: 6 Teaching languages: Catalan, Spanish, English

Teaching staff

Coordinator: JAUME PUIGAGUT JUAREZ

Others: IVET FERRER MARTI, MARIANNA GARFI, JAUME PUIGAGUT JUAREZ

Opening hours

Timetable: Friday from 11 to 14. We can arrange other visit hours during the classes.

Degree competences to which the subject contributes

Specific:

3047. Knowledge and understanding of supply and treatment systems, and how to dimension, construct and conserve them.

Generical:

3104. 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.

3110. 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.

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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:

585. ENTREPRENEURSHIP AND INNOVATION - Level 1. Showing enterprise, acquiring basic knowledge about organizations and becoming familiar with the tools and techniques for generating ideas and managing organizations that make it possible to solve known problems and create opportunities.

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 4 hours a week of classes.

Theoretical classes in some cases supplemented with audiovisual and practical classes in solving problems that arise in groups. Some classes consist of reading and discussion of technical articles.

Learning objectives of the subject

Students will acquire an understanding of water supply and sanitation systems, as well as the design, construction and preservation of sewage treatment plants. They will also acquire an understanding of ecosystem functioning and environmental factors.

Upon completion of the course, students will have acquired the ability to: 1. Carry out a water quality analysis that includes chemical and biological factors. 2. Analyse the cycle of a sewage treatment plant. 3. Analyse the cycle of a water purification plant.

Basic concepts of ecology and ecosystems; Microbial growth kinetics; Microbiological water quality; Chemistry and biogeochemical cycles: nitrogen, phosphorus, carbon, and sulphur; BOD5 and COD; Environmental management: water quality assessment, environmental impact and limnology; Biological diversity; Water purification: disinfection and fluoridation; Sewage treatment (urban and industrial), sanitation networks, basic and secondary sewage treatment processes, activated sludge; Sludge digestion: physical-chemical methods, lagooning and decentralised sanitation; Marine outfalls and the reuse of sewage and sludge

1. To know, understand and apply the fundamentals of environmental engineering in the context of civil engineering.
2. To have an integrated view of environmental issues and proposed actions for management.
3. To develop and implement mass balances in treatment processes.
4. Understanding and applying technologies for water treatment.

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Study load

Total learning time: 150h	Theory classes:	32h	21.33%
	Practical classes:	16h	10.67%
	Laboratory classes:	12h	8.00%
	Guided activities:	6h	4.00%
	Self study:	84h	56.00%

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Content

Water microbial quality

Learning time: 9h 36m

Theory classes: 2h
Practical classes: 2h
Self study : 5h 36m

Description:
Characteristics of fecal contamination indicators
Groups of indicators
Concentrations and survival
Resistance to treatments
Methods of analysis
Interpretation of data: normal distribution and log-normal
Bathing water quality regulations

Microbiological quality problems

Specific objectives:
Understand the main microbiological indicators of fecal contamination and their usual range of concentrations.

Water physico-chemical quality

Learning time: 19h 12m

Theory classes: 2h
Practical classes: 4h
Laboratory classes: 2h
Self study : 11h 12m

Description:
Importance of physico-chemical parameters
Solids
Turbidity
Electrical conductivity
pH, alkalinity and hardness

Dissolved oxygen
Biochemical oxygen demand
Chemical oxygen demand
Total organic carbon
Assessment of water quality
Sampling and conservation
Sample types
Mass emission rate
Inhabitant equivalent
Physical and chemical quality 3
Physico-chemical quality problems

Specific objectives:
Basic knowledge of the physical and chemical parameters of water quality.

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Wastewater treatment processes

Learning time: 19h 12m

Theory classes: 4h
Practical classes: 2h
Laboratory classes: 2h
Self study : 11h 12m

Description:
Sewerage networks
Characteristics of wastewater
Wastewater treatment theory
Pretreatment
Primary treatment

Secondary treatment
Activated sludge
Eutrophication control
Effect of lake thermal cycle on eutrophication
Marine outfalls
Initial dilution, horizontal dispersion and inactivation
Sanitation problems

Specific objectives:
Understand, calculate and dimensioning of key processes applied to wastewater treatment. Understanding of a wastewater plant.

Microbial growht kinetics

Learning time: 14h 23m

Theory classes: 2h
Practical classes: 2h
Laboratory classes: 2h
Self study : 8h 23m

Description:
Organisms classification
Microbial cultures: qualitative and quantitative aspects
Reactor theory

Phases of microbial growth
Michaelis-Menten-Monod model
Application of microbial kinetics to a mixed reactor with and without recycling
Kinetic parameter values

Kinetics problems

Specific objectives:
Learn basics of microbiology, microbial cultures and reactors.

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Sludge treatment and management	Learning time: 9h 36m Theory classes: 4h Self study : 5h 36m

Description:
Characteristics of sludge
Thickening
Dewatering
Anaerobic Digestion
Final disposal

Specific objectives:
Understand the main processes applied to the sludge treatment.

Water supply treatment processes	Learning time: 19h 12m Theory classes: 4h Practical classes: 2h Laboratory classes: 2h Self study : 11h 12m

Description:
Urban water circuit
Distribution networks
Objectives of treatment processes
Coagulation and flocculation
Application of reactors theory to coagulation-flocculation
Supply problems 1
Sedimentation
Granular media filtration
Adsorption
Supply problems 2

Specific objectives:
Understand, calculate and dimensioning key processes applied to water supply. Understanding the performance of a water supply plant.

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Desalination	Learning time: 9h 36m Theory classes: 2h Laboratory classes: 2h Self study : 5h 36m

Description:
Type of membranes
Reverse osmosis
Reversible electrodialysis
Desalination plants

Specific objectives:
Understand the basic principles of desalination as well as the performance of a desalination plant.

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

Description:
Importance of disinfection
Chlorination: chemistry of chlorinated species
Kinetic aspects of chlorination
Break point

Disinfection with ozone
Disinfection with UV radiation
Other disinfectants
Disinfection problems

Specific objectives:
Understand the basic principles of disinfection and its calculation and dimensioning.

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Solid waste treatment and management

Learning time: 14h 23m

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

Description:
Management strategies
Selective collection
Properties of wastes
Composting
Anaerobic digestion
Incineration
Controlled landfills
Solid waste problems

Specific objectives:
Understand the main processes of treatment and solid waste management.

Atmospheric pollution

Learning time: 9h 36m

Theory classes: 2h
Laboratory classes: 2h
Self study : 5h 36m

Description:
Structure and composition of the atmosphere
Origins and sources of air pollution
Air pollutants
Effects and episodes of air pollution
Greenhouse gases
Alteration of the greenhouse effect
Global warming potential
Impact of climate change
Climate change control

Specific objectives:
Know the major air pollutants.

Noise pollution

Learning time: 4h 48m

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

Description:
Noise and air pollution problems

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Qualification system

Continuous evaluation. The mark of the subject is derived from the ratings of two exams that are performed during the course (the weigh of each exam is calculated from de Number of sessions).

Criteria for re-evaluation qualification and eligibility: Students that failed the ordinary evaluation and have regularly attended all evaluation tests will have the opportunity of carrying out a re-evaluation test during the period specified in the academic calendar. Students who have already passed the test or were qualified as non-attending will not be admitted to the re-evaluation test. The maximum mark for the re-evaluation exam will be five over ten (5.0). The non-attendance of a student to the re-evaluation test, in the date specified will not grant access to further re-evaluation tests. Students unable to attend any of the continuous assessment tests due to certifiable force majeure will be ensured extraordinary evaluation periods.

These tests must be authorized by the corresponding Head of Studies, at the request of the professor responsible for the course, and will be carried out within the corresponding academic period.

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.

Bibliography

Basic:

Mihelcic, J.R.. Fundamentos de ingeniería ambiental. México, DF: Limusa, 2001. ISBN 9681859162.

Kiely, G. Ingeniería ambiental: fundamentos, entornos, tecnologías y sistemas de gestión. Madrid: McGraw-Hill, 1999. ISBN 8448120396.

Henry, J.G.; Heinke, G.W. Ingeniería ambiental. 2a ed. México: Prentice-Hall, 1999.

Masters, G.M.; Ela, W.P. Introduction to environmental engineering and science. 3rd ed. Englewood Cliffs: Prentice-Hall, 2008. ISBN 9780132339346.

Peavy, H.S.; Rowe, D.R.; Tchobanoglous, G. Environmental engineering. New York: McGraw-Hill, 1985. ISBN 0070491348.

Complementary:

APHA-AWWA-WPCF. Standard methods for the examination of water and wastewater. 18th Edition. Washington: American Public Health Association, 1992. ISBN 0875532071.

Metcalf & Eddy. Wastewater engineering: treatment and reuse. 4th ed. Boston [etc]: McGraw-Hill, 2003. ISBN 0070418780.

Droste, R. L. Theory and practice of water and wastewater treatment. New York: J. Wiley, 1997. ISBN 0471124443.

Tchobanoglous, G; Kreith, F. Handbook of solid waste management. 2nd ed. New York [etc.]: McGraw-Hill, cop. 2002. ISBN 0071356231.