Course guide
2500019 - GECTECNAMB - Environmental Technology

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 CIVIL ENGINEERING (Syllabus 2020). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Catalan, English

LECTURER

Coordinating lecturer: JAUME PUIGAGUT JUAREZ

Others: ANA ÁLVAREZ GONZÁLEZ, MANUEL BARBERO DEL RÍO, EDUARD BORRÀS CAMPS, ANA MARIA JOSE CANDELARIA CANO LARROTTA, CLARA CORBELLA VIDAL, MARTA FERNANDEZ GATELL, FABIANA LOPES DEL REI PASSOS, JAUME PUIGAGUT JUAREZ

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
14408. Ability to apply study methodologies and environmental impact assessments. (Common module to the Civil branch)
14417. Knowledge and understanding of the supply and sanitation systems, as well as their sizing, construction and conservation. (Specific technology module: Civil Construction)
14419. Knowledge and understanding of the functioning of ecosystems and environmental factors. (Specific technology module: Hydrology)
14420. Knowledge of urban services projects related to water distribution and sanitation. (Specific technology module: Hydrology)
14421. Knowledge and understanding of the supply and sanitation systems, as well as their sizing, construction and conservation. (Specific technology module: Hydrology)

Generical:
14380. Scientific-technical training for the exercise of the profession of Technical Engineer of Public Works and knowledge of the functions of advice, analysis, design, calculation, project, construction, maintenance, conservation and exploitation.
14383. Ability to project, inspect and direct works, in their field.
14390. Identify, formulate and solve engineering problems. Pose and solve construction engineering problems with initiative, decision-making skills and creativity. Develop a systematic and creative method of analysis and problem solving. (Additional school competition).

TEACHING METHODOLOGY

The course consists of 3 hours per week of lectures in the classroom, outlining the basics of the subject, presenting examples and solving exercises.

Support material is provided through the Virtual Campus ATENEA.

There is a compulsory technical visit.

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

Knowledge of the characteristics of sewage and drinkable water. Microbial Kinetics. Design of Sedimenters. Processes and design of conventional treatment systems. Decentralized sanitation systems. Drinkable water: processes and technology. Desalination: Processes and technology. Sludge Management. Urban waste management. Noise pollution. Air pollution.

1 Ability to conduct a water quality analysis study including chemical and biological factors.
2 Ability to analyze the cycle of a sewage treatment plant.
3 Ability to analyze the cycle of a water purification plant.

Basic knowledge of ecology and ecosystems, kinetics of microbial growth. Microbiological quality of a water. Chemistry, biogeochemical cycles: nitrogen, phosphorous, carbon and sulfur. BOD5 and COD. Environmental Management: Evaluation of the quality of a water, Environmental Impact, limnology, biological diversity. Water purification: disinfection and fluoridation.Sewage treatment (urban and industrial), sanitation networks, basic sewage treatment processes, secondary, activated sludge. Sludge digestion, physico-chemical, lagoon and autonomous sanitation. Submarine outfalls, reuse of sewage and sludge.

Knowledge and understanding of the main treatment systems of drinkable water, wastewater and municipal solid waste.

STUDY LOAD

Type	Hours	Percentage
Guided activities	6,0	4.00
Self study	84,0	56.00
Hours large group	30,0	20.00
Hours medium group	30,0	20.00

Total learning time: 150 h

CONTENTS

Presentation

Description:
Presentation of the course

Full-or-part-time: 2h 24m
Theory classes: 1h
Self study : 1h 24m

1. Water quality assessment

Description:
Urban water circuit
Sampling and preservation of samples
Mass emission rate
Inhabitant equivalent

Specific objectives:
To describe the urban water circuit
To explain the process of sampling and preservation of samples
To define the concepts of mass emission rate and inhabitant equivalent

Full-or-part-time: 4h 48m
Theory classes: 2h
Self study : 2h 48m

2. Water characterization

Description:
Composition of water

Physico-chemical water quality
Microbiological water quality

Specific objectives:
To describe the typical composition of different water sources

To define the main physico-chemical and microbiological water quality parameters

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

3. Drinkable water treatment

Description:
Standards for water supply
Distribution networks
Objectives of drinkable water treatment processes
Coagulation and flocculation

Applying the theory of reactors in the coagulation-flocculation
Exercises on coagulation-flocculation
Sedimentation
Granular media filtration
Adsorption
Exercises on coagulation-flocculation, sedimentation and filtration

Specific objectives:
To list water supply quality standards
To describe the distribution networks
To explain the processes of coagulation and foculació

To applying the theory of reactors in the coagulation-flocculation
To solve exercises on coagulation-flocculation
To describe the process of sedimentation
To compare the filtration in slow and fast granular media filters
To explain the role of active carbon adsorption
To solve exercises on the processes of coagulation-flocculation, sedimentation and filtration

Full-or-part-time: 28h 47m
Theory classes: 3h
Practical classes: 4h
Laboratory classes: 5h
Self study : 16h 47m

4. Water disinfection

Description:
Importance of disinfection
Chlorination
Disinfection with ozone
Disinfection with UV

Applying the theory reactors to water disinfection
Exercises on water disinfection

Specific objectives:
To compare the main methods of water disinfection
To describe the process of breakpoint chlorination

Applying the theory of the disinfection reactors
Solving exercises in water disinfection

Full-or-part-time: 21h 36m
Theory classes: 2h
Practical classes: 2h
Laboratory classes: 5h
Self study : 12h 36m

5. Desalination of water

Description:
Filtration membranes
Reverse Osmosis
Desalination plants

Specific objectives:
To define the process of reverse osmosis
To describe the treatment line of a desalination plant

Full-or-part-time: 2h 24m
Theory classes: 1h
Self study : 1h 24m

Evaluation

Full-or-part-time: 14h 23m
Laboratory classes: 6h
Self study : 8h 23m

6. Wastewater treatment

Description:
Regulation of wastewater
Sanitation networks
Theory of wastewater treatment
Pretreatment
Utfalls
Primary treatment
Secondary treatment
Tertiary treatment
Outfalls
Kinetics of microbial growth
Application of microbial kinetics in a CSTR with and without recirculation
Exercises on activated sludge systems

Specific objectives:
To list the wastewater regulations
To describe the processes used on wastewater pretreatment, primary treatment, secondary treatment and tertiary treatment
To apply a microbial kinetics in a CSTR with and without recirculation
To solve exercises on activated sludge systems

Full-or-part-time: 28h 47m
Theory classes: 5h
Practical classes: 2h
Laboratory classes: 5h
Self study : 16h 47m

7. Sludge treatment

Description:
Characteristics of sludge
Thickening
Dewatering
Anaerobic Digestion
Final Destination of sludge
Exercises of sludge treatment systems

Specific objectives:
To define the main characteristics of sludge
To describe the process of thickening, dewatering and anaerobic digestion of sludge
To solve exercises on sludge treatment systems

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

Technical Visit

Description:
Technical visit to a water or solid waste treatment plant

Specific objectives:
To describe water and municipal solid waste treatment processes

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

8. Municipal solid waste management and treatment

Description:
Composting
Anaerobic digestion
Incineration
Landfills
Exercises on municipal solid waste treatment
Incineration
Lanfilling

Specific objectives:
To describe municipal solid waste composting, anarobic digestion and incineration
To compare the processes of composting and anaerobic digestion
To decribe the life cycle of landfills
To solve exercises on municipal solid waste treatment
To describe the process of incineration of municipal solid waste
To describe the life cycle of landfills

Full-or-part-time: 19h 12m
Theory classes: 6h
Practical classes: 2h
Self study : 11h 12m

GRADING SYSTEM

The grade for the course is obtained from continuous assessment activities and exams.

Continuous assessment includes activities such as exercises and a technical visit (30% of the grade for the course).

Exams consist of theroretical questions with exercises. There are two exams (35% of the grade for the course each).

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.

EXAMINATION RULES.

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

To have access to the re-evaluation the minimum mark is 4.

BIBLIOGRAPHY

Basic:
- Kiely, G. Ingeniería ambiental: fundamentos, entornos, tecnologías y sistemas de gestión. Madrid: McGraw-Hill, 1999. ISBN 8448120396.
- Mihelcic, J.R. Fundamentos de ingeniería ambiental. México: Limusa Wiley, 2001. ISBN 9681859162.
- Henry, J.G.; Heinke, G.W. Ingeniería ambiental. 2a ed. México: Prentice-Hall, 1999. ISBN 9701702662.
- Water treatment handbook. 7th ed. Malmaison Cedex: Degremont, 2007. ISBN 9782743009700.
- Metcalf & Eddy. Wastewater engineering: treatment and reuse. 4th ed. Boston, EEUU: Mc Graw-Hill Higher Education, 2003. ISBN 0070418780.

Complementary:
- APHA-AWWA-WPCF. Standard methods for the examination of water and wastewater. 18th Edition. Washington: American Public Health Association, 1992. ISBN 0875532071.
- Agencia de Residus de Catalunya [on line]. [Consultation: 29/03/2022]. Available on: http://residus.gencat.cat/ca/inici.
- Agencia Catalana de l'Aigua [on line]. [Consultation: 29/03/2022]. Available on: http://aca-web.gencat.cat/aca/appmanager/aca/aca/.
- Àrea Metropolitana de Barcelona - Medi Ambient [on line]. [Consultation: 29/03/2022]. Available on: http://www.amb.cat/s/web/medi-ambient/medi-ambient.html.