VNIVERSITAT DE VALÈNCIA

Course Guide
34783 Water Treatment

COURSE DATA

Data Subject	
Code	34783
Name	Water Treatment
Cycle	Grade
ECTS Credits	6.0
Academic year	2019 - 2020

Study (s)

Degree	Center	Acad. year	Period
1401 - Degree in Chemical Engineering	School of Engineering	4	Second term

Subject-matter

Degree	Subject-matter	Character
1401 - Degree in Chemical Engineering	23 - Optional subjects	Optional

Coordination

Name	Department
JIMENEZ BENITEZ, ANTONIO LUIS	245 - Chemical Engineering
SECO TORRECILLAS, AURORA	245 - Chemical Engineering

SUMMARY

The subject Water Treatment is an elective four-monthly subject that is taught in the fourth year and second semester of the Degree in Chemical Engineering. The subject is part of the group of subjects focused on Environmental Engineering taught in the Chemical Engineering Degree and complete the knowledge acquired in the subjects Sustainability and Environment and Environmental Pollution Engineering , both compulsory and taught in the second and third degree course respectively.

The subject, of 6 ECTS, includes theoretical and practical tasks, so that the theoretical knowledge is complemented by the resolution of problems and by carrying out different assignments.

This subject aims to provide students with the knowledge and skills necessary for the preliminary design of water treatment facilities for human consumption or provision of facilities and treatments applied in the purification of urban and industrial wastewater.

To do this, firstly, the most common physical and chemical methods for treatment of water and wastewater are developed in detail.

This is followed by a thorough study of the biological treatments, which are widespread used in the treatment of urban and industrial wastewater. The complexity of these processes justifies the importance of a detailed study of them.

Aspects concerning the process microbiology, kinetics and stoichiometry of biochemical reactions, types of processes, process schemes, applicability, etc. are included in. Emphasis will be placed on technologies aimed at the simultaneous removal of organic matter and nutrients.

Finally, the problem of sludge production and the existing treatment methods are studied.

The knowledge will be consolidated through class exercises involving the completion of the preliminary design of various water treatment plants.

The theory classes will be taught in Spanish and the practical and laboratory classes as stated in the course sheet available on the web of the degree.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

For the success on addressing this subject is advisable that the student has completed or is enrolled in the subjects Environment and Sustainability and Environmental Pollution Engineering and other fundamental subjects of Chemical Engineering as Basis of Chemical Engineering, Unit Operations of Chemical Engineering and Chemical Reaction Engineering addressed in previous semesters.

OUTCOMES

1401 - Degree in Chemical Engineering

- O1 - More comprehensive skills than those acquired in compulsory subjects.

LEARNING OUTCOMES

• Know the possibilities of the use of wastewater as a resource (Competence O1).

• Know and apply the various physical, chemical and biological water treatments (Competence O1).

• Evaluate various treatment alternatives from a technical, economic and social point of view (Competence O1).

• Acquire the ability to plan, design and operate facilities for water treatment (Competence O1).

• Understand and apply advanced technologies for the treatment of persistent and emerging contaminants (Competence O1).

• Understand and apply advanced technologies to minimize sludge production and its valorisation (Competence O1).

• Understand the importance of control in treatment plants (Competence O1).

• Acquire an overview of a treatment plant integrating the various processes involved in the different treatment lines (Competence O1).

• Know the techniques to characterize a wastewater and a biological sludge from an activated sludge process in the laboratory (Competence O1).

• Acquire the ability to perform a "Jar-test" and interpret their results (Competence O1).

DESCRIPTION OF CONTENTS

1. Introduction to water treatment

Importance of water treatment. Legal framework. Methods of treatment of the water. Treatment schemes. Sustainable management of water quality.

2. Physical treatment of waters

Screening. Flow equalization. Mixing. Flocculation. Sedimentation. Flotation. Aeration. Filtration. Membrane processes.

3. Chemical treatment of waters

Precipitation. Coagulation. Adsorption. Oxidation. Ion exchange. Disinfection.

4. Physical and chemical treatment of sludge

Thickening. Stabilization. Dehydration. Minimization.

5. Biological methods for wastewater treatment

Introduction to biological treatments. Microbiology of treatment processes. Kinetics and stoichiometry of the reactions.

6. Suspended-growth biological processes I

Activated sludge. Organic matter removal. Nitrification. Denitrification. Advanced treatmenst: aerobic bio-membrane reactors, SHARON process, ANAMMOX, BABE. Biological phosphorus removal. Wastewater treatment plants for biological nutrient removal.

7. Suspended-growth biological processes II

Aerobic digestion of sludge. Anaerobic suspended-growth treatments. Anaerobic bio-membranes reactors. Anaerobic digestion of sludge.

8. Attached-growth biological processes

Trickling Filters. Rotating biological contactors. Peat beds. Anaerobic attached-growth processes.

9. Laboratory of Water Treatment

Practice 1: Characterization of wastewater: COD, BOD, nitrogen and phosphorus.
Practice 2: "Jar-test".
Practice 3: Characterization of an activated sludge system: SS, IVF and microbiological parameters.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	25,00	100
Classroom practices	20,00	100
Laboratory practices	15,00	100
Development of group work	10,00	0
Development of individual work	10,00	0
Study and independent work	15,00	0
Readings supplementary material	5,00	0
Preparation of evaluation activities	20,00	0
Preparing lectures	10,00	0
Preparation of practical classes and problem	20,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

The development of the subject is structured around four axes: the lecture sessions, practical activities, the fulfilment of an individual project and tutorials:

Lecture sessions: the teacher will give an overview of the issue impacting on the key to understanding it. Also will recommend adequate resources for the further deepening of the subject by the student (Competence O1).

Practical activities: activities will complement the lecture sessions with the aim of applying the basics and expand the knowledge and experience acquired during the realization of the work proposed. These activities include one or more of the following types of classroom activities: classes of problems, discussion sessions, problem solving exercises and solving of previously worked problems by the students. Also, a visit to one or more wastewater treatment plants in the area of Valencia will be planned (Competence O1).

Laboratory Practice Sessions: The student will perform three laboratory practical sessions of 5 hours. Students will practice in pairs, integrated into teams of 4-8 students depending on the practice to perform. Each pair in one of the teams will be responsible for a particular aspect of the practice.

The student must submit a report that integrates and encompasses all aspects covered in each of the sessions.

Attendance at laboratory sessions is mandatory (Competence O1).

Fulfilment of projects: Students must take a compulsory project that will be delivered on the agreed date (Competence O1)

Tutorials: The tutorials will arise as sessions to resolve any doubts arising from the resolution of the problems or work that students must perform on their own. In addition, the teacher will guide the student on the most appropriate methodology for learning basic knowledge of the subject. Tutorials will be conducted both individually and at the group level with the frequency that the teacher deems appropriate. In the latter, the main difficulties encountered in solving a number of problems that students have solved and delivered previously will discuss (Competence O1).

EVALUATION

Method of evaluation A:

Assessment of learning by the students will take place through continuous assessment and a final assessment that will include:

Individual project: the student must fulfil an individual project proposed by the teacher which will be valued at 35% of the final grade (minimum grade to pass the subject is 5) (Competence O1).

Laboratory practice: the student must perform a memory of the laboratory practices which will be valued at 20% of the final grade (minimum grade of each memory to pass the subject 5) (Competence O1).

Final exam: the student must take a final exam which will evaluate the fundamental concepts of the subject. The exam is valued at 25% of the final grade (minimum grade 3.5) (Competence O1).

Continuous assessment: based on participation and level of student involvement in the teaching-learning process, taking into account regular attendance to the planned classroom activities (5%) and the resolution of the exercises proposed (15%) (Competence O1).

Method of evaluation B:

Alternatively to the evaluation method described above, the evaluation may be performed by a final exam (which include the fulfilment of a project) counting 75% of the final mark (Competence O1) and the presentation of the three practice reports (20%) (Competence O1), keeping the assessment of the activities developed during the course (5%) (Competence O1), but with a proportionally reduced weight.

In both evaluation methods, to pass is necessary to obtain an average rating of 5 out of 10, provided on the final exam to obtain a grade equal to or greater than 3.5 points (out of 10) and 5 points (out of 10) on the project.

In any case, the evaluation system will be governed by what is established in the Evaluation and Qualification Regulations of the Universitat de València for Degrees and Masters (https://webges.uv.es/uvTaeWeb/MuestraInformacionEdictoPublicoFrontAction.do?accion=inicio&idEdictoSeleccionado=5639)

REFERENCES

Basic

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- Ferrer Polo, J., y Seco Torrecillas, A. Tratamientos físicos y químicos de aguas residuales. Editorial UPV (197), 2011.
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- Metcalf & Eddy. Wastewater Engineering: Treatment and reuse. 4th Ed. McGraw Hill, New York, 2003.

Additional

- Water Environmental Federation. Wastewater Treatment Plant Design. WEF and IWA Publishing, Alexandria, 2003.
- American Public Health Association, American Water Works Association and Water Environment Federation. Standard Methods for the Examination of Water and Wastewater 20th edn, Washington DC, USA, 2005.
- Cervantes, F., Pavlostathis, S., van Haandel, A. Advanced Biological Treatment Processes for Industrial Wastewaters. Principles & application. IWA Publishing, 2006.
- IWA. Process Science and Engineering for Water and Wastewater Treatment. IWA Publishing, London, 2002.
- Seviour, R. And Nielsen, P.H. Microbial Ecology of Activated Sludge. IWA Publishing, London, 2010.
- Gabriel Bitton. Wastewater microbiology. Wiley-Liss, cop. New York. 2005.

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

English version is not available