



Course guide

320072 - TRAR - Wastewater Treatment and Reuse

Last modified: 17/07/2026

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 713 - EQ - Department of Chemical Engineering.
702 - CEM - Department of Materials Science and Engineering.

Degree: BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN TEXTILE TECHNOLOGY AND DESIGN ENGINEERING (Syllabus 2009). (Optional subject).

Academic year: 2026 **ECTS Credits:** 6.0 **Languages:** Spanish

LECTURER

Coordinating lecturer: Buscio Olivera, Valentina

Others: Barajas Lopez, Maria Guadalupe
Buscio Olivera, Valentina

PRIOR SKILLS

It is advisable to have passed the subject ENVIRONMENTAL TECHNOLOGIES AND SUSTAINABILITY.

TEACHING METHODOLOGY

- Presential sessions for exposing the contents.
- Presential sessions of practical work (laboratory).
- Presential sessions of individual work (problems).
- Self-directed study.
- Preparation and evaluation of assessable group activities.

LEARNING OBJECTIVES OF THE SUBJECT

The main objective of the subject is to provide advanced concepts on the conventional treatments (biological and physicochemical) most used for the purification of urban and industrial wastewater. In addition, it is intended to provide an overview of the advanced purification processes aimed at the regeneration and reuse of water.

Based on this main objective, the following general (OG) and specific (OE) learning objectives have been established:

OG1: Know the quality of wastewater based on the characterization parameters.

- OE1: Define the main sources of pollution.
- OE2: Classify the types of pollution.

OG2: Understand the main wastewater purification processes.

- OE3: Distinguish the main wastewater treatments.
- OE4: Relate the water characterization parameters to the applicable treatments.
- OE5: Explain the most used pretreatments.
- OE6: Explain the fundamentals of biological treatments.
- OE7: Distinguish the purpose of biological treatments.
- OE8: Explain the control systems of a WWTP.
- OE9: Predict problems in the operation of a WWTP.
- OE10: Summarize sludge management.

OG3: Evaluate the operation of a biological wastewater treatment plant.

- OE11: Design a basic system for an activated sludge plant.

OG4: Know the main advanced debugging processes.

- OE12: Classify advanced debugging processes.
- OE13: Describe the main characteristics of advanced debugging processes.
- OE14: Identify when it is advisable to use advanced debugging processes.

STUDY LOAD

Type	Hours	Percentage
Hours large group	30,0	20.00
Self study	90,0	60.00
Hours medium group	15,0	10.00
Hours small group	15,0	10.00

Total learning time: 150 h

CONTENTS

MODULE 1: Introduction to wastewater treatment

Description:

Topic 1.1. Wastewater in the water management
Topic 1.2. Main sources and types of pollution
Topic 1.3. Objectives of the main treatments
Topic 1.4. Normative

Specific objectives:

OE1. Evaluate the quality of wastewater based on characterization parameters

Related activities:

Test 1
Practice exam
P1: Characterization of wastewater.

Full-or-part-time: 12h

Theory classes: 2h
Practical classes: 1h
Laboratory classes: 3h
Self study : 6h

MODULE 2: Pretreatments and primary decanters

Description:

Topic 2.1. Main pretreatments
Topic 2.2. Types of primary decanters
Topic 2.3. Fundamental parameters in the design of primary settlers
Topic 2.4. Criteria and design of primary decanters

Specific objectives:

OE2: Identify and describe the main wastewater purification processes
OE3: Design a basic system of a biological wastewater treatment plant

Related activities:

Test 2
SP2: Design of a primary decanter.
Visit WWTP or company talk.

Full-or-part-time: 29h

Theory classes: 6h
Practical classes: 5h
Self study : 18h

MODULE 3: Biological treatments

Description:

Topic 3.1. Fundamentals of biological processes
Topic 3.2. Suspended biomass processes
Topic 3.2.1. Activated sludge processes
Topic 3.2.2. Design of an activated sludge process
Topic 3.3. Basics of biological nutrient removal
Topic 3.3.1. Biological nitrogen removal
Topic 3.3.2. Biological phosphorus removal
Topic 3.4. Control systems for biological treatments
Topic 3.4.1. Basic sampling in a WWTP
Topic 3.4.2. Calculation and control of parameters
Topic 3.4.3. Causes that can alter the operation of a WWTP
Topic 3.4.4. Prevention methods
Topic 3.5. Sludge management
Topic 3.5.1. Sludge line diagram
Topic 3.5.2. Generation and characteristics of sludge
Topic 3.5.3. Sludge treatment

Specific objectives:

OE2: Identify and describe the main wastewater purification processes
OE3: Design a basic system of a biological wastewater treatment plant

Related activities:

Test 3
Practice exam
SP1: BOD kinetics.
SP3: Design of an activated sludge biological reactor.
P2: Biological treatment using activated sludge.
P4: Microscopic observation of activated sludge in biological treatment.
P5: Determination of dissolved oxygen and respiration rate.
Project: Design and simulation of an activated sludge process.

Full-or-part-time: 85h

Theory classes: 18h

Practical classes: 7h

Laboratory classes: 6h

Self study : 54h

MODULE 4: Physicochemical treatments

Description:

Topic 4.1. Coagulation process – flocculation

Topic 4.2. Chemical precipitation

Topic 4.3. Adsorption

Specific objectives:

OE2: Identify and describe the main wastewater purification processes

Related activities:

Test 4

Practice exam

P3: Study of a physicochemical process. Coagulation- flocculation

Full-or-part-time: 11h

Theory classes: 2h

Practical classes: 1h

Laboratory classes: 2h

Self study : 6h

MODULE 5: Advanced processes

Description:

Topic 5.1. Use of advanced processes

Topic 5.2. Moving bed bioreactor

Topic 5.3. Membrane technology

Topic 5.4. Membrane bioreactors

Topic 5.5. Advanced oxidation processes

Topic 5.6. Regeneration and reuse of water.

Specific objectives:

OE4. Define the main advanced processes

Related activities:

Test 5

Practice exam

P6: Study of an advanced oxidation process for the degradation of dyes.

Full-or-part-time: 13h

Theory classes: 2h

Practical classes: 1h

Laboratory classes: 4h

Self study : 6h

GRADING SYSTEM

Any academic fraud, plagiarism or use or possession of unauthorised means in an assessment activity leads to a mark of zero (0) for the affected test or assignment. Furthermore, in accordance with the University's regulations, if disciplinary proceedings are initiated the subject is recorded as "Pending Assessment" until a decision is reached. These incidents are managed in accordance with the [Action Framework for Academic Integrity in Assessment at the UPC](#).

- Written tests 60%: 1st exam (30%), final exam (30%).
- Laboratory 20%
- Tests 10%
- Project 10%

The unsatisfactory results of the first exam can be redirected by means of a written test. This test can be accessed by all students. The qualification (punctuation 0 - 10) obtained will replace the grade of the first exam, as long as it is higher.

EXAMINATION RULES.

Attendance to laboratory and problems sessions is mandatory.

BIBLIOGRAPHY

Basic:

- Tchobanoglous, George; Metcalf & Eddy. Wastewater engineering: treatment and resource recovery [on line]. 5th ed. New York [etc.]: McGraw-Hill, cop. 2014 [Consultation: 18/01/2023]. Available on: <https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=5662641>. ISBN 9781259010798.
- Ramalho, Rubens Sette. Tratamiento de aguas residuales [on line]. Barcelona: Reverté, 1991 [Consultation: 23/04/2025]. Available on: <https://research-ebSCO-com.recursos.biblioteca.upc.edu/plink/8f78f933-4bab-359c-b4ae-e8af05e0a9f5>. ISBN 9788429179750.
- Trapote Jaume, Arturo. Depuración y regeneración de aguas residuales urbanas. 3a ed. Alacant: Publicaciones Universidad Alicante, 2020. ISBN 9788497177290.

Complementary:

- Ferrer Polo, J.; Seco Torrecillas, A.; Robles Martínez, A. Tratamientos biológicos de aguas residuales [on line]. 3a ed. València: Universitat Politècnica de València, 2022 [Consultation: 14/11/2022]. Available on: https://gdocu.upv.es/alfresco/service/api/node/content/workspace/SpacesStore/935a8d7c-2081-4d74-9f7c-bf3ad9e69bb4/TOC_0358_03_03.pdf?quest=true. ISBN 9788413960159.

RESOURCES

Other resources:

- Ministerio de Medio Ambiente y Medio Rural Marino. Manual para la implantación de sistemas de depuración en pequeñas poblaciones: <https://www.aragon.es/documents/20127/24009052/Manual+CEDEX2.pdf/32188fba-b20f-ecac-fb01-49a15e0e3cd9?t=1578648844927>