COURSE DATA

Data Subject	
Code	43809
Name	Waste management and treatment
Cycle	Master's degree
ECTS Credits	6.0
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
2227 - M.U. en Ingeniería Ambiental	School of Engineering	1	Second term
2250 - M.D. in Environmental Engineering	School of Engineering	1	Second term

Subject-matter

Degree	Subject-matter	Character
2227 - M.U. en Ingeniería Ambiental	3 - Treatment of land, waste and air emissions	Obligatory
2250 - M.D. in Environmental Engineering	14 - Gestión y tratamiento de residuos	Obligatory

Coordination

Name	Department
BORRAS FALOMIR, LUIS	245 - Chemical Engineering
BOUZAS BLANCO, ALBERTO	245 - Chemical Engineering

SUMMARY

In the present subject it is intended that students know all management operations, from generation to final destination, both urban solid waste and hazardous waste, as well as propose, for a given type of waste, which it is the most appropriate management scheme according to the existing conditions. For this it is necessary to achieve the following specific objectives:

Know the operations of collection and transport of waste.

Study the different waste treatment operations: recovery of the organic fraction (composting and biomethanisation), recovery of the combustible fraction (incineration with energy recovery), physical and chemical treatment of hazardous waste and disposal operations.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

Relationship with other subjects of the same degree:
There are no specified enrollment restrictions with other subjects of the currículum.

Other requirements:
There are no specified enrollment restrictions with other subjects of the currículum.

OUTCOMES

2227 - M.U. en Ingeniería Ambiental

- Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.
- Students should be able to integrate knowledge and address the complexity of making informed judgments based on incomplete or limited information, including reflections on the social and ethical responsibilities associated with the application of their knowledge and judgments.
- Students should communicate conclusions and underlying knowledge clearly and unambiguously to both specialized and non-specialized audiences.
- Students should demonstrate self-directed learning skills for continued academic growth.
- Students should possess and understand foundational knowledge that enables original thinking and research in the field.
- Identify and apply technologies, tools and techniques in the field of environmental engineering.
- Assume with responsibility and ethics the Environmental Engineer role in a professional context.
- Promote and apply the principles of sustainability.
- Adapt to changes, being able to apply the principles of Environmental Engineering to unknown cases and use new and advanced technologies and other relevant developments, with initiative and entrepreneurial spirit.
- Identify, declare and entirely analyze environmental problems.

- Assess the application of measures for the pollution prevention and the recovery, protection and improvement of environmental quality.
- Carry out theoretical analyzes of environmental systems, both natural and artificial, and develop and apply mathematical models for their simulation, optimization or control.
- Design and calculate engineering solutions to environmental problems, comparing and selecting technical alternatives and identifying emerging technologies.
- Understand and apply environmental national and international legislation, adapting environmental solutions to these regulations.
- Be able to characterize the emissions to soils, coming from the anthropogenic activity.
- Evaluate the treatment of solid wastes to assess different alternatives and obtain the required information for the design of the selected treatment processes.
- Design and operate systems for waste management and treatment.

2250 - M.D. in Environmental Engineering

- Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.
- Students should be able to integrate knowledge and address the complexity of making informed judgments based on incomplete or limited information, including reflections on the social and ethical responsibilities associated with the application of their knowledge and judgments.
- Students should communicate conclusions and underlying knowledge clearly and unambiguously to both specialized and non-specialized audiences.
- Students should demonstrate self-directed learning skills for continued academic growth.
- Students should possess and understand foundational knowledge that enables original thinking and research in the field.
- Identify, formulate and solve complex environmental engineering problems by applying engineering, scientific and mathematical principles.
- Apply environmental engineering designs to produce solutions that meet specific needs addressing public health, safety and welfare taking account of global, cultural, social, environmental and economic factors.
- Recognise the ethical and professional responsibilities of environmental engineering and make informed judgements considering the impact of engineering solutions in global, economic, environmental and social contexts.
- Work in a team effectively and with leadership, in a collaborative and inclusive environment, setting goals, planning tasks and meeting objectives.
- Learn and apply new knowledge, using appropriate learning strategies.
- Implement measures for preventing pollution and recovering, protecting and improving environmental quality.

- Design, calculate and select engineering solutions to environmental problems, comparing alternatives that include emerging technologies under criteria of technical, social, economic and environmental viability.
- Manage and operate treatment and/or purification systems in the field of environmental engineering
- Interpret and apply national and international environmental legislation and adapt environmental solutions to these regulations.
- Prepare and draft technical reports and/or environmental engineering projects considering technical, economic, social, energy and/or environmental aspects.
- Develop environmental solutions under the principles of circular economy and the sustainable development goals.

LEARNING OUTCOMES

1 Know all management operations, from generation to final destination, both urban solid waste and hazardous waste.

2 Know the different types of waste defined by legislation, its origin and fundamental properties.

3 Know the priorities in the management of waste, its regulation and planning at national and regional level.

4 To have the necessary knowledge and skills to organize, plan and manage waste management taking into account the external conditions and the geographical scope.

5 Know the main ways of using waste of different types.

6 Know the different methods and technologies used in the collection of waste and its transport to the management facilities.

7 Know the different methods and technologies used for the separation and classification of urban solid waste.

8 Be able to design and design facilities for the management of waste, both urban and industrial.

9 Be able to solve basic problems of design and exploitation of waste recovery and / or disposal facilities.

10 Know and be able to propose basic conceptual designs of the most important waste recovery facilities: composting, biomethanization and incineration.

11 Know the specific technologies for the treatment of hazardous waste.

DESCRIPTION OF CONTENTS

1. 1

Introduction: Waste concept. Origins and type of wastes. Classification.
Hazardous and non-hazardous waste. Production and composition of waste. Legal Framework: Legislation of the Autonomous, State and European Community.

2. 2

Physical, chemical and biological properties of solid waste. Introduction to the study of physical, chemical and biological transformations of urban solid waste. Comparative study of treatment methods.

3. 3

Waste management. Priorities in waste management. National and regional plans.

4. 4

Collection, transfer and transport of solid waste. Transfer and treatment centers.

5. 5

Basic operations for the separation and processing of residual materials. Waste sorting plants for the recovery of waste materials.

6. 6

Recovery of the organic fraction of non-hazardous waste (I):
Composting. Microbiology of the process. Factors that intervene in the process. Phases of fermentation. Compost manufacturing process: Reception and classification, composting methods, fermentation and storage areas. Composting of vegetable waste.

7. 7

Recovery of the organic fraction of non-hazardous waste (II):
Biomethanization. Microbiology of the process. Factors that intervene in the process. Phases of digestion. Biomethanization process: conditioning of waste, digestion, collection and use of biogas and treatment of the solid fraction.

8. 8

Valorisation of the combustible fraction: Incineration: combustion of waste, cooling of combustion fumes, control of air pollution, solid waste produced, thermal balance of an incinerator, combustion furnaces, treatment facilities for the resulting products, facilities of heat recovery. Gasification. Pyrolysis

9. 9

Landfills. Selection of the location. Basic studies necessary for the writing of a project. Elements of a project. Classification of non-hazardous waste landfills. Teams and staff Methods of exploitation of non-hazardous waste landfills. Specific problems in the operation of a landfill. Recovery and subsequent use of landfills. Landfills for hazardous waste. Security deposits.

10. 10

The hazardous waste. Most common treatments of hazardous waste. Physical and chemical treatments. Advanced treatments. Inerting techniques. Solidification and stabilization. Thermal destruction Industrial use of waste streams.

11. 11

Management of special waste streams: hospital waste, end-of-life vehicles, used tires, used oils, etc.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	25,00	100
Classroom practices	16,00	100
Other activities	5,00	100
Tutorials	5,00	100
Group work	4,00	100
Theoretical and practical classes	3,00	100
Seminars	2,00	100
Development of group work	20,00	0
Study and independent work	30,00	0
Preparation of practical classes and problem	20,00	0
Resolution of case studies	20,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

The training activities will be developed according to the following distribution:

• Theoretical activities.

In the theoretical classes the topics will be developed providing a global and integrating vision, analyzing in greater detail the key aspects and of greater complexity, promoting, at all times, the participation of the student.

• Practical activities.

They complement the theoretical activities with the aim of applying the basic concepts and expanding them with the knowledge and experience that they acquire during the realization of the proposed works. They include the following types of face-to-face activities:

- Classes of problems and questions in the classroom.

- Discussion and problem solving sessions and exercises previously worked on by the students.

- Oral presentations.

- Visits to industrial facilities.

- Scheduled tutoring (individualized or in groups).

• Student's personal work.

Realization (outside the classroom) of monographic works, directed bibliographic search, issues and problems, as well as the preparation of classes and exams (study). This task will be carried out individually and tries to promote autonomous work.

• Work in small groups.

Realization, by small groups of students (2-4) of work, issues, problems outside the classroom. This task complements the individual work and fosters the capacity for integration in work groups.

For the development of all these activities, the e-learning platform (Virtual Classroom of the Universitat de València and / or PoliformaT of the Universitat Politècnica de València) will be used as a communication support with the students. Through it you will have access to the didactic material used in class, as well as the problems and exercises to solve.

EVALUATION

To evaluate the students' learning, both in the first and in the second call, a final exam will be carried out that will include both theoretical questions and problems and that will have a weight in the final grade of 50%.

The rest of the grade will be obtained from the group work carried out by the students throughout the course (25%), as well as from the continuous evolution of each student (25%), based on regular attendance at classes, participation and degree of involvement of the student in the teaching-learning process, etc.

To do average, it will be necessary to obtain 4 points out of 10 in group work and in the final exam, both in the theory part and in the problems. Students who do not pass the exam in first call will have to take all parts of the exam (theory and problems) in second call. Moreover, students who do not pass the group work in first call will have to repeat the group work in second call. To pass the course it will be necessary to obtain an average grade of at least 5 points out of 10.

The planned activities that the student must carry out outside of face-to-face assistance will be coordinated between the different subjects of the master's degree and under the supervision of the Master's Academic Coordination Commission.

In any case, the evaluation system will be governed by the provisions of the Regulation of *Avaluació i Qualificació of the University of Valencia per a títols de Grau i Màster* (http://links.uv.es/7S40pjF).

REFERENCES

Basic

- Barat, R., Ferrer, J., Seco, A., Segura, F. (2008) Gestión de Residuos Sólidos. Tomo I. Servicio de Publicaciones de la Universidad Politécnica de Valencia, Nº 128, Valencia.

Tchobanoglous, G., Theisen, H., Vigil, S.A. (1996) Gestión Integral de Residuos Sólidos. McGraw-Hill Interamericana de España, Madrid.

Surampalli, R., Zhang, T.C. et al. (2018) Handbook of Environmental Engineering. McGraw-Hill

Education, New York. Acceso en línea: https://links.uv.es/5PNJ5Wc

Chang, N.B., Pires, A. (2015) Sustainable Solid Waste Management: A Systems Engineering Approach. 1st ed. John Wiley & Sons, Inc., Hoboken, New Jersey. Acceso en línea: https://links.uv.es/z85eKxf.

Maletz, R., Dornack, C., Ziyang, L. (2018) Source Separation and Recycling: Implementation and Benefits for a Circular Economy. 1st ed. Springer International Publishing, Cham, Suiza. Acceso en línea: https://links.uv.es/FdWaP9n.

Additional

- Mata-Alvarez, J. (2003) Biomethanization of the organic fraction of municipal solid wastes. IWA Publishing, London.

Baskar, C. (editor) (2022) Handbook of Solid Waste Management: Sustainability Through Circular Economy. Springer Singapore Pte. Limited. Acceso en línea: https://links.uv.es/ng0h0eV.

Polprasert, C. (2007) Organic waste recycling. IWA publishing, London.

Schott, A.B.S., Aspegren, H., Bissmont, M., Jansen J.L.C (2013) Modern Solid Waste Management in Practice: The City of Malmö Experience / by. 1st ed. 2013. Springer, London. Acceso en línea: https://links.uv.es/6IUJzFl

Castells, X.E. (2005) Tratamiento y valorización energética de residuos. Díaz de Santos, Madrid.

Townsend, T.G. et al. (2015) Sustainable Practices for Landfill Design and Operation. 1st ed. Springer, New York. Acceso en línea: https://links.uv.es/WFMy0Hy.

Morone, P., Papendiek, F., Tartiu, V.E. (2017) Food Waste Reduction and Valorisation: Sustainability Assessment and Policy Analysis. 1st ed. 2017. Springer International Publishing, Cham, Suiza. Acceso en línea: https://links.uv.es/frYoEG7.