Universitat de Lleida

DEGREE CURRICULUM

ENVIRONMENTAL ENGINEERING

Coordination: RAMOS MARTÍN, MARÍA CONCEPCIÓN

Academic year 2021-22

ENVIRONMENTAL ENGINEERING 2021-22

Subject's general information

<table>
<tr><td>Subject name</td><td>ENVIRONMENTAL ENGINEERING</td></tr>
<tr><td>Code</td><td>102482</td></tr>
<tr><td>Semester</td><td>1st Q(SEMESTER) CONTINUED EVALUATION</td></tr>
<tr><td>Typology</td><td>
<table>
<tr><th>Degree</th><th>Course</th><th>Character</th><th>Modality</th></tr>
<tr><td>Bachelor's Degree in Forest Engineering</td><td>4</td><td>OPTIONAL</td><td>Attendance-based</td></tr>
<tr><td>Double degree: Bachelor's degree in Forest Engineering and Bachelor's degree in Nature Conservation</td><td>5</td><td>OPTIONAL</td><td>Attendance-based</td></tr>
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<tr><td>Course number of credits (ECTS)</td><td>6</td></tr>
<tr><td>Type of activity, credits, and groups</td><td>
<table>
<tr><th>Activity type</th><td>PRACAMP</td><td>PRAULA</td><td>TEORIA</td></tr>
<tr><th>Number of credits</th><td>0.4</td><td>2.8</td><td>2.8</td></tr>
<tr><th>Number of groups</th><td>1</td><td>1</td><td>1</td></tr>
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<tr><td>Coordination</td><td>RAMOS MARTÍN, MARÍA CONCEPCIÓN</td></tr>
<tr><td>Department</td><td>ENVIRONMENT AND SOIL SCIENCES</td></tr>
<tr><td>Teaching load distribution between lectures and independent student work</td><td>40% classroom +videoconferences
60% personal work</td></tr>
<tr><td>Important information on data processing</td><td>Consult this link for more information.</td></tr>
<tr><td>Language</td><td>Catalan: 75%
Spanish: 25%</td></tr>
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Distribution of credits	1. Introduction. Concept of waste and impact. European environmental legislative policy and principles. General strategy for waste management and treatment. Waste sorting. Waste minimization at source. Regulations that regulate them more directly: "IPPC" Directive, "Nitrates" Directive, "Landfill" Directive, "Sludge" Directive, Royal Decree on "Contaminated Soils", "Waste" Directive, "Industrial Emissions" Directive, "Directive" waste incineration ", Climate Change Regulations (Kyoto Protocol, GHG reduction). Application of organic by-products and sewage sludge in the soil (1c) 2. Description and characterization of waste and pollutants (0.6c) 3. Fundamentals of process engineering. Conservation of the dough. Continuity equation. Reaction Kinetics Reactor analysis (0.2c) 4. Treatment of air emissions (fumes, dust and suspended particles) (0.6c) 5. Wastewater treatment 5.1. Physical-chemical treatment processes (1c) Pretreatments: Roughing. Homogenization and regulation of flows. Sedimentation and flotation. Type of sedimentation. Dynamics of the particles in a liquid medium. Floatation. Coagulation and flocculation. Filtration. Membrane processes: Properties of membranes. Inverse osmosis. Ultrafiltration Electrodialysis Gas separation Ion exchange. Ionic exchange theory. System design. Applications. Aeration and stripping. Adsorption 5.2. The composting process for solid waste (0.4c) 5.3. Biological processes of treatment. Kinetic and stoichiometric expressions. Environmental and control parameters (1c) 5.3.1. Macrophyte-based systems: green filters and lagoon 5.3.2. Suspended biomass systems. Suspended Biomass Active sludge Equations of matter balance. Sizing parameters. Oxygen requirements in aerobic systems 5.3.3. Fixed biomass systems. Biofilms Definition and characteristics Biofilm Kinetics Reactor kinetics based on biofilm maintenance. Percolating filters, biodisks and submerged filters 6. Anaerobic fermentation (0.2c) 7. Alternative solid waste treatment techniques: incineration (as a non-alternative reference), gasification (syngas production), plasma gasification (GasPlasma), pyrolysis, biomass bioconversion in a mixture of combustible alcohols (pilot scale), biosecado (0.4c) 8. Controlled deposits (0.4c)

ENVIRONMENTAL ENGINEERING 2021-22

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
COLLADO SANTOLARIA, NOEMÍ	noemi.collado@udl.cat	,6	
ESTARAN JUSTRIBÓ, CARLOS	carlos.estaran@udl.cat	3,8	
RAMOS MARTÍN, MARÍA CONCEPCIÓN	mariaconcepcion.ramos@udl.cat	1,6	

Learning objectives

The objective of the subject is that the student acquires the knowledge that allows him to defend with technical arguments a choice of action (management and treatment) when managing and treating waste of the forestry activity.

Competences

Basic skills

CB1. That students have demonstrated and understand knowledge in an area of study that starts from the basis of general secondary education, and is usually found at a level that, while supported by advanced textbooks, also includes some aspects that involve knowledge from the forefront of their field of study.

CB2.That students know how to apply their knowledge to their work or vocation in a professional way and possess the skills that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study

CB3 That students have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include reflection on relevant social, scientific or ethical issues.

CB4 That students can transmit information, ideas, problems and solutions to both a specialized and non-specialized audience.

CB5. That students have developed those learning skills necessary to undertake further studies with a high degree of autonomy.

General skills

CG2. Ability to analyze the structure and ecological function of forest systems and resources, including landscapes.

CG3. Conocimiento de los procesos de degradación que afecten a los sistemas y recursos forestales (contaminación, plagas y enfermedades, incendios, etc.) y capacidad para el uso de las técnicas de protección del medio forestal, de restauración hidrológico forestal y de conservación de la biodiversidad.

CG4. Ability to evaluate and correct the environmental impact, as well as apply the techniques of auditing and environmental management.

CG7. Ability to solve the technical problems arising from the management of natural spaces.

Subject contents

Fundamental contents of the subject

1. Introduction. Concept of waste and impact. European environmental legislative policy and principles. General strategy for waste management and treatment. Waste sorting. Waste minimization at source. Regulations that regulate them more directly: "IPPC" Directive, "Nitrates" Directive, "Landfill" Directive, "Sludge" Directive, Royal Decree on "Contaminated Soils", "Waste" Directive, "Industrial Emissions" Directive, "Directive" waste incineration ", Climate Change Regulations (Kyoto Protocol, GHG reduction). Application of organic by-products and sewage sludge in the soil (1c)

2. Description and characterization of waste and pollutants (0.6c)

3. Fundamentals of process engineering. Conservation of the dough. Continuity equation. Reaction Kinetics Reactor analysis (0.2c)

4. Treatment of air emissions (fumes, dust and suspended particles) (0.6c)

5. Wastewater treatment

5.1. Physical-chemical treatment processes (1c)

Pretreatments: Roughing. Homogenization and regulation of flows. Sedimentation and flotation. Type of sedimentation. Dynamics of the particles in a liquid medium. Floatation. Coagulation and flocculation. Filtration. Membrane processes: Properties of membranes. Inverse osmosis. Ultrafiltration Electrodialysis Gas separation Ion exchange. Ionic exchange theory. System design. Applications.

Aeration and stripping. Adsorption

5.2. The composting process for solid waste (0.4c)

5.3. Biological processes of treatment. Kinetic and stoichiometric expressions. Environmental and control parameters (1c)

5.3.1. Macrophyte-based systems: green filters and lagoon

5.3.2. Suspended biomass systems. Suspended Biomass Active sludge Equations of matter balance. Sizing parameters. Oxygen requirements in aerobic systems

5.3.3. Fixed biomass systems. Biofilms Definition and characteristics Biofilm Kinetics Reactor kinetics based on biofilm maintenance. Percolating filters, biodisks and submerged filters

6. Anaerobic fermentation (0.2c)

7. Alternative solid waste treatment techniques: incineration (as a non-alternative reference), gasification (syngas production), plasma gasification (GasPlasma), pyrolysis, biomass bioconversion in a mixture of combustible alcohols (pilot scale), biosecado (0.4c)

8. Controlled deposits (0.4c)

Practical activities

Classroom practices (problems and cases): Resolution of cases and problems on various aspects of the calculation of sizing different treatment processes.

Work: Personal work consisting of describing a forestry activity (processes and mass and energy balances in all of them), diagnosing the emissions and possible environmental problems that it has or may cause, making a proposal

(with calculations and arguments) of what form of management , treatment or combination of treatments resolves / on emissions and pollution and how it is integrated into forestry (an industry) more appropriately.

Visit: Visit to a plant or station for the treatment of waste from the forestry area and the Regional Plant for the treatment and controlled deposit of urban and similar waste from Segrià.

Methodology

Methodological axes of the subject

Type of activity	Description	Student face-to-face activity		Student non-face-to-face activity		Assessment	Total time
		Objetives	Time (h)	Student work	Time (h)	Time(h)	Hours/ECTS
Master class	Master class (Classroom. Large group)	Explanation of the main concepts	38	Study: to know, understand and synthesize knowledge	40	0.5	78.5h/3.14
Problems and study cases	Participatory (Classroom. Large group)	Study case and problem resolution	16	Learn to solve problems and casess	20	0.5	36.5h/1.46
Visit	Visit to a plant	On-site knowledge of process lines	4	Report on each visit	2		6h/0.24
Supervised activities	Student work	Drafting the calculation of a treatment facility		Compose a report	28	1	29h/1.16
Total			58		90	2	150/6

Observations 25 hours of total activity per ECTS credit have been considered.

Development plan

Methodological axes of the subject

Type of activity	Description	Student face-to-face activity		Student non-face-to-face activity		Assessment	Total time
		Objetives	Time (h)	Student work	Time (h)	Time(h)	Hours/ECTS
Master class	Master class (Classroom. Large group)	Explanation of the main concepts	38	Study: to know, understand and synthesize knowledge	40	0.5	78.5h/3.14
Problems and study cases	Participatory (Classroom. Large group)	Study case and problem resolution	16	Learn to solve problems and casess	20	0.5	36.5h/1.46

Visit	Visit to a plant	On-site knowledge of process lines	**4**	Report on each visit	**2**		**6h/0.24**
Supervised activities	Student work	Drafting the calculation of a treatment facility		Compose a report	**28**	**1**	**29h/1.16**
Total			**58**		**90**	**2**	**150/6**

Observations 25 hours of total activity per ECTS credit have been considered.Classes will be developpend in the classroom and by videoconference.

Evaluation

Activities

Type of activity	Evauation Activity		Weight qualification
	Procedure	Number	(%)
Master classes	Written tests on the theory and exercices of the program of the subject	**2**	**35**
Problems and stuyd cases	Delivery of written reports on problems and cases	**Various**	**65**
Total			**100**

Observations

The evaluation tests will be carried out in person. In case of impossibility, the appropriate procedure will be enabled. The work deliveries will be carried out preferably through a virtual campus.

For the purposes of the final qualification, in order to pass the subject, it will be necessary to have obtained a score equal to or greater than 5 points as a cumulative result of all evaluable tests and in each one of them.

Bibliography

The bibliography of the technological subjects requires a continuous revision. However, some manuals are cited whose content, despite being written in some cases more than a decade ago, is suitable for a first contact with the subject. At the beginning of the course, and eventually during the development of the subject, teachers will provide a more complete list of bibliographic sources, including portals and internet addresses with sector information.

Basic references

KIELY, G. (1999). Ingeniería Ambiental. Fundamentos, entornos, tecnologías y sistemas de gestión. Mc Graw-Hill.

TCHOBANOGLOUS, G., THEISEN, H., VIGIL, S.A. (1994). Gestión Integral de Residuos Sólidos. Mc Graw-Hill

Compremementary rerefences

HENZE, M., HARREMOES, P., JANSEN, J.C., ARVIN, E. (1995). Wastewater Treatment. Biological and Chemical Processes. Springer Verlag.

METCALF & EDDY (1991). Wastewater Engineering. Treatment, Disposal and Reuse. McGraw- Hill, Civil Engineering Series.

FLOTATS, X (Ed) (1997). 3r Curs d'Enginyeria Ambiental. Aprofitament energètic de residus orgànics. Servei Publicacions UdL.

HAUG, R.T. 1993. The practical handbook of composting engineering. Lewis Publishers.

WERF (1997). Biofiltration: Controlling air emissions through innovative technology. Project 92- VOC-1. Final report. Water Environment Research Foundation. Pps. (ISBN 1-57278-009-6).