DEGREE CURRICULUM

ENVIRONMENTAL ENGINEERING

Coordination: RAMOS MARTIN, MARIA CONCEPCION

Academic year 2023-24

ENVIRONMENTAL ENGINEERING 2023-24

Subject's general information

<table>
<tr><td>Subject name</td><td>ENVIRONMENTAL ENGINEERING</td></tr>
<tr><td>Code</td><td>102594</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 Agricultural and Food Engineering</td><td>4</td><td>COMPULSORY</td><td>Attendance-based</td></tr>
</table>
</td></tr>
<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>
</table>
</td></tr>
<tr><td>Coordination</td><td>RAMOS MARTIN, MARIA CONCEPCION</td></tr>
<tr><td>Department</td><td>ENVIRONMENT AND SOIL SCIENCES AND CHEMISTRY</td></tr>
<tr><td>Teaching load distribution between lectures and independent student work</td><td>40% classes
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>
</table>

ENVIRONMENTAL ENGINEERING 2023-24

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
COLLADO SANTOLARIA, NOEMI	noemi.collado@udl.cat	,6	
PALATSÍ CIVIT, JORGE MANUEL	jordi.palatsi@udl.cat	3,8	
RAMOS MARTIN, MARIA CONCEPCION	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 an option of action (management and treatment) at the time of managing and treating waste of the agricultural and agri-food 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 Que los estudiantes puedan transmitir información, ideas, problemas y soluciones a un público tanto especializado como no especializado.

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

General skills

CG2. Adequate knowledge of physical problems, technologies, machinery and water and energy supply systems, limits imposed by budgetary factors and construction regulations, and the relationships between facilities or buildings and farms, agri-food industries and spaces related to gardening and landscaping with their social and environmental environment,as well as the need to relate those and that environment with human needs and environmental preservation.

CG5 Ability to write and sign studies on rural development, environmental impact and waste management of agri-food industries, agricultural and livestock farms, and spaces related to gardening and landscaping.

CG7 Knowledge in basic, scientific and technological subjects that allow continuous learning, as well as an ability

to adapt to new situations or changing environments.

CG8 Ability to solve problems with creativity, initiative, methodology and critical reasoning.

CG11 Ability to develop their activities, assuming a social, ethical and environmental commitment in tune with the reality of the human and natural environment.

Subject contents

Theory classes and problems

I.1 Concept of waste and impact. European, Spanish and Catalan environmental policy and legislative principles. Classification of waste. Minimization of waste at source. Controls in soil, water and atmosphere. Competent administrations and documentation 0.2 c

I.2 Description and characterization of waste, emissions and waste water. Organic matter (COD/BOD), nutrients and other emerging pollutants. 0.6 c

Theory classes and problems

T1. Wastewater pre-treatments. Measurement of flows and sampling of residual currents. Homogenization and equalization of pollutant loads. Rough grids (hydraulic calculations). Fine sieves (technologies and sizing). Degreasers and degreasers (discrete sedimentation, efficiency and sizing). Problem solving. 1.5 c

T2 Primary Treatment. Sedimentation, coagulation and flocculation. Types of non-discrete sediments. Design of primary clarifiers. Technologies in industry. Troubleshooting 0.5c

T3_0 Secondary treatment. Microbiological bases, kinetics and stoichiometry of reactions. Microbial metabolism and growth. Inhibition processes. Competition and antagonism. Kinetic and stoichiometric expressions. Efficiencies and bacterial growth rates. Heterotrophic elimination of organic matter. Removal of nutrients (N and P). Anaerobic metabolism. Biological tests (aerobic and anaerobic biodegradability of substrates). Mathematical models (0.2c)

T3_1 Secondary treatment. Aerobic, facultative and anaerobic gaps. Algae/bacteria symbiosis. Stabilization and maturation gaps. Purpura bacteria.0.1c

T3_2 Secondary treatment. Biofilters and fixed biomass systems. Biofilms. Technologies and design parameters .0.1c

T3_3 Secondary treatment. Activated sludge technology. Types of reactors. Sizing and efficiency parameters. External recirculation and sludge production. Secondary settling and sludge purging. Calculation and dimensioning problems of activated sludge systems, for the removal of organic matter and nutrients. Chemical precipitation of phosphorus 0.4c

T3_4 Oxygen transfer and process control. Aeration technologies and systems. Sensors and control systems 0.2c

T4. Tertiary treatments. Regeneration of waste water. Treatment technologies. Membrane processes. Disinfection Reuse regulations 0.1c

T5_1 Sludge treatment. Thickening and flotation. Dimensioning and design of thickeners. Problem Solving.0.1c

T5_2 Anaerobic waste water treatment technologies (UASB, EGSB and IC).0.1c

T5_3 Biogas and bio-methane. Utilization and upgrading technologies. Facilities.0.1c

T5_4 Sludge treatment. Sludge dewatering technologies. Problem solving and consumption estimation 0.1c

T5_5 Sludge treatment. Anaerobic digestion + Composting + agricultural application. 0.6 c

T6. Other waste water treatment technologies. (SBRs, MBBRs/IFAs, MBR&AnMBR). Examples of industrial

installations. Aerobic granular biomass and Annamox. 0.2h

T7. Other bio-chemical processes (biodiesel, bioethanol) thermochemical processes (combustion, pyrolysis and gasification) and controlled waste deposits 0.1c

T8. Gaseous emission treatment 1.2c

Practical activities

Classroom and laboratory practices:

Determination of pollution parameters (0.2c)

Macro and microscopic identification of activated sludge. V30, protists and filamentous microorganisms 0.2c

Visit: Visit to treatment facilities 0.4c

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	**50**	**2.0**	**3.6**
Problems and study cases	Participatory (Classroom. Large group)	Study case and problem resolution	**14**	Learn to solve problems and casess	**34**	**2**	**2.0**
Visit	Visit to a plant	On-site knowledge of process lines	**4**	Report on the visit	**2**		**0.24**
Lab practical work	Student work	Identification of activated sluge	2	Compose a report	**4**		**0,16**
Total			**58**		**88**	**4**	**6,0**

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	**50**	**2.0**	**3.6**
Problems and study cases	Participatory (Classroom. Large group)	Study case and problem resolution	**14**	Learn to solve problems and casess	**34**	**2**	**2.0**
Visit	Visit to a plant	On-site knowledge of process lines	**4**	Report on the visit	**2**		**0.24**
Lab practical work	Student work	Identification of activated sluge	2	Compose a report	**4**		**0,16**
Total			**58**		**88**	**4**	**6,0**

Observations 25 hours of total activity per ECTS credit have been considered. Master classes in classroom and by videoconference.

Evaluation

The evaluation will consist of 4 blocks:
Block 1: Theoretical-practical written test.
1 Theoretical-practical written test on the contents of the course syllabus relating to atmospheric emissions and their treatment, with a weight of 25%. It will take place on the date proposed by the Directorate of Studies for the first partial exam. It will be necessary to obtain a minimum mark of 4/10 points.
Block 2: Theory written test
1 Written test on the contents of the course syllabus, with a weight of 40%, referring to water and solid waste. It will take place on the date proposed by the Directorate of Studies for the second partial exam. It will be necessary to obtain a minimum mark of 4/10 points.
Block 3: Written test on problems
Written test on problem solving, it will have a weight of 30% of the total mark. It will take place on the date proposed by the Directorate of Studies for the second mid-term exam. It will be necessary to obtain a minimum mark of 4/10 points.
Block 4: Visit report
The knowledge acquired during the visit will be assessed through the report and/or answers to the questions posed about the processes seen during the visit. It will have a weight of 5% of the mark. The deadline will be the date indicated by the Directorate of Studies for the second partial exam of the subject.

Alternative assessment: Students who request alternative assessment must take an exam on the date set by the Directorate of Studies for the second partial exam. The exam will include theory and problems of the whole subject and will have a weight of 100% of the mark.

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.

References

CHYNOWETH, D.P., ISAACSON, R. (1987). Anaerobic digestion of biomass. Elsevier Applied Sciences.

FLOTATS, X (Ed.) (1996). 2n Curs d'Enginyeria Ambiental. Eliminació biològica de nutrients en aigües residuals. Ed. Paperkite.

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.

HENRY, J.G., HEINKE, G.W. (1989). Environmental Science and Engineering. Prentice Hall Ed. Capítulo 6.

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

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

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

RAMALHO, R.S. (1991). Tratamiento de Aguas Residuales. Ed. Reverté, S.A.

TCHOBANOGLOUS, G., THEISEN, H., VIGIL, S.A. (1994). Gestión Integral de Residuos Sólidos. Mc Graw-Hill. Capítulos 11, 16 y 17.

WHEATLEY, A. (1991). Anaerobic Digestion: a Waste Treatment Technology. Elsevier Applied Science.