Universitat Autònoma de Barcelona

2023/2024

Sustainability and Green Engineering

Code: 44729
ECTS Credits: 6

Degree	Type	Year	Semester
4318303 Reseach and Innovation in Computer Based Science and Engineering	OB	0	1

Contact

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Teaching groups languages

You can check it through this link. To consult the language you will need to enter the CODE of the subject.
Please note that this information is provisional until 30 November 2023.

Prerequisites

None in particular.

Objectives and Contextualisation

The main objective of this course is that the student can acquire a global vision of environmental engineering and the fundamental concepts of sustainability. The main sustainability and environmental engineering tools, databases and systems will be worked on in order to quantify the environmental impacts of products and processes (carbon footprint, water footprint, energy efficiency, among others) and thus be able to optimize and minimize them. The content of this course mainly covers issues of life cycle assessment and environmental risk assessment based on environmental management of resources, including the description of the UN sustainable development goals. The concepts are explained with examples and case studies to illustrate the circular economy principle and the applicability of these assessment tools.

Learning Outcomes

- CA02 (Competence) By the end of the subject, students will know how to apply the principles of the circular economy using applications that take into account environmental, global, cultural, social and economic factors.
- CA03 (Competence) By the end of the subject, students will be able to handle inventory and process data in a structured and integrated way for decision-making and traceability in the value chain.
- KA03 (Knowledge) By the end of the subject, students will be able to describe the tools needed to make a project more sustainable.

- KA04 (Knowledge) By the end of the subject, students will be able to identify environmental management systems based on criteria and processes in order to respect the environment as much as possible and mitigate pollution.
- KA05 (Knowledge) By the end of the subject, students will be able to list the main environmental concerns associated with a product, process or system.
- SA06 (Skill) By the end of the subject, students will know how to develop tools that facilitate environmental improvement proposals for a product or process based on the results obtained after applying Life Cycle Assessment (LCA) methodology, and therefore optimise and mitigate its environmental impact.
- SA07 (Skill) By the end of the subject, students will know how to design the databases needed to apply LCA methodology.

Content

Topic 1. SUSTAINABILITY

- Introduction to the Sustainability concept. Sustainable development concept.

- Introduction to the concept of Green Engineering

- Agenda 2030. Green Deal. Sustainable Development Goals

- The measurement of Sustainability and indicators

Topic 2. CIRCULAR ECONOMY

- Concept of linear economy

- Circular Economy. butterfly diagram. Donut Economy

- Introduction of the methodology and application examples

Topic 3. Life Cycle Analysis

- History of stroke

- Origins of stroke.

- LCA methodology; Inventories, Characterization Factors, Life Cycle Impact Analysis, Interpretation of results, Uncertainty, LCA Programs

- Examples of application of the LCA methodology in various economic sectors as a tool to assess sustainability

- Regulatory framework • UNE-EN ISO 14040:2006. • UNE-EN ISO 14044:2006. • Related regulations.

Topic 4 Environmental risk assessment and decision making

- Introduction to environmental risk: REACH Directive

- Risk identification

- Toxicology/epidemiology

- Dose-response evaluation

- Exposure assessment

- Risk Characterization

Methodology

The teaching methodology to be followed is oriented to the continuous learning of the subject by the students.

This process is based on the realization of three types of activities that are developed at the end of the course: theoretical classes, problem seminars and practical sessions:

- Theoretical classes: The student acquires the knowledge of the subject by assisting in the master classes and complementing both cases to reinforce the knowledge in the theory classes.

The teacher will provide information on the knowledge of the subject and on strategies to acquire, expand and organize these knowledge. It will encourage the active participation of the students during these sessions, for example by raising discussions in those points that have a higher conceptual content.

- Seminars on problems: apply the knowledge acquired to the theoretical classes through practical cases. In the classroom practices there must be an understanding of the concepts introduced in the theoretical classes. The students have to participate actively to consolidate the knowledge acquired by resolving, presenting and debating problems that they are related to. The students will work individually or in groups depending on the activity.

- ***Practies*** Sessions: *the students have to work in teams of various people in the resolution of mathematical problems to serve computational purposes. After hauran present-them mitjançant oral and written reports.*

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Ploblems Sessions	20	0.8	SA06, SA07, SA06
Theory Sessions	26	1.04	KA03, KA04, KA05, KA03
Type: Supervised			
Practices	10	0.4	CA02, CA03, CA02
Project	20	0.8	SA06, SA07, SA06
Type: Autonomous			
Problems Desenvolupment	32	1.28	CA02, CA03, KA03, SA06, SA07, CA02
Study	32	1.28	KA04, KA05, KA04

Assessment

The evaluation of the subject will be done progressively and continuously throughout the semester.

The evaluation system is based on the following rules:

a) Scheduled evaluation process and activities

The following activities are planned:

Activity A: Practice Reports.Presentation of reports, in writing and orally, relating to the practices with a computer, worked on during the course, with the aim of following the evolution of each student in the understanding and use of the tools worked on in the subject, andat the same time promote the acquisition of transversal skills.This activity counts for 20% of the final grade of the subject.The final noteof this activity will be the average of the grades obtained in each practice.Activity B: Exam.Examination of the contents of the course, to promote the consolidation of all the material worked on during the course.This activity counts for 40% of the final grade of the subject.

Activity C: Project. Development of a project, to promote the consolidation of all the material worked on during the course. This activity counts for 40% of the final grade of the subject.

In order to pass the subject, a minimum grade of 5 in the assessment activities is essential.Must have innote that the Practice Activity (ACTIVITY A) and Project (Activity C) are not recoverable.This means in particular that if they are not completed and passed (a grade equal to or higher than 5 is obtained) in the time and form as indicated, it will not be possible to pass the subject.In the event that the evaluation of any of the parties does not finally exceed the minimum required, the numerical grade of the file will be the lower value between 4.5 and the weighted average of the grades.

Apart from the test already announced in the examination calendar for the degree, the dates corresponding to the rest of the assessment activities will be announced on the Virtual Campus.You must regularly consult this platform where various information about the operation of the subject will also be provided.

b) Programming of evaluation activities

The calendar of the evaluation activities will be given on the first day of the subject and will be made public through the Virtual Campus (Moodle) and on the website of the School of Engineering, in the exam section.

The following schedule is expected:

+ Activity A: It will be communicated in the first week of class.

+ Activity B: Examination: dates to be determined by the School.

+ Activity C: Project

c) Recovery process

For those students who at the end of the evaluation process have not obtained a qualification equal to or higher than 5 in the exam, there will be a re-evaluation. This will consist of carrying out, on the date scheduled by the School, an activity exam representative of the situations worked on during the course. If a student does not reach the minimum grade of 5 in any of the activities and for this reason does not pass the subject, the final grade will be a maximum of 4.5, that is, equal to the value of the weighted average if it is lower than 4.5 or 4.5 if higher.

d) Qualification review procedure

For each assessment activity, a review place, date and time will be indicated in which the student can review the activity with the teacher. In this context, claims can be made about the grade of the activity, which will be evaluated by the professor responsible for the subject. If the student does not attend this review, this activity will not be reviewed later.

e) Qualifications

The final grade of the subject will be calculated according to the percentages mentioned in section a) of this point. It should be noted that:

Honor matriculation Awarding an honors enrollment qualification is solely the decision of the teaching staff responsible for the subject. UAB regulations indicate that MH can only be granted to students who have obtained a final grade equal to or higher than 9:00 and in a quantity not higher than 5% of the number of students.

Not assessable. A student who has not attended any activity A, B or C will be considered "non-evaluable".

f) Irregularities on the part of the student, copying and plagiarism

Without prejudice to other disciplinary measures that are deemed appropriate, and in accordance with the current academic regulations, the irregularities committed by the student that may lead to a variation of the qualification of an evaluation act will be graded with a zero. Therefore, plagiarizing, copying or allowing any assessment activity to be copied will mean that it will be suspended with a zero and it will not be possible to recover it in the same academic year. If it is necessary to pass any of these evaluation activities to pass the subject, this subject will be suspended directly, without the opportunity to recover it in the same course.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Final Exam	40	2	0.08	KA03, KA04, KA05
Practices	20	4	0.16	CA02, CA03
Project	40	4	0.16	SA06, SA07

Bibliography

- Masters, G. M.; Ela, W.P. Introducción a la ingeniería medioambiental, Pearson Educación, Madrid, 2008
- Mihelcic, J.R., Fundamentos de Ingeniería Ambiental, Ed. Limusa Wiley, Méjico, 2001
- Klöpffer, W., & Grahl, B. (Birgit). (2018). Life cycle assessment (LCA): a guide to best practice.
- Matthews, H.S., Hendrickson, C.T., Matthews, D.H., 2014. Life Cycle Assessment: Quantitative Approaches for Decisions that Matter.
- Sonnemman G, Castells F, Schuchmacher M., Integrated Life-Cycle and risk assessment for industrial proceses, 2003 Editorial: lewis publishers, ISBN: 1-5667-0644-0 2

Software

Databases

- Ecoinvent https://www.ecoinvent.org/
- GaBi http://www.gabi-software.com/spain/index/

Software

1. OpenLCA http://www.openlca.org/
2. SimaPro https://simapro.com/