Course guide
2500223 - GEA0223 - Sustainable Transport

Unit in charge: Barcelona School of Civil Engineering
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering.
Degree: BACHELOR'S DEGREE IN ENVIRONMENTAL ENGINEERING (Syllabus 2020). (Compulsory subject).
Academic year: 2022  ECTS Credits: 6.0  Languages: Spanish

LECTURER

Coordinating lecturer: HUGO BADIA RODRÍGUEZ
Others: HUGO BADIA RODRÍGUEZ

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
14446. Solve mathematical problems that may arise in engineering by applying knowledge about: linear algebra, geometry, differential geometry, differential and integral calculus, optimization, ordinary differential equations.
14447. Obtain basic knowledge about the use and programming of computers, operating systems, databases and basic numerical calculation and applied to engineering.
14448. Manage the basic concepts about the general laws of mechanics and thermodynamics, concept of field and heat transfer, and apply them to solve engineering problems.
14450. Manage the basic concepts about the general laws of mechanics and thermodynamics, concept of field and heat transfer, and apply them to solve engineering problems.
14453. Describe and apply the techniques of analysis of physical, chemical and biological parameters; Integrate the experimental evidence found in field and / or laboratory data with the theoretical knowledge and interpret its results.
14457. Identify the fundamentals of structure theory, sustainable procedures for construction and dismantling of buildings and civil works; and describe the technology bases of the materials used in construction.
14458. Apply the methodologies of studies and evaluations of environmental impact and, in general, of environmental technologies, sustainability and waste treatment and of the management of international standards of environmental quality. Life cycle analysis, carbon footprint and water footprint and assess natural hazards (river, coastal floods, droughts, fires, soil erosion and landslides).
14459. Describe the components and modes of transport and the impact of their externalities on the environment; identify the principles of environmental management of transport systems and sustainable planning of the territory; and introduce the tools for the management and operation of transport systems.
14461. Analyze, design, simulate and optimize processes and systems with environmental relevance, both natural and artificial, and their resolution techniques, as well as recognize techniques for analysis and evaluation of climate change.
14465. Identify renewable energy generation techniques and energy transition concept.

Generic:
14440. Identify, formulate and solve problems related to environmental engineering.
14441. Apply the functions of consulting, analysis, design, calculation, project, construction, maintenance, conservation and exploitation of any action in the territory in the field of environmental engineering.
14442. To use in any action in the territory proven methods and accredited technologies, in order to achieve the greatest efficiency respect for the environment and the protection of the safety and health of workers and users.
TEACHING METHODOLOGY

The course consists of 4 hours per week of classroom activity.

2-3 hours are devoted to theoretical lectures in which the teacher presents the basic concepts and topics of the subject, shows examples and solves exercises.

1-2 hours are devoted to solving practical problems with greater interaction with the students. The objective of these practical exercises is to consolidate the general and specific learning objectives.

Support material in the form of a detailed teaching plan is provided using the virtual campus ATENEA: content, program of learning and assessment activities conducted and literature.

The course is mainly in Spanish, although we will use material in Spanish and English or Catalan.

Although most of the sessions will be given in the language indicated, sessions supported by other occasional guest experts may be held in other languages.

LEARNING OBJECTIVES OF THE SUBJECT

The causal and quantitative functioning of the transportation system is explained, as well as the behavior of the different agents that comprise it. The tools for the analysis and evaluation of transport systems are discussed, such as: traffic theory, operations analysis, demand estimation and prognosis techniques, transport economics, systems modeling, and flow allocation.

The estimation of user costs, operating costs and externalities derived from transport are proposed and discussed: accidents, noise, air pollution, evaluation of transport emissions, climate change, damage to nature and the landscape, the barrier effect, the occupation of space, traffic congestion, ...

Methodologies for evaluating transport projects, evaluating alternatives, cost-benefit analysis and multi-criteria are presented.

The principles of sustainable infrastructure management, public transport and private transport are addressed, with an impact on the environmental management of urban traffic, environmental pricing, car pooling or car sharing, deterrence parking, management policies and fleet renewal. The management of flexible and demand transportation systems is proposed.

Finally, elements of urban logistics and sustainability in the urban distribution of goods are discussed.

1. Know the components and modes of transport, the concepts of capacity and level of service and analyze the transport market, its costs, externalities and environmental impact.
2. Introduce the tools for the management and operation of transport systems, and study the modeling of demand.
3. Understand the principles of environmental management of transport systems and introduce the concepts for sustainable territorial development.

Sustainable transport. Basic concepts and tools to understand transportation management criteria, one of the main sources, will be studied causing air pollution. The principles of environmental management of transport systems and the keys to territorial development will be introduced sustainable.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Hours small group</td>
<td>15,0</td>
<td>10.00</td>
</tr>
<tr>
<td>Self study</td>
<td>84,0</td>
<td>56.00</td>
</tr>
<tr>
<td>Guided activities</td>
<td>6,0</td>
<td>4.00</td>
</tr>
<tr>
<td>Hours large group</td>
<td>30,0</td>
<td>20.00</td>
</tr>
<tr>
<td>Hours medium group</td>
<td>15,0</td>
<td>10.00</td>
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</tbody>
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Total learning time: 150 h
CONTENTS

Transport analysis tools

Description:
Problems of airplanes, trains and other vehicles represented by trajectories in space-time diagrams
Deterministic theory. Tail discipline. Optimization. Relation (st) and (Nt). Applications: traffic accident, train station. Stochastic models
Correctly apply the appropriate mathematical techniques to transport systems with capacity problems

Specific objectives:
Knowledge of the operations and operation of transport infrastructures
Knowledge of analysis tools for overcoming the distance of a vehicle

Full-or-part-time: 33h 36m
Theory classes: 10h
Practical classes: 4h
Self study: 19h 36m

Operations in transport systems

Description:
Traffic theory. Laboratories.
Urban Collective Transport. Problems

Specific objectives:
Knowledge of traffic theory for the correct analysis of vehicle operations on the road network
Correctly apply the models of management, evaluation and design of road networks to maximize the efficiency of the service to the user
Knowledge of the design, operation and operation of public transport systems
Correctly apply the models of design and operation of public transport networks to maximize the efficiency of the service to the user

Full-or-part-time: 33h 36m
Theory classes: 8h
Practical classes: 6h
Self study: 19h 36m
User behavior and demand models

Description:
Introduction to the problems of modeling of transport systems

Specific objectives:
Knowledge of models for forecasting demand and allocating transport flows

Full-or-part-time: 31h 12m
Theory classes: 8h
Practical classes: 5h
Self study: 18h 12m

Modes of urban transport

Description:
Comparison of the different modes of transport

Full-or-part-time: 9h 36m
Theory classes: 4h
Self study: 5h 36m

Evaluable activities

Description:
Course project. Introduction
Discussion of the partial results and evaluation of the progress of the project
Course project. Presentations of results

Full-or-part-time: 36h
Laboratory classes: 15h
Self study: 21h

GRADING SYSTEM

The mark of the course is obtained from the ratings of continuous assessment.

Evaluable activities are three: Course project, partial exam (not eliminate contents), final exam.

Final grade = 0.25 Course project + 0.25 Partial exam + 0.5 Final exam.
BIBLIOGRAPHY

Basic:

Complementary: