Universidad Zaragoza

Academic Year/course: 2021/22

60826 - Safe and sustainable mobility

Syllabus Information

Academic Year: 2021/22
Subject: 60826 - Movilidad segura y sostenible
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 532 - Master's in Industrial Engineering
ECTS: 6.0
Year: 2
Semester: Second semester
Subject Type: Optional
Module:

1. General information

1.1. Aims of the course

The subject and its expected results respond to the following approaches and objectives:

The general objectives of the subject of Safe and Sustainable Mobility are that students acquire advanced knowledge to achieve the ability to analyze, study and understand the aspects that are necessary to calculate and design safe and efficient transportation systems in Automotive Engineering. It is the case of; Design of active and passive safety systems and their relation with the reduction of accidents, design of efficient traction systems that reduces emissions and consumption, design of procedures for the rational use of the vehicle in urban and interurban environments that reduce accidents and Optimize the route and therefore improve its sustainability. .

It is necessary to point out the existence of a great quantity of Engineering subjects directly related to the Automobile Engineering, which will be explained in the introduction of the subject. This linking of knowledge will enable the student to relate the different disciplines involved.

1.2. Context and importance of this course in the degree

The subject is optional and is part of the training of students who study the Master of Industrial Engineering.

This subject is located in the third semester, after having studied subjects such as General Physics, Machine Design, Materials Science, Elasticity and Resistance of Materials and Structural Calculation, in the Engineering Degrees from which the student comes, as well as Other more specific subjects, linked to the subject in the first and second semester of the Master of Industrial Engineering.

The objective of the subject is that the student integrates the knowledge that is taken in the same, within the formative context of the degree, so that it has a solid formation in the matter, that allows him not only to know advanced aspects of Vehicle Engineering , But to analyze them so that they can be designed using modern calculation and testing techniques. Thus, during the exercise of his profession, when faced with problems of analysis and optimization of a vehicle in the production chain of a company or calculate the systems to use in them, the student is self-sufficient in the application of The knowledge necessary to solve these problems.

1.3. Recommendations to take this course

Given the technological and practical content of the subject, it is recommended that students take the course in person. Students who follow the classroom and continued the course must pass the evaluation tests programmed throughout the course. Those who do not follow the course face-to-face and must continue to pass a final evaluation test regarding all content modules.

It is recommended that students have basic knowledge of Physics, Mathematics, Mechanics, Machinery Design Criteria, Materials Resistance, Vehicle Design and Architecture and Mechanical Systems in Machinery and Vehicles.

2. Learning goals

2.1. Competences

By passing the subject, the student will be more competent to ...

BASIC SKILLS

CB1 - Possess and understand knowledge that provides a basis or opportunity to be original in the development and / or application of ideas, often in a research context

CB2 - Students should be able to apply acquired knowledge and problem solving skills in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of ??study

CB3 - Students are able to integrate knowledge and face the complexity of making judgments based on information that, incomplete or limited, includes reflections on social and ethical responsibilities related to the application of their knowledge and judgments

CB4 - Students can communicate their conclusions and the latest knowledge and reasons that support them to specialized and non-specialized audiences in a clear and unambiguous way

CB5 - Students have the learning skills that allow them to continue studying in a way that will be largely self-directed or autonomous.

GENERAL COMPETENCES

CG6 - Conduct research, development and innovation in products, processes and methods.

CG7 - Apply acquired knowledge and solve problems in new or little known environments within broader and multidisciplinary contexts.

CG8 - To be able to integrate knowledge and face the complexity of making judgments based on information that, incomplete or limited, includes reflections on the social and ethical responsibilities related to the application of their knowledge and judgments.

CG9 - Know how to communicate the conclusions - and the last knowledge and reasons that sustain them - to specialized and non-specialized audiences in a clear and unambiguous way.

CG10 - To possess the learning abilities that allow to continue studying in a self-directed or autonomous way.

SPECIFIC COMPETENCES

CE11 - Capacity for the analysis, design and testing of safe and sustainable vehicles.

CE12 - Knowledge and skills to perform verification and control of facilities, processes and products.

CE13 - Knowledge and skills to perform certifications, audits, verifications, tests and reports.

2.2. Learning goals

The student, to overcome this subject, must demonstrate the following results ...

The acquisition of analytical skills to determine the safe behavior of vehicles against an accident and human behavior in driving.

The acquisition of analytical capabilities to determine the mechanical, electrical and energy performance of machines and vehicles in efficient use in urban and interurban environments that allow to determine the keys for sustainable designs of vehicles.

The acquisition of practical capacities for the application of experimental methodologies for the analysis of the accident, its causes and its direct consequences in the prevention.

The acquisition of practical skills for the application of experimental methodologies for the analysis, design and calculation of machines and vehicles with benefits specially designed to be sustainable.

The analysis of the structural behavior of machines and vehicles and their components: introduction, methodologies and structural resolution tools.

Application of Numerical Methods of Advanced Calculation to virtual problem solving. Accident simulation programs, performance of vehicles, design of vehicles and their components, consumption and emissions, driving behavior, optimization of vehicle use and examples of application.

Design methodology based on the combination of simulation and test techniques. General aspects, analysis of results, validation of models.

Design, calculation and optimization of vehicle components systems and integration of the same so that the whole is safe and sustainable.

Approach and resolution of concrete cases through the application of numerical tools based on different mathematical algorithms.

2.3. Importance of learning goals

This subject is divided into the following two training blocks, which explains the importance of their learning outcomes:

Block 1: Safe Mobility

This block will describe the concepts related to accidents in the framework of sustainable mobility and the repercussions they have today in our society, increasingly involved with these aspects. The causes of traffic accidents in urban and interurban environments will be studied and determined, since they are many and varied and depend on different factors that intervene according to behavioral, temporal, technological, human, climatological, etc. variables. Impact of the introduction of new sustainable modes of transport and how the user and technology have had to adapt to a conception of these systems. It will be shown how the Traffic Accident Preventive Plans are developed and conceived, that allow to reduce the accident rates in the environments of shared circulation.

The theoretical classes in which the concepts mentioned above are explained, and where practical cases are solved, are complemented by a practical program, focused on the resolution of practical cases that are in line with the analysis of accident and Prevention of traffic accidents. Computer programs based on numerical mathematical methods are used to

make the necessary simulations and calculations. An internship program has been developed in which two practices of 3.5 hrs duration are considered, in which the causes of traffic accidents are analyzed as well as the development of the accident itself and where they can be carried out Valuations with the factors that intervene in the same causes.

Block 2. Sustainable Mobility.

This block first describes the different typologies of intelligent, efficient and sustainable transport systems, emphasizing this categorization, which will be given according to the different intelligent systems of which the transport systems, Traction or propulsion that incorporates the vehicle that makes it more energy efficient and less polluting, and the optimized use made of it and that allows considerable savings in its exploitation and use, making it sustainable. This block will also describe the advances in non-polluting vehicle technology, describing those technological systems that make a vehicle considerably reduce its emissions, analyzing from traction systems based on electric motorization, using the storage batteries of State-of-the-art energy, auxiliary energy storage systems such as ultra capacitors, inertia disks, compressed fluid systems, or self-generated energy systems such as fuel cells that require the use of hydrogen as feedstock. Hybrid systems and alternative systems combining various technologies will also be described and studied. The procedure for calculating the performance and dimensioning of electric vehicles will be analyzed and described, allowing efficient and alternative vehicle designs to be obtained from current vehicles. By means of specific calculation programs the main variables will be calculated to make an optimum sizing of the main systems of an electric car that allows to obtain a vehicle with the suitable benefits for a certain path and comparable to the current vehicles, but with a consumption index and Emission much lower. Finally, the different aspects that influence efficient mobility in urban and suburban environments will be analyzed and studied. The establishment of driving cycles adapted to the reality of the environments, makes it necessary to know tools that allow us to analyze the behavior of the vehicle in real operating environments.

A practical program has been developed in which it is proposed to carry out 2 practices of 3.5 hours duration, in which they will optimize the performance of an electric car so that the system is energy efficient and sustainable, The proper use of the vehicle will be analyzed and the most appropriate mobility strategies will be calculated to reduce consumption in urban and interurban environments.

It is considered basic that who owns an Master of Industrial Engineering by the University of Zaragoza is sufficiently prepared to accede to the sector of the Automotive Engineering. Therefore, one of the objectives to be achieved through the teaching of the subject is to include in the training the subject described in this guide, so that it possesses the knowledge bases to develop a work in a company of the sector. It should be borne in mind that the technology needed to work in these companies requires a clear knowledge of the systems and components that make up a vehicle, its operation, methods of design, calculation and testing. This will be the level of knowledge that will be transmitted to the student during the teaching of the subject.

In addition, students work in groups and with real data, so they also develop team collaboration skills in solving real problems.

3. Assessment (1st and 2nd call)

3.1. Assessment tasks (description of tasks, marking system and assessment criteria)

The student must demonstrate that he / she has attained the expected learning outcomes through the following assessment activities

The evaluation of the subject includes the following activities carried out continuously throughout the course:
1.A written test carried out individually by the entire group of students regarding the modules of Safe Mobility for Sustainable Mobility. This test will solve theoretical questions as well as numerical problems related to the syllabus and the practices carried out.
2.A individual or group report made by each of the students, reflecting a theoretical and practical development of some of the topics covered within the two blocks that constitute the subject. The report will be delivered in a time and manner specified by the teachers and will be presented in public to the teachers for evaluation.
3. The accomplishment of laboratory practices and the preparation of the corresponding reports of each one of the practices carried out, which will be evaluated and if they are approved, will avoid the need to carry out the corresponding global test.

Global test

Students who do not perform any of the previously proposed tests, programmed during the course, corresponding to the evaluation, must carry out the global test in the official examination of the subject. The test will be unique and written, and will coincide with the final written test of the subject.

Evaluation criteria:

In the evaluation of both written test, individual report or group, and practices will consider the following aspects:

- Reports and test responses will be answered correctly and in coherent language.

- The problems that are solved must be correctly posed and resolved.

- The terms used in each test must be defined correctly.

- Serious mistakes in basic concepts of the subject will suppose the annulment of the score given to the corresponding question or problem.

Levels of demand:

The written test is 50% in the final grade; To overcome them, the student must obtain a grade of at least 5 (out of 10).

The report of the individual work on one of the topics selected within the syllabus assumes the other 50% of the subject. For its evaluation, the content in terms of quality and complexity and scope will be taken into account, as well as an exhibition in

public that will have to be done in a time around 10 minutes.

The reports of the practices of the subject will be of obligatory presentation as they are carried out. In the case of not carrying out the practices and / or not delivering the corresponding reports, the knowledge will be evaluated in a global test.

To pass the subject the student must obtain a final grade computing all the tests of at least 5 points, out of 10.

Students who do not pass through the evaluation system referred to in the previous points must carry out in the official examinations an overall written compulsory test equivalent to the previous tests described and the practice reports. The final mark must be at least 5 points, out of 10.

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The methodology followed in this course is oriented towards achievement of the learning objectives. It promotes continuous work and focuses on the behavior of the vehicle and driving environments with shared circulation aspects, reinforcing aspects of the calculation and optimization of safe and sustainable vehicles. A wide range of teaching and learning tasks are implemented, such as

- Lectures, where theoretical and descriptive aspects of the systems, design criteria, procedures and sample calculation for the different systems covered in the course are explained and illustrated with case studies.
- Practice sessions, where current situations are discussed, such as how the use of the vehicle in familiar environments allows a certain casuistry to analyze the vehicle and the type of driving, so that it can be optimized, both the designs of the component systems of the vehicle and the vehicle as a whole in itself, and how to use them, through the management of numerical and experimental techniques. Actual design variables are handled.
- The evaluation focuses on the theoretical and practical aspects of the analysis and assessment of the factors involved in establishing a safe and sustainable mobility. Besides, procedures to determine the assessment criteria that define a safe and sustainable vehicle and use. Details of the assessment are in the "Assessment" section

4.2. Learning tasks

The course includes the following learning tasks:

- **A01 Lectures and practice sessions** (45 hours). Whole group sessions. Presentation of contents by the teacher, visiting experts or by the students themselves as well as problem-solving tasks related to accidents with vehicles, services and specific characteristics of safe and sustainable vehicles, the organization of efficient use of vehicles in urban and interurban environments, and procedures. Attendance is compulsory in person or in a remote way.
- **A02 Special sessions** (5 hours). Visits to facilities of interest, etc. whenever there is availability. Attendance is compulsory in person or in a remote way.
- **A03 Laboratory sessions** (15 hours). Small group sessions in the computer or experimental laboratory where students work on practical exercises. They develop skills in solving real problems and interpretation of results. Detailed information regarding the tasks will be available on the web. Attendance is compulsory in person or in a remote way.
- **A04 Assignment** (30 hours). Students carry out a research or practical project.
- **A05 Autonomous work and study** (50 hours).
- **A06 Assessment tests** (5 hours). Attendance is compulsory in person or in a remote way.

4.3. Syllabus

The course will address the following topics:

Section 1. Safe Mobility

1. The accident in the context of sustainable mobility
2. Determination of the causes of traffic accidents in urban and interurban environments
3. Impact on the accident of the introduction of new sustainable transport modes
4. Preventive Plans in traffic accidents

Section 2. Sustainable Mobility

1. Transport systems: intelligent, efficient and sustainable
2. Technology of clean vehicles
3. Performances and dimensioning of electric vehicles

4. Efficient Mobility in urban and suburban environments

4.4. Course planning and calendar

The course runs for the 15 weeks of the semester.

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course, will be provided on the first day of class or please refer to the EINA website and http://add.unizar.

Of the total teaching hours of the course, 45 hours of teaching of the subject are given to the whole group in the form of lectures and problem solving and practical cases, and the remaining 15 hours of teaching are intended for the realization Of practice of the subject. These practices will be carried out in the computer rooms of the Department of Mechanical Engineering, the computer room and the vehicle laboratory of the Transport Engineering and Infrastructure Area and the Mechanical Testing Laboratory of the Department of Mechanical Engineering.

A series of written tests of the two modules corresponding to Safe Mobility and Sustainable Mobility will also be carried out and correspondingly the practical contents developed during the course will also be evaluated.

In each official announcement, students who have not passed the course through the continuous assessment system described in the previous paragraphs will obtain their evaluation by performing written and practical tests, on the dates indicated by the Center for the official examinations, that allow to evaluate all the Learning outcomes that define the subject.

4.5. Bibliography and recommended resources

La bibliografía de la asignatura se podrá consultar a través de este enlace
http://biblioteca.unizar.es/como-encontrar/bibliografia-recomendada