

66429 - Advanced vehicle design

Syllabus Information

Academic year: 2023/24

Subject: 66429 - Advanced vehicle design

Faculty / School: 110 - Escuela de Ingeniería y Arquitectura

Degree: 536 - Master's in Mechanical Engineering

ECTS: 4.5

Year: 1

Semester: Second semester

Subject type: Optional

Module:

1. General information

Objectives of the subject

The main objective of the subject is for the student to acquire the ability to design and calculate subsets belonging to automotive engineering, which require advanced knowledge. This is the case with thermal, electric, and hybrid motor systems, or the body of a vehicle. Other subsets such as vehicle steering, suspension, and braking systems, will have been studied by the student in previous subjects corresponding to automotive engineering.

Sustainable Development Goals of the 2030 Agenda (<https://www.un.org/sustainabledevelopment/es/>) : Goal 11: Objectives 11.2 and 11.6; Goal 12: Objective 12.2; Goal 13: Objective 13.3

Recommendations to take the subject.

Students are advised to take the subject continuously. It is recommended that the student has basic knowledge of general physics, material science, elasticity and strength of materials, machine design and structural calculation, thermodynamics and heat and fluid transfer.

2. Learning results

1. To acquire analytical abilities to determine the structural and thermal behaviour of vehicles.
2. To acquire practical skills for the application of experimental methodologies in the design and calculation of vehicles.
3. To be able to analyse the structural behaviour of vehicles and their components.
4. To be able to apply the finite element method (FEM) to the virtual resolution of structural problems.
5. Design methodology based on the combination of simulation techniques and test execution. General aspects, result analysis, model validation.
6. To acquire the skills for the design and sizing of thermal systems in vehicles.
7. To acquire skills for the design and evaluation of comfort, active safety and ergonomics in vehicles.
8. To acquire skills for the design and evaluation of new fuels and hybrid propulsion technologies for vehicles.
9. To acquire skills for the design of ignition control and fuel systems in engines.
10. To design, calculate and optimise components and vehicles.
11. To propose and solve specific cases through the application of tools based on the FEM.

3. Syllabus

Module 1: Alternative internal combustion engines

- Typologies and operating principles of combustion engines
- Main components of engines and their typical arrangement
- Elements of electronic ignition and injection systems
- Characteristics of classic fuels and those derived from biomass. Impact on the pollutant emissions of an engine. Gas cleaning systems in vehicles.
- Analysis and measurement tools in engines, instrumentation and characteristics of test benches.

Module 2: Electric and hybrid motorization systems

- Power plants of hybrid and electric vehicles. Integration of both engines.
- Electric vehicles with fuel cell.
- Vehicle design based on its use (urban, highway or mixed), analysing the components of driving force and resistance to progress.
- Autonomy of operation in electric mode. Types of batteries, charging methods. Analysis of energy consumption of vehicles.

Module 3. Vehicle body design.

- Types of vehicle bodies for cars, buses and semi-trailers.
- Applicable design criteria based on requirements against static and dynamic loads and against shock.
- Materials used in the construction of vehicle bodies.

Sensitivity studies based on the solving of practical cases of design, calculation and optimization of vehicle bodies, through computer programs based on FEM.

4. Academic activities

- Master Class (10 hours)
- Problem solving and cases (12.5 hours)
- Laboratory practices (20 hours)
- Special practices (2.5 hours)
- Study of theory and practical application or research works (65 hours)
- Personalized teacher-student tutoring
- Assessment (2.5 hours)

5. Assessment system

The subject is preferably evaluated with a **continuous assessment** that consists of four blocks:

1. A work to be carried out by the students and presented publicly, referring to the *Alternative internal combustion engines* module. (33.4%, minimum grade 4/10)
2. A written individual test regarding the *Electric and hybrid Motorization* module. (16.7%, minimum grade 4/10)
3. A written individual test regarding the *Vehicle body design* module. (16.7%, minimum grade 4/10)
4. Individual reports that reflect the work carried out during the subject's practices in the Electric and hybrid motorization modules and Vehicle body design, and that show the student's ability to solve design, calculation and test problems related to the proposed cases, to be presented before the official call. (33.2%, minimum grade 5/10)

Students who do not take any of the tests proposed above or do not meet the minimum requirements must take the comprehensive test in the official call.

Alternatively, the student has the possibility of passing the subject by means of the **global evaluation** in the official calls for exams. The evaluation is carried out through a written test equivalent to the tests described and the practices report on the dates established by the centre.