240AU032 - Automobile Electronics

Coordinating unit: 240 - ETSEIB - Barcelona School of Industrial Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering
Academic year: 2019
Degree: MASTER'S DEGREE IN AUTOMOTIVE ENGINEERING (Syllabus 2012). (Teaching unit Compulsory)
MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2014). (Teaching unit Optional)
ECTS credits: 3
Teaching languages: Spanish

Coordinator: JUAN MANUEL MORENO EGUILAZ
Others: Sergi Busquets Monge, Manuel Moreno Egiluz

Opening hours
Timetable: Previous request by e-mail

Prior skills
Ability to analyse electronic circuits

Requirements
Electric Systems in the Automobile

Degree competences to which the subject contributes

Specific:
1. Apply knowledge of mathematics, physics and technology obtained through study, experience and practice, using critical reasoning to establish economically viable solutions to technical problems in the automotive sector
2. Conceptualize engineering models, apply innovative methods in problem solving and applications suitable for the design, simulation, optimization and control of processes and systems

General:
3. Ability to apply appropriate knowledge of mathematical aspects, analytical, scientific, instrumental, technological and management, the resolution of the problems of the automotive
4. Develop independent learning skills to maintain and enhance the powers of Automotive Engineering, to allow the continued development of the profession.

Teaching methodology
- MD-2: Lecture class
- MD-3: Autonomous learning

Learning objectives of the subject

General objectives:
- Provide a wide and panoramic vision of the electronics in the automotive field.

Specific objectives:
240AU032 - Automobile Electronics

- Describe the special features of the electronics in the automotive field.
- Explain how and why determinate methodologies are used to design the electronic systems in the automotive field.

**Study load**

<table>
<thead>
<tr>
<th>Total learning time: 75h</th>
<th>Hours large group: 18h</th>
<th>24.00%</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Hours small group: 9h</td>
<td>12.00%</td>
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<tr>
<td></td>
<td>Guided activities: 0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Self study: 48h</td>
<td>64.00%</td>
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# Content

## 1. Introduction to electronics in the automobile

**Description:**
- Evolution of the automotive electronics.
- Panoramic vision of the electronics inside the car: distributed control.
- Systems "X by Wire".
- Current and future trends.

**Related activities:**
- Expositive session from SEAT

**Specific objectives:**
- Show the special features of the automotive electronics.
- Show the importance and the need of the electronics in the automotive sector industry.
- Introduce the student into the jargon of automotive electronics.

**Learning time:** 4h
- Theory classes: 2h
- Self study: 2h

## 2. Automotive hardware

**Description:**
- Sensors.
- Actuators.
- Power converters.
- Microcontrollers.
- Electronic control units (ECUs).

**Related activities:**
- Interactive classes.
- Monographic report.

**Specific objectives:**
- Show the special features of the components used in automotive hardware.
- Know the connection and interrelation between hardware components.

**Learning time:** 20h
- Theory classes: 12h
- Self study: 8h
### 3. Automotive software

<table>
<thead>
<tr>
<th>Learning time:</th>
<th>4h</th>
</tr>
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<tbody>
<tr>
<td>Theory classes:</td>
<td>2h</td>
</tr>
<tr>
<td>Self study:</td>
<td>2h</td>
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</tbody>
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**Description:**
- Automotive real time operative systems (OSEK/VDX).
- Standards in automotive software (the case of AUTOSAR).

**Related activities:**
- Interactive classes.
- Monographic report.

**Specific objectives:**
- Demonstrate the need to have tools and standards to achieve the correct operation of the automotive software.

### 4. Automotive communications

<table>
<thead>
<tr>
<th>Learning time:</th>
<th>12h</th>
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</thead>
<tbody>
<tr>
<td>Theory classes:</td>
<td>4h</td>
</tr>
<tr>
<td>Laboratory classes:</td>
<td>2h</td>
</tr>
<tr>
<td>Self study:</td>
<td>6h</td>
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**Description:**
- Internal buses: LIN, CAN, FlexRay, MOST, etc.
- Communication vehicle-vehicle (V2V) and vehicle-infrastructure (V2E).

**Related activities:**
- Interactive classes.
- Monographic report.
- Practical session in the laboratory, where it will be possible to see communication systems in operation, tools for monitoring and diagnosis as well as tools for ECU simulation (communications).

**Specific objectives:**
- Explain the need to have communications and buses in the car.
- Describe the most used buses in the automotive industry, as well as the communications between vehicles and/or with the infrastructure.
5. Diagnose, tests and regulations

**Learning time:** 8h
- Theory classes: 4h
- Self study: 4h

**Description:**
- On board diagnosis (OBD).
- Electromagnetic compatibility (EMC).
- Tests and regulations

**Related activities:**
- Interactive classes.
- Monographic report.

**Specific objectives:**
- Demonstrate the need to have a diagnose system as well as test and regulation to ensure a correct operation of the vehicle.

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**Qualification system**

- IE.1: Written exams (partial, 25% and final, 50%): total: 75%
- IE.4: Monographic report: 25%

**Extraordinary evaluation:**
- Monographic report (25%) + Extraordinary written exam (75%)

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**Regulations for carrying out activities**

- Any type of documentation will not be allowed during the development of the written examinations.
- To carry out the monographic report, the professors of the course will propose different topics. The written report must be delivered before the last examination of the course.

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**Bibliography**

**Basic:**

**Complementary:**