Course guide  
240216 - 240AU054 - Connected Vehicle

Unit in charge: Barcelona School of Industrial Engineering  
Teaching unit: 744 - ENTEL - Department of Network Engineering.

Degree: MASTER'S DEGREE IN AUTOMOTIVE ENGINEERING (Syllabus 2019). (Compulsory subject).

Academic year: 2023  ECTS Credits: 6.0  Languages: Spanish

LECTURER

Coordinating lecturer: De La Cruz Llopis, Luis Javier

Others:

TEACHING METHODOLOGY

Lectures  
Application classes  
Laboratory classes  
Laboratory sessions  
Individual work (not presential)  
Group work (not presential)  
Short-answer tests (Control)  
Short-answer tests (Test)  
Extended-response tests (Final Exam)

LEARNING OBJECTIVES OF THE SUBJECT

This subject aims to provide attendees with the basic knowledge of different infrastructures and communication systems used by vehicles, both for internal communications between their own electronic systems and for external communications with other vehicles or with other devices on the road. To do this, the theory classes are combined with several laboratory sessions.  
The course starts with basic concepts of transmission systems and communication networks, provides a global view of the more used protocol hierarchies, and finish with a detailed description of the ETSI standards for intelligent transport systems.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self study</td>
<td>96,0</td>
<td>64.00</td>
</tr>
<tr>
<td>Hours large group</td>
<td>54,0</td>
<td>36.00</td>
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</tbody>
</table>

Total learning time: 150 h
# CONTENTS

## Lesson 1. Basic concepts.

**Description:**
- Channels and nodes in communications networks.
- Multiplexing of transmission channels.
- Network topologies.
- Switching modes.
- Protocol architectures.

**Full-or-part-time:** 11h
- Theory classes: 4h
- Self study: 7h

## Lesson 2. Data link.

**Description:**
- Flow control and error control.
- Medium access control techniques.
- Vehicle internal communication buses.
- Local area networks.

**Full-or-part-time:** 45h 30m
- Theory classes: 6h
- Laboratory classes: 6h
- Self study: 33h 30m

## Lesson 3. TCP / IP protocol architecture

**Description:**
- Basic network protocols (IP, ARP, ICMP).
- Transport protocols (UDP, TCP).

**Full-or-part-time:** 36h 30m
- Theory classes: 8h
- Laboratory classes: 3h 30m
- Self study: 25h


**Description:**
- Cellularization
- Control and management functions of a cellular system: transfer, search, location.
- Cellular systems: Evolution, LTE, 5G.

**Full-or-part-time:** 36h
- Theory classes: 5h
- Laboratory classes: 2h
- Self study: 29h
Lesson 5. Intelligent transport systems.

Description:
Protocol architecture ETSI-G5.
Facilities.
Basic transport protocol.
GeoNetworking.
Access 802.11p and C-V2X.

Full-or-part-time: 21h
Theory classes: 4h
Laboratory classes: 2h
Self study: 15h

GRADING SYSTEM

- This subject has theory (60%) and laboratory (40%) evaluation.
- The theory mark consists of a midterm control (40% of the theory mark) and a final exam (60% of the theory mark).
- The laboratory mark is obtained by carrying out a practical control (80% of the laboratory mark) and the follow-up mark assigned by the professor (20% of the laboratory mark).
- To pass the subject, the attendance to laboratory class must be 100%, except cases justified in writing.

Addendum: In case the health situation during the course by COVID-19 requires it, the method and the assessment tests will be suitably modified so that they can be carried out in a non-face-to-face mode.

BIBLIOGRAPHY

Basic: