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: 2022 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 presental)
Group work (not presental)
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>Hours large group</td>
<td>54,0</td>
<td>36.00</td>
</tr>
<tr>
<td>Self study</td>
<td>96,0</td>
<td>64.00</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:**