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.
# 240216 - 240AU054 - Connected Vehicle

## Content

### Lesson 1. Basic concepts.

**Learning time:** 11h  
Theory classes: 4h  
Laboratory classes: 0h  
Self study: 7h

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

### Lesson 2. Data link.

**Learning time:** 45h 30m  
Theory classes: 6h  
Laboratory classes: 6h  
Self study: 33h 30m

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

### Lesson 3. TCP / IP protocol architecture

**Learning time:** 36h 30m  
Theory classes: 8h  
Laboratory classes: 3h 30m  
Self study: 25h

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


**Learning time:** 36h  
Theory classes: 5h  
Laboratory classes: 2h  
Self study: 29h

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

<table>
<thead>
<tr>
<th>Description:</th>
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<tbody>
<tr>
<td>Protocol architecture ETSI-G5.</td>
</tr>
<tr>
<td>Facilities.</td>
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<tr>
<td>Basic transport protocol.</td>
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<tr>
<td>GeoNetworking.</td>
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<td>Access 802.11p and C-V2X.</td>
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Learnign time: 21h
- Theory classes: 4h
- Laboratory classes: 2h
- Self study: 15h

Qualification system

- This subject has theory (60%) and laboratory (40%) evaluation.
- Both the theory part and the laboratory part have continuous evaluation, consisting of two mid term controls for each part. The value of each mid term control is 50% of its corresponding part (theory or laboratory). The subject can be passed directly with the continuous assessment.
- In case of not passing the theory part with the continuous evaluation, a final theory exam has to be carried out.
- To pass the subject, the attendance to laboratory class must be 100%, except cases justified in writing.

Bibliography

Basic:
