Course guide
240216 - 240AU054 - Connected Vehicle

Last modified: 13/03/2025

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: 2025 **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

Type	Hours	Percentage
Self study	96,0	64.00
Hours large group	27,0	18.00
Hours small group	27,0	18.00

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

Lesson 4. Cellular networks.

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 (50%) and laboratory (50%) 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 consists of a midterm control (40% of the laboratory mark) and a final exam (60% 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:

- Forouzan, B. A. Data communications and networking : with TCP/IP protocol suite [on line]. 6th ed. New York: McGraw-Hill, 2022 [Consultation: 09/04/2025]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=6452018. ISBN 9781260597820.
- European Telecommunications Standards Institute. Intelligent Transport Systems (ITS) : Communications Architecture [on line]. V1.1.1. Sophia Antipolis: ETSI, 2010 [Consultation: 28/06/2019]. Available on: https://www.etsi.org/deliver/etsi_en/302600_302699/302665/01.01.01_60/en_302665v010101p.pdf.