Course guide
240274 - 240AU131 - Adas and Radio Frequency Systems

Last modified: 16/05/2023

Unit in charge: Barcelona School of Industrial Engineering
Teaching unit: 739 - TSC - Department of Signal Theory and Communications.

Degree: MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2014). (Optional subject).
MASTER'S DEGREE IN AUTOMOTIVE ENGINEERING (Syllabus 2019). (Optional subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: Albert Aguasca Solé

Others:

TEACHING METHODOLOGY

Lectures
Application classes
Laboratory sessions Homework (problems and exercises)
Individual work (distance)
Short answer tests
Final Exam

LEARNING OBJECTIVES OF THE SUBJECT

The aim of this course is to recognize and understand the devices and elements on which driving aids and support systems are based, such as radar, lidar, inertial sensors, etc. It is also intended that the student be introduced to wireless communications systems as a basic element of future ADAS systems and autonomous vehicles, which describe their characteristics, their basic parameters, areas of application and limitations. The theory sessions are combined with various laboratory practices in order to delve into the application side of the different systems being worked on.

STUDY LOAD

Type	Hours	Percentage
Hours large group	54,0	36.00
Self study	96,0	64.00

Total learning time: 150 h

CONTENTS

Driver Assistance Systems: Sorrounding Recognition

Description:
The main Driver Assistance systems that allow the recognition of sorroundings are described: Radar, Lidar, Ultrasonic sensors, etc. Structure, Principle of Operation, Characterization and description of the Measures that can be carried out.
The laboratory sessions are devoted to the use of laboratory RADAR and LIDAR systems, to have a deep understanding of these different systems.

Full-or-part-time: 46h
Theory classes: 7h
Laboratory classes: 14h
Self study : 25h

Driver Assistance Systems: Vehicle positioning

Description:

The main driver assistance systems that allow the location within the sorrounding are presented: Cartography, inertial sensors, GNSS and their modes of operation. Positioned by triangulation of communications base stations.

The laboratory sessions are focused on the use of inertial and GNSS systems to determine the trajectory and orientation of the vehicle. The so-called dead-reckoning navigation will be worked on. The student will also experiment with GPS receivers in different modes of operation

Full-or-part-time: 43h
Theory classes: 6h
Laboratory classes: 12h
Self study : 25h

Radio Frequency Wireless Communication systems

Description:
The purpose of this chapter is to provide an overview and summary of the fundamental meaning and concepts of radio-frequency and wireless communication systems.
Among others, the following concepts will be described,
- Frequency spectrum. Terms of use
- Device-level wireless communications: Basic elements of a Transmitter-Receiver system, key parameters.
- Wireless communications: Link budget, radio channel errors due to noise, range.
- Wireless communications: urban propagation, propagation anomalies (refraction, reflection, diffraction, atmospheric devices)
A set of laboratory sessions will be carried to take an inside view of: frequency spectrum, antennas, the concept of range and signal-to-noise ratio, use of Radio Frequency instrumentation.

Full-or-part-time: 80h 30m
Theory classes: 13h 30m
Laboratory classes: 27h
Self study : 40h

GRADING SYSTEM

This course has theory (50%) and laboratory (50%) assessment
Both the theory and the laboratory part have continuous evaluation. From the theory part, two Short answer tests are carried out. Each of the tests is worth 50% of its corresponding part. The course can be passed directly through continuous assessment.
In the case of not passing the theory part through continuous assessment, a final theory exam must be taken.
Attendance at laboratory sessions must be 100% to pass the course, except in justified cases.

BIBLIOGRAPHY

Basic:

- Skolnik, Merrill I. Introduction to radar systems. 3rd. ed. Boston (Mass.) [etc.]: McGraw-Hill, cop. 2001. ISBN 0-07-288138-0.
- Parkinson, Bradford W; Spilker, James J. Global positioning system : theory and applications. Washington: American Institute of Aeronautics and Astronautics, cop. 1996. ISBN 156347106X.
- Weisman, Carl J.. The Essential Guide to RF and Wireless. New York: Prentice Hall, 2002. ISBN 9780130354655.
- Winner, Hermann [et al.]. Handbook of Driver Assistance Systems : Basic Information, Components and Systems for Active Safety and Comfort [on line]. Cham: Springer International Publishing, 2019 [Consultation: 21/04/2023]. Available on: https://link-springer-com.recursos.biblioteca.upc.edu/referencework/10.1007/978-3-319-12352-3. ISBN 9783319098401.