GENERAL INFORMATION

Data of the subject	
Subject name	Automotive Electronics
Subject code	DEA-OPT-421
Mainprogram	Bachelor's Degree in Electromechanical Engineering
Involved programs	Grado en Ingeniería en Tecnologías Industriales [Fourth year] Grado en Ingeniería en Tecnologías de Telecomunicación [Fourth year]
Credits	3,0 ECTS
Type	Optativa (Grado)
Department	Department of Electronics, Control and Communications
Coordinator	Vicente de Las Heras Bañón
Schedule	morning

Teacher Information	
Teacher	
Name	Vicente Pio de las Heras Bañón
Department	Department of Electronics, Control and Communications
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DESCRIPTION OF THE SUBJECT

Contextualization of the subject
Prerequisites

Contribution to the professional profile of the degree

The aim of this course is to introduce the modern electronic devices and systems with applications in automotive electronics industry. The underlying physics of devices, their functional characteristics, fabrication technologies, design of the electronic devices and systems will be covered.

This course provides an overview of the electronic systems found in automotive designs including critical systems, navigation, sensoring, interfacing, safety systems and communication systems. The course also reviews trends in automotive electronics as well as issues (such as production techniques, cost, reliability and systems integration) that are driving the industry with a couple of visits to the Bosch industrial plant and laboratories included. **As a result, they will be able to develop electronic systems for the car industry or third party industries in which a solid background in the topic is often requested.**

Prerequisites

Fundamentals of Electronics (analogue and digital circuits). Digital Electronics Systems, Control Engineering.

Course contents

Contents

SECTION 1: Automotive Electronics Fundamentals

This section aims to fundamentals to electronics in vehicles.

T1: Introduction to Automotive Engineering

1.1 Overview of vehicle electronic systems

1.2 Review the trends in automotive electronics as well as issues that are driving the automotive industry.

T2: Fundamentals of Automotive Electronics

2.1 Integration of electronic components and systems in vehicles.

2.2 Embedded processors and microcontrollers.

2.3 Interfaces to peripherals and to sensors

SECTION 2: Electronic Systems

This section introduces specific and basic electronics on board vehicles.

T3: Automotive Communications Systems

3.1 Introduction to communications standards.

3.2 Introduction to networks, safety critical issues and reliability.

3.3 Communication protocols for automotive application. CAN, LIN Bus and others.

3.4 Telematics for automotive applications.

3.5 GPRS, GPS for use in and automotive environment.

T4: Automotive Control and Power Systems

4.1 Electronic control methods (analogue and digital).

4.2 Stability algorithms for control (cruise control, traction control).

4.3 Actuator limiting, wind-up, gain scheduling and others.

4.4 Energy management strategies: regenerative breaking, start-stop, torque boost.

4.5 Sensing and control systems. Interfacing using power devices.

T5: Sensors and Interfacing

5.1 Introduction to electronic instrumentation for sensors: temperature, distance, velocity, speedometer, anti-collision and others.

5.2 Interfacing electronics with Operational Amplifiers.

5.3 DA/AD converters, limitations, topologies and processing for sensors.

SECTION 3: Safety and Security Systems

This section addresses safety and security systems electronics

T6: Automotive Security: Active and Passive Systems

6.1 Introduction to security systems, from passive to active.

6.2 Passive system electronics: Airbag and sensors

6.3 Active systems electronics: Antilock-breaking system (ABS), Electronic Stability Program (ESP), Anti-slip regulation (ASR) and others

T7: Driver Assistance Systems

7.1 Advanced active systems electronics: ACC

7.2 Active safety system applications: lane detection, blind spot, crash avoidance control electronics.

T8: Production Techniques

8.1 Overview of the Manufacturing process for ultrasound and airbag sensors.

8.2 Quality management

T9: Automotive Diagnostics Techniques.

9.1 Diagnosis evolution

9.2 Parameter monitoring

9.3 Functional test

9.4 Central unit programming

9.5 Diagnosis SW and HW

T10: Visit (2) to Bosch Industrial Automotive Factory and Laboratories

EVALUATION AND CRITERIA

Grading
Regular Assessment

- **Theory** will account for 70%, of which:
    - Mid-term & quizzes: 30%
    - Final exam: 40%
- **Tech Project** will account for the remaining 30%, of which:
    - Oral and technical evaluation: 60%
    - Short paper project: 40%

In order to pass the course, the mark of the final exam must be greater or equal to 4 out of 10 points and the mark of the project must be at least 5 out of 10 points. Otherwise, the final grade will be the lower of the two marks.

Retakes

Project marks will be preserved, if it has a passing grade. Otherwise a new project will have to be developed and handed in. In addition, all students will take a final exam. The resulting grade will be computed as follows:

- Final exam: 60%
- Project: 40%

As in the regular assessment period, in order to pass the course, the mark of the final exam must be greater or equal to 4 out of 10 points and the mark of the final project must be at least 5 out of 10 points. Otherwise, the final grade will be the lower of the two marks.

Course Rules

Class attendance is mandatory according to Article 93 of the General Regulations (Reglamento General) of Comillas Pontifical University and Article 6 of the Academic Rules (Normas Academicas) of the ICAI School of Engineering. Not complying with this requirement may have.

BIBLIOGRAPHY AND RESOURCES

Basic References

Basic bibliography

- Notes prepared by the lecturer (available in Moodle).
- Robert Bosch Gmbh 2013, *Bosch Automotive Electrics and Automotive Electronics: Systems and Components, Networking and Hybrid Drive*. Publication Date: July 31, 2013 ISBN-13: 978-3658017835. 6th Ed.

Complementary bibliography

- James D. Halderman. 2013. Advanced Automotive Electricity and Electronics. Prentice Hall.
- Williams B. Ribbens, 2012. Understanding Automotive Electronics. Seventh Edition, Elsevier Åström, Wittenmark. Computer Controlled Systems. 3rd ed. Prentice Hall, 1997
- S. Krueger, W.Gessner 2002, Advanced Mycrosystems for Automotive Applications. Springer
- Tom Denton 2004, Automobile Electronic & Electronic Systems, 3rd edition Ed.
- Link to others books http://www.cvel.clemson.edu/auto/info/books.html