

Academic Year: (2024 / 2025)

Review date: 07-06-2024

Department assigned to the subject: Electronic Technology Department

Coordinating teacher: LOPEZ ONGIL, CELIA

Type: Electives ECTS Credits : 3.0

Year : 1 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Microprocesores (VERY RECOMMENDABLE)
 Digital and Analogue Electronics (basic) (RECOMMENDABLE)

OBJECTIVES**SKILLS**

Students should be able to apply their knowledge and should have the ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study .
 Students should be able to integrate knowledge and handle complexity, and formulate judgments based on information that, being incomplete or limited, includes thoughts about social and ethical responsibilities linked to the application of their knowledge and judgments.
 Developing concise, clear and justified documentation and specifying the work to be done for the development, integration and implementation of complex and high added value electronic systems.
 Ability to conceive, design , implement and maintain an electronic system in a specific application.
 Ability to work within a design team integrating multidisciplinary focuses
 Adopting the scientific method as a fundamental working tool in both professional and research careers.
 Ability to design electronic systems at the behavioral level, from a set of certain specifications, such as at system level, using modeling and simulation tools , such as at subsystem level, using hardware description languages.
 Ability to handle tools, techniques and methodologies for designing advanced electronic systems or subsystems
 Ability to design a device, system or application that meets a given specification , using a systematic and multidisciplinary approach and integrating modules and advanced tools that are specific to the field of Electronic Engineering .
 Ability to solve practical problems derived from interaction within an electronic system and external elements, with effects such as signal interferences, EMI or thermic management, in design, prototyping and redesign stages.
 Ability to search efficiently for information as well as to identify the state of the art of a technological problem in the electronic systems scope and its possible application to new systems

LEARNING OUTCOMES

The students passing this course should be able to:

- From a set of specifications and requirements of the different blocks involved in an electronic system, for a given professional application or research activity, to know the tools required for designing and developing every block and for planning system integration
- To know the differences between a reconfigurable digital system and microprocessor-based digital system, and to assess their usage for every application or even their integration within an embedded system.
- To know the elements involved in a data communication system and the different abstraction levels, with a block specification focus (considering required elements for an electronic system working in a network)
- To know the different networks topologies applied to the design and specification of electronic systems, including sensor networks.

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DESCRIPTION OF CONTENTS: PROGRAMME

1. Introduction to Sensor Networks
 - 1.a. Communication networks, Sensor networks, OSI model
 - 1.b. Sensor networks built with Embedded Systems
 - 1.c. Computing on-the-edge
2. Nodes Hardware
 - 2.a. Nodes Architecture.
 - 2.b. Dealing Sensor Data
 - 2.c. Sensors
 - 2.d. Sensor-Node Interfaces (SPI, I2C, 1wire, etc.)
 - 2.e. Energy harvesting, power consumption and sustainability
3. Networks and Communications
 - 3.a. Introduction to communications
 - 3.b. Network fundamentals
 - 3.b. Communications protocols
 - 3.c. Design and implementation
 - 3.d. Artificial intelligence with on-the-edge computation
 - 3.f. Application and case studies.
4. Seminar taught by an expert in the generation of solutions for the challenges of Society, pursuing the achievement of Sustainable Development Goals.

5. Practice

- Real WSN implementation
- Research Study on WSN,

Master's students should implement a system, including software and hardware, considering the generation of solutions including Artificial Intelligence to solve a given problem, as well as sustainability, data protection, cybersecurity and ethical aspects.

In this design, the bias in data for training the AI algorithms, as well as the blocks for data acquisition and preprocessing will have an important relevance.

LEARNING ACTIVITIES AND METHODOLOGY

LEARNING ACTIVITIES

Lectures

Theoretical and practical classes

Practical classes

Oral presentation from the students

Individual support when required by student (online and face-to-face)

Team work

TEACHING METHODOLOGIES

Teacher explanations supported with audiovisual media and information technology, in which the main concepts of the subject are developed and the reference literature is provided to supplement student learning.

Demonstration of practical cases, problems, etc.. The cases are posed by the teacher and solved individually or in groups with support of IDE tools

ASSESSMENT SYSTEM

% end-of-term-examination: 50

% of continuous assessment (assignments, laboratory, practicals...): 50

Continual Assessment (50%). It is composed of:

- 1 short test (or short questions exams) (10%) after the seminar taught by an expert in the field

Two options (autonomous work by the students, with general advice from the professors):

One:

- 1 computer lab work with the hardware supplied by the professors (15%)

- 1 team work where knowledge acquired during course should be applied (25%)

Two:

- 1 research work on a topic proposed by the student with the advice of the professors (15%)

- 1 oral presentation with mixed assessemnt (professors-students) (25%)

Final exam (50%)

Extraordinary Exam:

Assessment can be fitted with the continuous assessment process with the same system as in ordinary system or a final exam with the 100% of qualification.

In this course, students should not use artificial intelligence tools to carry out the work or exercises proposed by the faculty. In the event that the use of AI by the student gives rise to academic fraud by falsifying the results of an exam or work required to accredit academic performance, the Regulation of the University Carlos III of Madrid of partial development of the Law 3/2022, of February 24th, of University Coexistence, will be applied.

BASIC BIBLIOGRAPHY

- Mohammad Ilyas, Imad Mahgoub Handbook of Sensor Networks: Compact Wireless and Wired Sensing Systems. ISBN: 9780849319686, CRC Press, 2004

- W. Dargie, C. Poellabauer "Fundamentals of Wireless Sensor Networks Theory and Practice" ISBN: 978-0-470-99765-9, Willey Series on Wireless Communication and Computing, 2010

ADDITIONAL BIBLIOGRAPHY

- J. Fraden Handbook of Modern Sensors, Physics Design and Applications, Springer, 2004
- Peter Marwedel Embedded System Design, Springer Science, 2011. 2nd Edition