

**1. General information****Course:** SENSORS AND SENSOR WIRELESS NETWORKS**Code:** 59665**Type:** ELECTIVE**ECTS credits:** 6**Degree:** 385 - DEGREE IN TELECOMMUNICATIONS TECHNOLOGY ENGINEERING**Academic year:** 2023-24**Center:** 308 - SCHOOL POLYTECHNIC OF CUENCA**Group(s):** 30**Year:** 4**Duration:** First semester**Main language:** Spanish**Second language:****Use of additional****languages:****English Friendly:** Y**Web site:****Bilingual:** N**Lecturer:** ESTEFANIA PRIOR CANO - Group(s): 30

| Building/Office | Department | Phone number | Email | Office hours |
|-----------------|--|--------------|-----------------------------|--|
| 2.11 | INGENIERÍA ELÉCTRICA, ELECTRÓNICA, AUTOMÁTICA Y COMUNICACIONES | | Estefania.PriorCano@uclm.es | The office hours will be available in Secretaría Virtual |

2. Pre-Requisites

To have successfully completed the courses of "Fundamentals of Mathematics I", "Fundamentals of Mathematics II", "Fundamentals of Mathematics III", "Programming", "Components and Circuits", "Electronics Devices", "Electronics I", "Electronics II" and "Digital Electronics Systems". More precisely, students will be required to manage and handle concepts related to integration and derivation, resolution of systems of linear equations, analysis of electrical circuits in permanent and transitory regimes, basic measurement techniques, semiconductor physics and circuit analysis with diodes, transistors and photonic devices, amplification, A/D conversion, structured programming, basic algorithms, and software debugging.

3. Justification in the curriculum, relation to other subjects and to the profession

This course aims to familiarize students with the different types of sensors in the industry, robotics and home automation (temperature, humidity, presence, strength, etc.). Thus, students are prepared to obtain information on how to study the physical fundamentals of the different sensors, the alternatives of implementation, and the conditioning of the signal that allows its integration in a computer-based system. Moreover, some basic alternatives to communicate a set of sensors, as well as, to establish wireless networks of sensor are also covered in this course.

4. Degree competences achieved in this course**Course competences**

| Code | Description |
|------|---|
| E26 | The ability to construct, use and manage telecommunication networks, services, processes and applications, which are defined as systems for capturing, transporting, representing, processing, storing, managing and presenting multimedia information, from the viewpoint of transmission systems. |
| E28 | The ability to analyse components and its specifications for guided and non-guided communications systems. |
| G02 | Correct, oral and written, communication skills. |
| G06 | Knowledge of basic subjects and technologies, enabling students to learn new methods and technologies, as well as providing great versatility to adapt to new situations |
| G07 | The ability to tackle problems with initiative, making decisions, creativity, and to communicate and transmit knowledge, skills and abilities, including the ethical and professional responsibility of the activity of a Technical Telecommunications Engineer |
| G08 | Knowledge to perform measurements, calculations, assessments, appraisals, surveys, studies, reports, task planning and other similar work in their specific telecommunications field |
| G13 | The ability to look for and understand information, whether technical or commercial in different sources, to relate and structure it to integrate ideas and knowledge. Analysis, synthesis and implementation of ideas and knowledge. |

5. Objectives or Learning Outcomes**Course learning outcomes****Description**

Knowledge and respect of professional ethics and deontology.
Analysis, synthesis and compression of technical documentation and mastery of specific vocabulary.
Synthesis of capacities of several telecommunications engineering areas.
Knowing the fundamental aspects of sensors and wireless sensor networks, as well as their factors of choice and applications.
Correct use of oral and written expression to convey ideas, technologies, results, etc.
Application of telecommunication systems in various fields of engineering.
Use of ICT to achieve the specific objectives set in the subject.

6. Units / Contents**Unit 1: Introduction to instrumentation systems.****Unit 1.1** Measures and errors

Unit 1.2 Sensors

Unit 1.3 Signal conditioning

Unit 1.4 Laboratory 1. Basic circuits

Unit 2: Introduction to sensing software and hardware

Unit 2.1 Acquisition of signals and hardware

Unit 2.2 Analysis and processing of information

Unit 2.3 Presentation of information

Unit 2.4 Sensors conditioning

Unit 2.5 Sensing temperature, pressure, level, distance, etc.

Unit 2.6 Laboratory 2. Acquisition of data

Unit 2.7 Laboratory 3. Sensing

Unit 2.8 Laboratory 4. Communication between digital sensors

Unit 3: Introduction to wireless sensor networks

Unit 3.1 Different topologies

Unit 3.2 Wireless protocols

Unit 3.3 Sensor Networks

ADDITIONAL COMMENTS, REMARKS

Hardware and software tools available at electronics laboratory will be used to develop the proposed hands-on experiments

7. Activities, Units/Modules and Methodology

| 7. Activities, Units/modules and Methodology | | | | | | | |
|---|----------------------------------|--|--------------------------------------|-------|----|-----|--|
| Training Activity | Methodology | Related Competences (only degrees before RD 822/2021) | ECTS | Hours | As | Com | Description |
| Class Attendance (theory) [ON-SITE] | Lectures | E28 G06 | 0.75 | 18.75 | N | - | Participative lectures in class teaching theoretical concepts |
| Problem solving and/or case studies [ON-SITE] | Problem solving and exercises | E28 G06 G07 G08 | 0.7 | 17.5 | Y | N | Solving theory and practical problems and answers in the class forum. Plagiarism is not allowed according to REE art. 8 |
| Laboratory practice or sessions [ON-SITE] | Practical or hands-on activities | E26 E28 G02 G06 G07 G08 G13 | 0.7 | 17.5 | Y | N | Laboratory work in small groups. It is assessed with a pre-laboratory report, an in-laboratory report and oral questions during the laboratory session. In the extraordinary call it will be assessed with only one laboratory session covering all the concepts of the ordinary sessions. Plagiarism is not allowed according to REE art. 8 |
| Practicum and practical activities report writing or preparation [OFF-SITE] | Group Work | E26 E28 G02 G06 G07 G08 G13 | 0.5 | 12.5 | Y | N | Laboratory work in small groups. It is assessed with an in-laboratory report and/or oral questions during the laboratory session. Laboratory number 4 may include a poster session performed externally for scientific dissemination. In the extraordinary call it will be assessed with only one laboratory session covering all the concepts of the ordinary sessions. Plagiarism is not allowed according to REE art. 8 |
| Writing of reports or projects [OFF-SITE] | Group Work | E26 E28 G02 G06 G07 G08 G13 | 1 | 25 | Y | N | Development of a theory project about sensor networks in unit 3. It is assessed with a oral talk in class. In the extraordinary call it is assessed with a new and different report and oral talk. Plagiarism is not allowed according to REE art.8 |
| Mid-term test [ON-SITE] | Assessment tests | E28 G02 G06 G07 G08 G13 | 0.18 | 4.5 | Y | N | Assessment of theory concepts related to units 1 and 2. In the extraordinary call it is assessed similarly. Plagiarism is not allowed according to REE art. 8 |
| Study and Exam Preparation [OFF-SITE] | Self-study | E26 E28 G02 G06 G07 G08 G13 | 2.1 | 52.5 | N | - | Study and exam preparation by the student herself/himself |
| Individual tutoring sessions [ON-SITE] | Self-study | E26 E28 G02 G06 G07 G08 G13 | 0.07 | 1.75 | N | - | Individual tutoring sessions at the student's request |
| Total: | | | 6 | 150 | | | |
| Total credits of in-class work: 2.4 | | | Total class time hours: 60 | | | | |
| Total credits of out of class work: 3.6 | | | Total hours of out of class work: 90 | | | | |

As: Assessable training activity

Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

| 8. Evaluation criteria and Grading System | | | |
|---|-----------------------|----------------------------|--|
| Evaluation System | Continuous assessment | Non-continuous evaluation* | Description |
| Mid-term tests | 10.00% | 10.00% | Theory exams (units 1 and 3), solving problems, and oral talk related to unit 3. |
| Laboratory sessions | 60.00% | 60.00% | Reports on hands-on experiments and practical problems and oral questions within the laboratory session. |
| Assessment of problem solving and/or case studies | 10.00% | 10.00% | Solving theory and practical problems and answers in the class forum. |
| Oral presentations assessment | 20.00% | 20.00% | Development of a theory project about sensor networks in unit 3. It is assessed with a oral talk in class. |
| Total: | 100.00% | 100.00% | |

According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject, an ordinary and an extraordinary one (evaluating 100% of the competences).

Evaluation criteria for the final exam:

Continuous assessment:

No minimum mark for any activity developed during the course will be required, but the weighted average score for all of them should be higher than 5 points (in a scale of 10 points). The marks obtained in a call will not be maintained for subsequent calls.

Laboratory number 4 may include a poster session performed externally for scientific dissemination. This will include extra marks.

Plagiarism is not allowed according to REE art. 8

Non-continuous evaluation:

By default, all students are evaluated with the continuous evaluation. If a student cannot attend to class or does not want to attend must communicate this to the professor in order to change to non-continuous evaluation. This change must be done as soon as possible and never having completed 50% or more of the continuous evaluation tasks. Having completed 50% or more of the tasks will result in mandatory continuous assessment.

No minimum mark for any activity developed during the course will be required, but the weighted average score for all of them should be higher than 5 points (in a scale of 10 points).

Plagiarism is not allowed according to REE art. 8

Specifications for the resit/retake exam:

In this second opportunity to pass the course, all activities have to be done again and be submitted for their re-assessment on the date set by the Studies Sub-direction.

As in previous evaluation, no minimum mark for any activity will be required, but the weighted average score for all of them will have to be higher than 5 points (in a scale of 10 points).

New project should be done in case of laboratory number 4.

A different research should be done in case of sensor network project.

Specifications for the second resit / retake exam:

In this opportunity to pass the course, all activities have to be done again and be submitted for their re-assessment on the date set by the Studies Sub-direction.

As in previous evaluation, no minimum mark for any activity will be required, but the weighted average score for all of them will have to be higher than 5 points (in a scale of 10 points).

New project should be done in case of laboratory number 4.

A different research should be done in case of sensor network project.

| 9. Assignments, course calendar and important dates | |
|--|--------------|
| Not related to the syllabus/contents | |
| Hours | hours |
| Practicum and practical activities report writing or preparation [AUTÓNOMA][Group Work] | 12.5 |
| Mid-term test [PRESENCIAL][Assessment tests] | 4.5 |
| Study and Exam Preparation [AUTÓNOMA][Self-study] | 52.5 |
| Individual tutoring sessions [PRESENCIAL][Self-study] | 1.75 |
| General comments about the planning: This planning is purely advisory and may be subject to alteration during the course. | |
| Unit 1 (de 3): Introduction to instrumentation systems. | |
| Activities | Hours |
| Class Attendance (theory) [PRESENCIAL][Lectures] | 3.25 |
| Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises] | 3 |
| Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities] | 2 |
| Unit 2 (de 3): Introduction to sensing software and hardware | |
| Activities | Hours |
| Class Attendance (theory) [PRESENCIAL][Lectures] | 11 |
| Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises] | 13 |
| Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities] | 15.5 |
| Unit 3 (de 3): Introduction to wireless sensor networks | |
| Activities | Hours |
| Class Attendance (theory) [PRESENCIAL][Lectures] | 4.5 |
| Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises] | 1.5 |
| Writing of reports or projects [AUTÓNOMA][Group Work] | 25 |
| Global activity | |

| Activities | hours |
|---|-------|
| Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises] | 17.5 |
| Writing of reports or projects [AUTÓNOMA][Group Work] | 25 |
| Mid-term test [PRESENCIAL][Assessment tests] | 4.5 |
| Class Attendance (theory) [PRESENCIAL][Lectures] | 18.75 |
| Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities] | 17.5 |
| Practicum and practical activities report writing or preparation [AUTÓNOMA][Group Work] | 12.5 |
| Study and Exam Preparation [AUTÓNOMA][Self-study] | 52.5 |
| Individual tutoring sessions [PRESENCIAL][Self-study] | 1.75 |
| Total horas: 150 | |

| 10. Bibliography and Sources | | | | | | |
|------------------------------|---|-------------------------------|------|-------------------|------|-------------|
| Author(s) | Title/Link | Publishing house | Citv | ISBN | Year | Description |
| Morris, Alan S. | Measurement & Instrumentation Principles | Pearson Educación | | 970-26-0138-X | 2001 | |
| PALLAS ARENY, Ramón | Transductores y acondicionadores de señal | Barcelona Marcombo, cop. 1989 | | 8426707645 | 1989 | |
| Pérez García, M.A., et alt.; | Instrumentación electrónica | Thomson | | 978-84-9732-166-2 | 2008 | |
| Lajara Vizcaíno, José Rafael | LabView : entorno gráfico de programación | Marcombo | | 978-84-267-1696-5 | 2010 | |
| Larsen, Ronald W. | Labview for Engineers | Prentice Hall | | 978-0-13-609429-6 | 2011 | |