Course guide
240IEE11 - 240IEE11 - Electronic Instrumentation Systems

Last modified: 16/05/2023

Unit in charge: Barcelona School of Industrial Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering.

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

Academic year: 2023 **ECTS Credits:** 4.5 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: Calomarde Palomino, Antonio

Others:

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CEEELECT1. Design electronic systems (mixed analogical and digital systems and micro-mechanical systems on silicon, digital systems based on discrete components, logical programable devices and/or microprocessors, electronic instrumentation systems and power electronic systems) and manage development projects and/or commercialization of electronic systems or development projects and/or commercialization of systems in which the electronic subsystems have an important specific weight.
CEEAUT2. Ability for the design, selection and use of sensors and actuators in control systems.
CEMEI07. Ability to design electronic systems and industrial instrumentation.
CEEELECT2. Analyse, diagnose and maintain the electronic systems and manage the maintenance equipment of electronic systems or of systems in which the electronic subsystems have an important specific weight.

TEACHING METHODOLOGY

The course is structured in two parts: a theoretical part and a practical part. Each of these parts involves classroom activities, non-attendance activities and evaluation activities.
The course is assigned a load of 4.5 credits, which is equal to 112.5 hours of student dedication. 42 of these 112.5 hours will correspond to 26 hours of lectures and exercises, 10 hours of attendance to laboratory practices and 6 hours for assessments. The other 70.5 hours correspond to non-attendance activities (10h for circuit simulations and 60.5 hours of personal study and practice).
The theoretical part includes theoretical presentations and resolution and / or discussion of problems and examples, going from one activity to another at the discretion of the teacher. The lectures will follow the program contents.
Due to the Covid-19, theoretical activities will be lectured by videoconference.

The theoretical activities will consist ofl lectures and problems solving, taking place during the weeks of the academic year, totaling a minimum of 26 classroom hours (13 sessions of 1 hour).

The practical part includes a project that will involve a set of circuits that must be simulated and / or assemble and experiment. The activities will consist of five laboratory practices in the schedules established for this purpose of duration of two hours, which will be developed in teams of two / three students. The number of students in the sessions of practice is limited to 15. Practices are held at the Electronics Laboratory II, located on the 9th floor. Each practice is associated with a set of tasks to be performed as a preparation for practice. It is also recommended carefully preparation prior practice, as significantly facilitates their understanding and their realization in the laboratory.

LEARNING OBJECTIVES OF THE SUBJECT

General objectives
Electronic Instrumentation Systems in industrial environments. The objective is that students fulfill acknowledgments and design skills in data acquisition systems.
Specific objectives
The student will study distinct types of sensors and its specific conditioning circuits always from the standpoint of Specification compliance.
Modeling an evaluation of measure errors, treatment of noise and electromagnetic interferences are preferential topics.
Other important issues are antialiasing filtering, sampling and A/D and D/A t signal conversion.

STUDY LOAD

Type	Hours	Percentage
Hours large group	27,0	24.00
Self study	72,0	64.00
Hours small group	13,5	12.00

Total learning time: 112.5 h

CONTENTS

Modulo 1. Instrumentation Systems

Description:

Full-or-part-time: 1h
Theory classes: 1h

Modulo 2. Virtual Instrumentation

Description:

Related activities:
Experiment 1: The Virtual laboratory. Labview

Full-or-part-time: 1h
Theory classes: 1h

Modulo 3. Electronic Instrumentation errors

Description:

Full-or-part-time: 3h
Theory classes: 3h

Modulo 4. Measurement techniques for electronic instrumentation

Description:

Related activities:
Experiment 2: Selection and specification of a Project. Data Acquisition device

Full-or-part-time: 3h
Theory classes: 3h

Modulo 5. Sensors

Description:

Full-or-part-time: 3h
Theory classes: 3h

Modulo 6. Measure conditioning

Description:

Related activities:
Experiment 3: Signal Conditioning

Full-or-part-time: 2h
Theory classes: 2h

Modulo 7. Routing of analog signals

Description:

Full-or-part-time: 2h
Theory classes: 2h

Modulo 8. Amplification and isolation

Description:

Full-or-part-time: 2h
Theory classes: 2h

Modulo 9. Filtering and sampling

Description:

Full-or-part-time: 1h
Theory classes: 1h

Modulo 10. D/a and A/D conversion

Description:

Related activities:
Experiment 4: Digital Processing

Full-or-part-time: 3h
Theory classes: 3h

Modulo 11. Smart Sensors and Sensor networks

Description:

Full-or-part-time: 2h
Theory classes: 2h

Modulo 12. Noise and Electromagnetic interference

Description:

Related activities:
Experiment 5: Debugging and functional and specification test

Full-or-part-time: 3h
Theory classes: 3h

GRADING SYSTEM

The theoretical part will be assessed through two tests of individual character: a partial test first half of the semester, a final exam when the course has ended. The practical part will be evaluated by three notes. The grade evaluation of the project presented the note of continued evaluation and the note for individual development of the student in the group.

The rating actions will follow the equation below, rounded to the nearest tenth of a point:
Nfinal1 = 0,20 Npp + 0,4 Npf + 0,2 Nap + 0,10 Nac + 0,10 Nai

Npp: partial test
Npf: final test
Nap: Project evaluation
Nac: Continuous evaluation
Nai: Individual evaluation

EXAMINATION RULES.

The first part of the theory test will last two hours and will consist of a series of questions and designs related to the lecturers until the day of the test. The test will last 3 hours and will consist of a series of questions and designs the entire syllabus of the subject.

Students must carry their ID card, passport or other official identification document.

The scores of the tests will published in the Digital Campus. Regarding the qualifications of laboratory will be published during the week following the completion of the course.

BIBLIOGRAPHY

Basic:
- Fraile Mora, Jesús. Instrumentación aplicada a la Ingenieria. 3a ed. Madrid: Ibergarceta, 2013. ISBN 9788415452331.
- Pallás Areny, Ramón. Sensores y acondicionadores de señal : problemas resueltos. Barcelona: Marcombo, 2008. ISBN 9788426714947.
- Pérez García, Miguel Ángel. Instrumentación electrónica : 230 problemas resueltos. Madrid: Garceta, 2012. ISBN 9788415452003.
- Pérez García, Miguel A. Instrumentación Electrónica. Madrid: Paraninfo, 2014. ISBN 9788428337021.

Complementary:
- Mànuel, A. [et al.]. Instrumentación virtual : adquisición, procesado y análisis de señales [on line]. Barcelona: Edicions UPC, 2001 [Consultation: 04/04/2023]. Available on: https://upcommons.upc.edu/handle/2099.3/36187. ISBN 8483014734.
- Gómez, Carles. Sensors everywhere: wireless network technologies and solutions. s.l: Fundación Vodafone España, 2010. ISBN 9788493474058.
- Kester, Walt, ed.. Practical design techniques for sensor signal conditioning. Norwood, MA: Analog Devices, Inc, 1999. ISBN 0916150206.
- Pallás Areny, Ramón. Adquisición y distribución de señales. Barcelona: Marcombo, 1993. ISBN 842670918.
- Sebastián Franco, José Luis. Fundamentos de Compatibilidad Electromagnética. Madrid: Addison-Wesley Iberoamericana España, 1999. ISBN 8478290265.
- Lajara Vizcaíno, José Rafael. LABVIEW: Entorno gráfico de programación. 3a ed. Barcelona: Marcombo, 2017. ISBN 9788426724366.