

Advanced Instrumentation

Course Description



Departamento de
**Ingeniería
Electrónica**

Universidad Politécnica de Madrid

Máster Oficial en Ingeniería
de Sistemas Electrónicos

www.die.upm.es



Index

Advanced Instrumentation	2
Objectives.....	2
Program.....	3
Bibliography	4
Teachers	4
Teaching Methodology	4
Evaluation.....	5
Contact	5

Advanced Instrumentation

Semester: 1

Number of credits: 4 ECTs

Type: optional

Objectives

After a general introduction in which the student reviews the general principles of electronic instrumentation, the subject consists of two blocks. In the first one, dedicated to electronic instrumentation is intended to provide knowledge of electronics to the design, construction and management of electronic instruments. These skills include techniques both conventional analog and digital circuitry in instrumentation as related to noise and its treatment. In a second part, dedicated to electronic instrumentation itself, is intended to enable the student to master the actual physical quantity measurement, for which we present the general principles of sensors and transducers, we study the most common and are briefly described associated instrumentation systems. Finally, it also includes the description and study of computer-instrument control and some common systems and instrumentation devices.

Program

INTRODUCTION

BASIC SYSTEMS DATA ACQUISITION

- Applications of converters in data acquisition systems.
- Data collection plates.
- Data loggers.

INSTRUMENTAL COMPACT AND DISTRIBUTED SYSTEMS

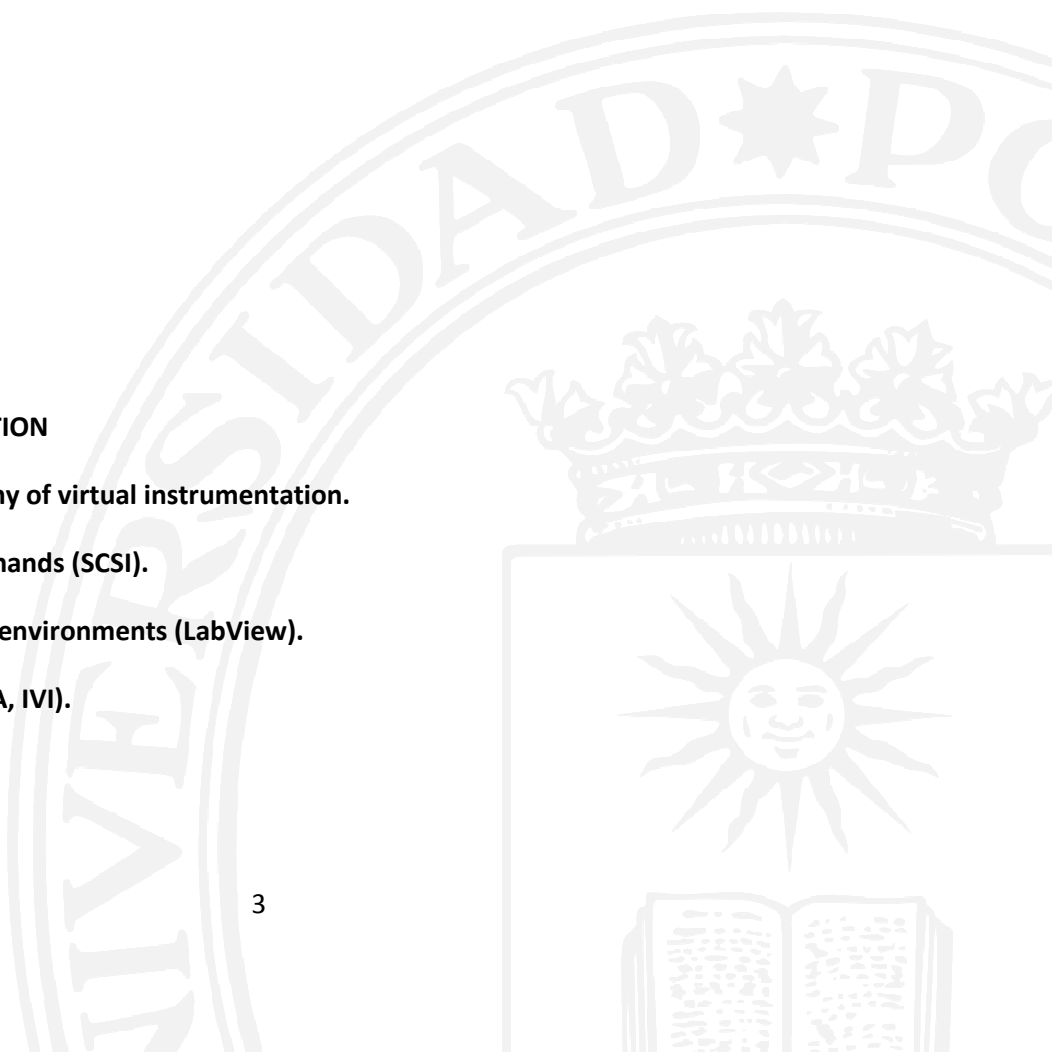
- Compact systems: instrumentation buses.
- Distributed systems: fieldbus.
- Some proprietary systems.

INTELLIGENT SENSORS

- Advanced sensors.
- Wireless sensors.
- Networks of sensors.
- Regulations.

VIRTUAL INSTRUMENTATION

- Principles and philosophy of virtual instrumentation.
- Systems based on commands (SCSI).
- Development graphical environments (LabView).
- Architectures (SICL, VISA, IVI).
- SCADA.



MEASURES, METROLOGY AND PATTERNS

- Introduction to the measure.
- Expression and calculation of uncertainties A and B.
- Propagation of uncertainties.
- Calibration and traceability. Introduction to employers.
- Accreditation, certification: standards

Bibliography

The teaching materials made available to students are:

- Slides.
- Statements of the proposed cases.

The material will be accessible via the Internet as they develop lessons. This course does not follow a particular textbook and indeed it is difficult to cite one that covers a significant part of it, because much of the information is constantly evolving. Available information will be used in various network systems and protocols, using as appropriate the information provided by various foundations and partnerships involved in many of these issues. Obviously, the initial links will be provided to students. Among the basic books available for reference, are the following:

- J. R. Taylor, An Introduction to Error Analysis, 2nd edition, University Science Books, 1997.
- Guide to the expression of uncertainty, Spanish Centre of Metrology, 2000.
- M. A. Pérez García et al., Instrumentation Electronics, Thomson, 2004.
- M. Ilyas, I. Mahgoub, Handbook of Sensor Networks: Compact Wireless and Wired Sensing Systems, CRC Press, 2005.
- E. H. Callaway, Wireless Sensor Networks: Architecture and Protocols, Auerbach Publications, 2004.
- Robert Helsler, Visual Programming with HP VEE, Hewlett-Packard Professional Books, Prentice Hall PTR, 1998.
- National Instruments Corporation, LabView Tutorial Manual, 1996.
- Practices Manual Laboratory Virtual Instrumentation 2013-14.

Teachers

Coordinator: Alfredo Martín Mínguez (Dpto. Tecnología Electrónica)

Teachers: José Javier Serrano Olmedo, Alfredo Sanz Hervás (Dpto. Tecnología Electrónica)

Teaching Methodology

The methodology consists of classes in which they are presented and proposed to develop the issues students must solve cases and present the teacher and the rest of the class, debating the solution adopted. This system is intended to engage students in the techniques developed in this subject and are aware of the training needs they require.

In the section on Virtual Instrumentation, classes will be held, as an exercise, use practices and program design in LabView LFI Laboratory of Electronic Instrumentation.

In summary, the main lines which include the teaching methodology of the course are:

- Master classes.
- Presentation and discussion of papers.
- Problem solving.
- Labs in Virtual Instrumentation.

Evaluation

The evaluation will be done by assessing the work / problems proposed along the course, with a total weight of 60% of the final grade, and a final exam multiple choice with the remaining 40%.

In the valuation of the proposed work will be considered, apart from the technical aspects, the ability to present, explain and defend the chosen solutions to the teacher and the rest of the course.

Contact

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Moodle: <http://moodle.upm.es/titulaciones/oficiales/course/view.php?id=3064>