

M.Sc. in Smart Control Systems for Energy Management

Course Structure

Course Code : SM7002

Course Title : Advanced Digital Measurements

Credit Hours : 3

Course Description

Introduction to measurement and error, Transducers, Applied electronics lab, Mechanical transducers, Sensors, Data acquisition systems (DAS), Parameters of A/D conversion, Signal conditioning, Ideal operational amplifiers, Non idealities of operational amplifiers. Error. CMRR. Bandwidth, PSRR. Random noise treatment in electronic circuits, The instrumentation amplifier.

Course Objectives

Training in all the parts of the measurement chain: sensors and actuators, signal conditioning, A/D and D/A conversion and advance instrumentation

Course Topics

- Introduction to measurement and error (2h). Type of signals. Parameters in a measure. Noise and error. Electronic chain for signal processing.
- Transducers.- Temperature transducers: Resistive temperature detectors, thermocouples (2h). Practices. Applied electronics lab (AEL). Lesson 1- Digital storage oscilloscopes. Introduction to Arduino. (2h)
- Transducers.- Mechanical transducers: Strain/force, acceleration, distance (2h). AEL. Lesson 2- Measuring temperature with Arduino (2h).
- Transducers.- Other transducers. (2h)
AEL. Lesson 2- Measuring with an accelerometer (2h).
- Sensors.- Seminar.- (2h) Solution of problems about sensors.
- Data acquisition systems (DAS).- Data acquisition circuits principles. (2h)
- DAS.- Parameters of A/D conversion. (1h)
Measuring with a data acquisition module and MATLAB (2h).
- Introduction to digital filters (2h)
AEL. Lesson 3- Implementing a digital filter with a Data Acquisition Module and MATLAB (2h).
- Signal conditioning.- Ideal operational amplifiers. Adapting levels (2h).
- Signal conditioning.- Non idealities of operational amplifiers. Error. CMRR. Bandwidth (2h). AEL.- Assembling an amplifier (2h).
- Signal conditioning.- PSRR. Random noise treatment in electronic circuits. (2h).
- Signal conditioning.- The instrumentation amplifier (1h).
AEL.- Assembling an amplifier II (2h).
- Seminar. Solving data acquisition systems problems (2h).

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References

- Walt Boyes. Instrumentation Reference Book (Fourth Edition). Elsevier Inc. ISBN: 978-0-7506-8308-1
- William C. Dunn. Industrial Instrumentation and Process Control. Mc Graw-Hill. DOI 10.1036/0071466932
- D.V.S. Murty Transducers and Instrumentation (2nd Edition). PHI learning 2011. ISBN 978-81-2013-3569-1
- Miguel A. Pérez García. Instrumentation Electronica (language Spanish). Para info 2104 ISBN-9788497321662