

Sheet course ()

Course	MSc IN MECHANICAL ENGINEERING		
Unit	Sensors and Actuators	Mandatory	<input checked="" type="checkbox"/>
		Optional	<input type="checkbox"/>
Unit scientific area	Control Systems	Category	C

Unit category: B - Basic; C - Core Engineering; E - Specialization; P - Complementary.

Year: 1st	Semester: 1st		ECTS: 5,5			
Contact time	Total:	T:	TP: 45,0	PL:	S:	OT:

T - Lectures; TP - Theory and practice; PL - Lab Work; S - Seminar; OT - Tutorial Guidance.

Unit Director	Title	Position
Mário J. G. C. Mendes	Ph.D.	Associate Professor

Learning Objectives (knowledge, skills and competences to be developed by students)

(max. 1000 characters)

To study and to know the different Metrologic concepts.

To identify systems and chains of measure and its essential components.

To identify and to know different types of sensors and actuators.

To select the most correct measurement systems for determined situations.

To recognize and to know elements of final control.

To understand the functioning and to analyze the behaviour, in the time, of diverse industrial sensors.

To analyze and to understand the use of the different Metrologic characteristics of the sensors/transducers.

Syllabus

(max. 1000 characters)

1. Basic definitions: Sensors/Transducers: Active and passive. Measurement systems. Statistical Analysis in Measurement. Static and dynamic characteristics of a measurement instrument.

Beddings and Calibrations of:

2. Displacement and Position Sensors: Potentiometers. Strain gauge. LVDT (Linear Variable Differential

Transformer). Inductive and Capacitive. Piezoelectric. Optics.

3. Temperature Sensors: Thermal expansion. Thermocouples. Termoresistances. Radiation. Heat Flow. Temperature measurement in fluids dynamic.

4. Pressure Sensors: Elastic manometers. Metallic manometers. Liquid Column Manometer. High-pressure sensors. Low pressure sensors. Dynamic effects.

5. Flow Sensors: Transducers of local speed. Direction and amplitude. Constant area. Differential pressure. Transducers of mass flow.

6. Actuators: Its importance in the measure, control and actuations chain.

Demonstration of consistency of the syllabus with the objectives of the course

(max. 1000 characters)

The curricular unit objectives are achieved by making an oral presentation of the syllabus, with main emphasis on the concepts, principles and different physical measurement techniques. Students learn throughout the semester, the measurement and actuation chain, as well as the fundamental metrological concepts that are used by the sensors / transducers to measure different variables.

Teaching methodology (evaluation included)

(max. 1000 characters)

Teaching methodologies

Exposition;

Demonstration;

Activities.

Assessment

1 theoretical/practical exam, classified between 0 and 20 points;

The students should have a minimum grade of 9,5 points in the theoretical/practical exam.

Demonstration of consistency of teaching methods with the learning objectives of the course

(max. 3000 characters)

The curricular unit teaching is accomplished by combining theoretical lessons with practical exercises on the whiteboard. In some classes students use several sensors, provided by the teacher, and on which elaborate calibration curves and verify some of the studied concepts. In addition to the oral presentation, application examples are given and the students are stimulated to participate and discuss the issues. Students are always encouraged to previous study and to analyze the matters to be addressed soon. A final exam assesses individual theoretical and practical skills acquisition of the matters taught.

Main Bibliography

(max. 1000 characters)

Balbinot , A. e Brusamarello , V. J., Instrumentação e Fundamentos de Medidas ,Volumes I e II, 2ª Edição, Editora GEN-LTC, 2010.

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Almeida, G., Sistema Internacional de Unidades (SI), Grandezas e Unidades Físicas , terminologia , símbolos e recomendações ,2ª Edição , Plátano Editora, S.A., 1997.

Johnson, C. D., Controlo de Processos: Tecnologia daInstrumentação ,Fundação Calouste Gulbenkian, 1990.

Wilson, J. S., Sensor Technology Handbook , Elsevier, 2005.

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Doebelin , E., MeasurementsSystems Applications and Design ,McGraw-Hill Editions, 1990.

Pallás-Areny , R. e Webster J. G., Sensors and signal Conditioning , John Wiley & Sons, Inc ., 1991.

Nawrocki , W., Measurement Systems and Sensors , Artech House , 2005.