

MEASUREMENT AND CALIBRATION TECHNIQUES

Code: 322111

Main Scientific Area: Electronics and hardware

Lecturer: José António da Silva Barradas

Language of Instruction: Portuguese

Regime: S1

Contact Hours: 30h Total Workload: 54h

ECTS: 3,0

Objectives

Describe the methods used and standards in metrology. Describe and explain many magnitudes of measurement methods and specify characteristics of measuring instruments. Elaborate calibration procedures, quantify errors and calculate the measurement uncertainty in calibration.

Learning Outcomes

Students who complete this course successfully should be able to: Describe adopted methods and standards in metrology. Describe and explain many magnitudes of measurement methods and specify characteristics of measuring instruments. Elaborate calibration procedures, quantify errors and calculate the measurement uncertainty in calibration.

Course Contents

1 - basic metrology notions

Normalization; metrology action areas. fundamental metrology, industrial and legal. metrology laboratories.

2 - the measurement techniques Fundamentals

Systems and instruments of measure. static and dynamic characteristics. Errors of systems and instruments of measure - absolute error, relative errors, systematic errors random errors. Sources of errors. uncertainty of notions, dispersion, accuracy, accuracy class.

3 - Statistical Methods in extent

Descriptive statistics: indicators of location and dispersion, linear regression, non-linear. Distributions with applications in the area of ??metrologia- uniform distribution, normal distribution. Statistical tests. Estimation confidence interval.

4 - Measurement methods and interpretation of measurement results

Methods of absolute and relative measurement. Methods of measurement for replacement. Methods differential measurement. Methods zero. Repeatability and reproducibility of the measurements.

5 - Calibration and verification of measuring instruments

Calibration and verification electrical measuring instruments, temperature, pressure and dimensional. measurement uncertainty in the calculation and calibration of measuring instruments: uncertainty type A and B. Sources of uncertainty: resolution, influence quantities, repeatability of measurements, the standard uncertainty. Tolerance and acceptance criteria.

Recommended Bibliography

1. Silvestre Antunes; Metrologia e Qualidade, IPQ
2. Paul Hewit; Modern Techniques in Metrology, World Scientific Pub Co Inc , 1984. ISBN: 997196645X
3. Chris Evans; Precision Engineering, Cranfield Pr., 1991. ISBN: 1871315018
4. Bucher Jay L., The Metrology Handbook, Second Edition, 2012, Quality Press

Learning and Teaching Methods

The contents are presented in order to exploit sustainably the materials needed to complement the training of students in the field of measurement and calibration techniques, seeking to deepen concepts related to areas of most importance in the areas of measured variables such as: Specification of instruments for measuring characteristics. Calibration procedure, quantization errors and calculation of calibration measurement uncertainties.

Assessment Methods

The evaluation of the discipline contemplates the accomplishment of a written test as well as three practical works done in group:

The Practical Work component is worth a total of 45%:

- 1st Work (TP1) - 15%
- 2nd Job (TP2) - 15%
- 3rd Work (TP3) - 15%

The minimum grade is 9.5 Values in each evaluation issue.

The Written Assessment Test (PAE) will have a percentage in the final grade of 55%.

The minimum grade in the written test is 9.5 Values. The final grade is obtained as follows:

- Final classification (FC) $FC=(0,15 \times TP1+0,15 \times TP2+0,15 \times TP3)+0,55 \times PAE$
- Only students with a final grade higher than 9.5 will be approved, in compliance with the minimum grades in each component.
- Students with a negative mark in any of the components will have to take the written test (resource exam) with a total weight of 100%.
- Students who have passed the course and who wish to improve, will have to take a written test at the time of appeal / special with a total weight of 100%.