Module Title:
Please provide a module title which should have only 30 characters including punctuation and spaces .
Introduction to Measurement Uncertainty

Module Code:
Please code according to the code QM-xx-xx, AM-xx-xx or DA-xx-xx
DA0201

Maximum Number of Students:
Please include any limitation on the number of students able to take the module.
30

Total ECTS Credits
This should be the sum of the credits for each of the semesters in which the module is to run.
10

Notional Learning Hours
(a) Contact Time -   10 h
(b) Private Study -   40 h

Format of Teaching:
Lectures   6 h
Laboratories or Practicals   4 h
Other   0 h

Teaching Strategy:
Please show how the contact hours are to be allocated in terms of the type of class involved.
Formal lectures in 60/90 min timetable and application examples of the evaluation of the uncertainty associated with single analytical steps and simple chemical measurements.

Convener:
The name of the member of permanent staff responsible for the module.
I. Cavaco

University / Department:
The name of the University and Department responsible for the module.
University of Algarve

Language of Tuition:

Please state whether module is to be taught through the medium of English or another language.   If bi-lingual please indicate % of each language
English

Module Description - The Purpose or Aims:
This should specify the purpose of the module where it fits into the programme specification and what it aims to provide. Please list the Aims in numerical order.
1. To motivate students for the importance of the evaluation of the measurement uncertainty
2. To introduce the concept of measurement uncertainty
3. To introduce the principles of the ISO guide to the expression of uncertainty in measurement (GUM)

Specific Learning Outcomes for this module: (contributing to general learning outcomes GLO 1 – GLO 10)
Learning Outcomes should provide statements which articulate what the student has achieved upon completion of the course. What will a student know, understand or be able to do?

At the end of the module the learner is expected to be able to:
1. Establish the traceability of a simple chemical measurement
2. Estimate the uncertainty associated with single analytical steps (volumetric, gravimetric and instrumental quantification steps)
3. Estimate the uncertainty associated with simple chemical measurements
4. Evaluate the compliance of a sample with a legal or specification limit considering the measurement uncertainty.

Summary of Course Content:
This should be a summary paragraph of list of the topics to be covered by the module.
This module aims to motivate students for the need for reporting measurements traced to adequate chemical references and with an objective estimation of their quality (i.e. measurement uncertainty).
Basic concepts in measurement traceability and uncertainty are introduced. The principles of the GUM are presented and applied to the evaluation of the uncertainty associated with simple analytical methods.

Transferable Skills Taught:
Please list in numerical order the key skills taught e.g. communication, information technology, interpersonal skills, teaching/study skills. Please relate these to benchmark statements.
Communication:
Communication with use of metrology terminology

Information Tecnhology:
Elaboration of spreadsheets for the evaluation of measurements uncertainty

Assessment Methods:
Details of assessment methods should include forms of assessment and the contribution of each to the summative assessment of the module. The relationship to the learning outcomes of the module should be explicit and the numbers of the various learning outcomes should be attached to the assessment methods listed. Please list in numerical order
1. LO1 – final work assignment (50%)
2. LO2, LO3 - Homework Assignments (50%)

Assessment Criteria:
Details of assessment methods should include forms of assessment and the contribution of each to the summative assessment of the module. The relationship to the learning outcomes of the module should be explicit and the numbers of the various learning outcomes should be attached to the assessment methods listed. Please list in numerical order.

Treshold
LO1 – State the relevance of reporting measurements with uncertainty.
LO2 – Clarify the role of measurements traceability on their comparability.
LO3 – Describe how measurement uncertainty should be considered in the evaluation of the compliance of a sample with a legal or specification limit.

Good
LO1 – Distinguish different measurands associated with the analysis of the same analyte in the same item.
LO2 – Describe the traceability of simple chemical measurements.
LO3 – Evaluate the uncertainty associated with single analytical steps

Excellent
LO1 – Evaluate the uncertainty associated with simple analytical methods.
LO2 - Develop strategies for the optimization of the cost and performance of an analytical method considering the uncertainty budget.
LO3 – Develop models for the evaluation of "worst-case" uncertainty estimations.

Resource Implications of Proposal and Proposed Solutions:
Details on any resources required and should be included. Please also list e.g core texts; recommended reading material; equipment; films etc.
Lecture notes will be available for students. These will eventually be included in the course textbooks.
Recommended reading: ISO GUM (introductory material), Eurachem/CITAC: Quantifying Uncertainty in Analytical Measurement, 2nd Edition (2000) [http://www.eurachem.org/guides/QUAM2000-1.pdf], Eurachem/CITAC, Traceability in Chemical Measurement (2003) [http://www.eurachem.org/guides/EC_Trace_2003.pdf]

Pre-Requisites:
Any module(s) which must have been taken prior to the current module, or any specific background required to take this module.
QM03 - Traceability
DA01 - Basic Statistics