Code: 1644 **Environmental Sampling and Analysis**
Degree: 1st cycle –Environmental Engineering
Curricular Year: 2nd **Semester Course: 2nd**
Credits: 6 ECTS **Compulsory**
Language: Portuguese/English
Prerequisites: Measurement Methods and Procedures
Responsible: José Paulo Mourão de Melo e Abreu
Other lecturer(s): Maria Manuela Costa Neves Figueiredo
Web Site: http://www.isa.utl.pt/home/node/4014

1. Contact hours:
Lectures 28 **Praticals/Laboratory** 42 **Others** 14 **Total** 84

2. Objectives:

To transmit knowledge in order to delineate, to mount and to operate an experimental layout to analyze an environmental system.

3. Programme:

I. Sampling plan
Simple and stratified random sampling. Group and multi-step sampling, and sequential sampling.

II. Brief introduction to re-sampling methods
a) The bootstrap methodology. Computational bootstrap for the estimation of bias, variance, sampling distribution and confidence interval.
b) The jackknife methodology.
c) Examples in environmental field.

III. Introduction to metrology
a) Error theory and error propagation.
b) Characteristics of the measurement. Instrumental response.
c) General constitution of an instrument.
d) Instrumental calibration. Indirect measurement . Calibration curves.

IV. Sensors and transducers, processors and registers and automation
a) Sensors and transducers: Sensors to measure temperature, moister, radiation and flow of heat and mass.
b) Data processing and logging:
Measurement and acquisition of data;
Auxiliary circuits for resistance measurement;
Constitution and operation of dataloggers.
Automation.

V. Analysis of environmental data

VI. Case studies

4. Bibliography:

Main Bibliography

Abreu, J. P. de Melo e. 2004. Aquisição e armazenamento e processamento de dados em Agricultura e Ambiente. INIA, EAN, Oeiras.
B. Marshall & F.I. Woodward (eds). Instrumentation for Environmental Physiology. Cambridge University Press, New York.
Barnett, V. 1991. Sampling survey. Principles & Methods. Edward Arnold.
Cochran, W. G. 1977. Sampling Techniques. Wiley.
Efron, B. & Tibshirani, R.J. 1993. An Introduction to bootstap. Chapman & Hall.
Fritschen, L.J., & L.W. Gay. 1979. Environmental instrumentation. Springer-Verlag, New York.
Strangeways, I. 2003. Measuring the Natural Environment. 2nd Edition. Cambridge University Press, New York, 544 pp.

Other Bibliography

Abreu, J. P. de Melo e 1985. O Balanço da Radiação de uma Superfície Plana e Horizontal e as suas Componentes: Estimativa e Breve Apontamento sobre a Medição. Instituto Superior de Agronomia. Lisboa. 55 p.
Christian, D. 1994. Analytical Chemistry, 5th ed., Wiley
Skoog, D, Holler, F, Nieman, T 1998, Principles of Instrumental Analysis, 5th Ed, Brooks-Cole
Tryfos, P. 1996. Sampling Methods for Applied Research. John Wiley & Sons.

5. Assessment:

One final work
One final test (or final exam)

6. Estimated Workload: 168 Hours

7. Last Update: 4/3/2011