

Code: 1442 Environmental Modelling**Degree:** 2nd cycle – Environmental Engineering**Stream:** all**Curricular Year:** 1st**Semester Course:** 2nd**Credits:** 6 ECTS**Compulsory****Language:** Portuguese/English**Responsible:** José Paulo Mourão de Melo e Abreu**Other lecturer(s):** -**Web Site:** <http://www.isa.utl.pt/home/node/3917>**1. Contact hours****Lectures 28 Practicals/Laboratory 42 Others 14 Total 84****2. Objectives:**

Develop capacities to construct, calibrate and validate a software application capable of modelling an environment system.

Consolidate knowledge and practice with a programming language.

Learn mathematical methods and the use of tools needed for modelling.

Use of some existing models for environmental simulation.

3. Programme:**I. Introduction**

a. Concepts: Systems, systems analysis, models (physical, conceptual, mathematical), coding, simulation.

b. Classification of models: static & dynamic, empirical & mechanistic, deterministic & stochastic. Examples.

c. Type of model commonly used in environmental modelling.

II. Revision through practical use of complex formulas in Excel, and non-linear regression using solver, and numerical integration of differential equations.

III. Crash-course in Visual Basic for Applications and practical exercises.

IV. Modelling and model building

a. Objectives modelling

b. Structure and formulation of models.

c. Calibration and validation of models.

d. Sensitivity analysis.

e. Errors and uncertainty.

f. Practical exercises.

V. Case studies of construction, calibration and validation of models

a. Construction of subroutines for estimation and generation of meteorological variables.

b. Computation of the energy received by a solar panel.

c. Growth of a canopy.

d. Model prediction of erosion and sediment transport.

VI. Using a decision support system to manage water resources.

VII. Presentation and discussion of proposals for group work.

4. Bibliography:**Main Bibliography**

Atkinson, Kendall E, 1993,Elementary Numerical Analysis. John Wiley & Sons, Inc. New-York. 417 pp

Barnsley, M. 2007. Environmental Modelling: A Practical Introduction. CRC Press, 406 pp.

Smith, J. , Smith, P. 2007. Introduction to Environmental Modelling. Oxford Univ. Press. 256 pp.

Other Bibliography

Abreu, J. P. de Melo e. 1994. Modelo de crescimento e produção da cultura do trigo em condições mediterrânicas. Tese de Doutoramento. Universidade Técnica de Lisboa. Instituto Superior de Agronomia. 309 pp.

Dunnivant, F. M., Anders, E. 2006. A Basic Introduction to Pollutant Fate and Transport : An Integrated Approach with Chemistry, Modelling, Risk Assessment, and Environmental Legislation. 504 pp.

John Wainwright, J., Mark Mulligan, M. (Eds.). 2004. Environmental Modelling: Finding Simplicity in Complexity. Wiley, 430 pp.

5. Assessment:

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| 1. Realization and discussion of a final work for integration of all the subjects taught during the semester |
| 2. Final test or final exam for all students |

6. Estimativa total de trabalho:	168	Horas
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7. Data de actualização:	4/3/2011
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