Code: 1629 **Hydrology**
Degree: 1st cycle - Environmental Engineering; 2nd cycle – Agriculture
Stream: Agriculture – Agricultural Engineering
Curricular Year: 3rd (EnvEng) / **2nd** (Agr) **Semester Course: 1st**
Credits: 6 ECTS **Compulsory** (Environmental Engineering)
Language: Portuguese/English **Optional** (Agriculture)
Responsible: Paulo Guilherme Martins de Melo Matias
Other lecturer(s): -
Web Site: http://www.isa.utl.pt/home/node/4010

1. Contact hours:
Lecture/Practicals 70 **Others** 14 **Total** 84

2. Objectives:

The first objective is that the students acquire knowledge about the processes and components of the land phase of the hydrological cycle: its physical characterization, measurement methods of the variables and parameters involved, and modelling of those processes with different time and space scales (empirical or physically based, deterministic or stochastic).
The second objective is that the students pass from the knowledge of the processes to its integration in engineering applications, at the watershed scale, needed tools at different levels of planning and management of water resources.

3. Programme:

Hydrology and Hydrological cycle: hydrological processes, water resources distribution around the world, continuity equation and hydrological balance. Water in Portugal. Hydrological Models and their classification. Topographic and hydrographical catchment: hydrological behaviour and concentration time, physiographic characteristics. Precipitation: formation of precipitation, storm structure, measurement instruments, hydrological series and stochastic characterization, heterogeneity in rainfall records, estimation of missing data, precipitation over an area, precipitation analysis for time steps less and greater than the day, design storms. Evaporation, interception and evapotranspiration: concepts and definitions, measurement instruments, empirical and physically based modelling, estimates for a water body, an agricultural crop and a forest. Water in Soil: soil moisture content and water potential, movement of water in soil, measurement instruments. Infiltration: definitions, modelling in a soil column and in a watershed, infiltration capacity and ponding time, measurement instruments. Soil water redistribution: time steps less than the day and daily, monthly and annual time steps. Introduction to ground water: aquifer classification, aquifer characteristics, equations for saturated porous media, depletion curve. Runoff: formation and measurement, fluvial regimes, runoff frequency, hydrograph analysis and separation techniques. Rainfall-runoff relationship: modelling in small, medium and large watersheds, and for different time steps. Hydrological flood routing: reservoirs and channels. Sediment in the hydrologic cycle: properties, production and sources of sediment, sediment transport and routing, deposition in reservoirs, measurement methods.

4. Bibliography:

Main Bibliography

Chow, V.T., D.R. Maidment and L.W. Mays (1988). *Applied Hidrology*, McGraw-Hill Book Co.
Lencastre, A. and F.M. Franco (1984). *Hydrology lessons* (in portuguese), Universidade Nova de Lisboa.

Other Bibliography

Bras, R.L. (1990). *Hydrology. An Introduction to Hydrologic Science*, Addison-Wesley Publishing Company, Inc.
Haan, C.T. (1979). *Statistical Methods in Hydrology*, The Iowa State University Press, Ames, Iowa, U.S.A.
Maidment, D.R. (Editor) (1993). *Handbook of Hydrology*, McGraw-Hill, Inc., USA.
Ponce, V.M. (1989). *Engineering Hydrology. Principles and Practices*, Prentice Hall, Inc.
World Meteorological Organization (WMO) (1994). *Guide to Hydrological Practices*, Data Acquisition and Processing, Analysis, Forecasting and Other Applications, nº 168, Switzerland.

5. Assessment:

i) Two midterms, at the middle and end of semester, concerning the two correspondent blocks of lectures. Minimum classification is 7 (on 20) and approval with a mean of 10 or more points. ii) For the students without approval in the midterms there is a final exam with the material from all lectures. Approval with a mean of 10 or more points.

6. Estimated Workload:	168	Hours
7. Last Update:	15/7/2010	