COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Agricultural Sciences		
ACADEMIC UNIT	Biosystems & Agricultural Engineering		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	BAE_710	**SEMESTER**	7th
COURSE TITLE	ENVIRONMENTAL HYDRAULICS-HYDROLOGY-WATER QUALITY		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	3	
Tutorials	0	
Laboratory	2	
TOTAL	**5**	**5**
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Background (Fundamental Principles of Environmental Hydraulics & Hydrology) Skills Development (Water quality control)
PREREQUISITE COURSES:	There are no prerequisite courses.
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek .-For Erasmus students in English
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

- The hydrological cycle and the water balance
- Basic knowledge on hydrological processes cental in water balance studies
- Basic knowledge of computation and measurements, and some knowledge on data sources and data analysis.
- Understand the basic characteristics of groundwater flow and mass transport in the subsurface.
- Be able to make simple calculations regarding flow and transport characteristics.
- Become familiar with simple groundwater models.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism

Team work	*Production of free, creative and inductive thinking*
Working in an international environment	*……*
Working in an interdisciplinary environment	*Others…*
Production of new research ideas	*…….*

The course will provide the foundations of Environmental Hydraulics-Hydrology-Water Quality, with a strong focus on developing a skill base necessary for the construction, analysis, and interpretation of experimental data, as well as a practical understanding and use of predictive models.
At the end of this course the student will have further developed the following skills (general skills):

- Use hydrological data for inflow and flood analysis
- Know measurement techniques for discharge and snow storage
- Calculations of processes and the water balance.
- Water quality control

In general, upon completion of this course the student will have further developed the following general skills (from the list above):
Search, analysis and synthesis of data and information, using the necessary technologies
Adaptation to new situations
Decision making
Autonomous work
Teamwork
Respect for the natural environment
Exercise criticism and self-criticism

(3) SYLLABUS

The course involves study of:
1.General Hydrology: Hydrological cycle, hydrometeorology, water balance, hydro-measurements analysis.
2. Precipitation origin, measurements, analysis and prognosis of rain and snow, evaporization and transpiration. Underground water flow, underground hydro-carriers, permeability, soil hydraulic parameters.
3. Runoff development, measurement and analysis of surface runoffs and water supply, hydrographs, precipitation-runoff simulations. Extreme runoff events, forecasting of flood events.
4. Characteristics of watersheds, hydrographic networks, receivers, limnography. Methods and applications of technical hydrology. Principles and systems of environmental hydrology.
5. General Hydraulics: Hydrostatics. Principles and equations of hydrodynamics.
6. Open pipes and channels, flow types (steady, uniform and non-uniform, instable), weirs, hydrofalls, watersheds, branching, cross section and slope changes, flow profile,
7. Closed pipes, underground hydraulics, flow inflation, shrinkage and suppression. Lake and coastal hydraulics.
8. Principles and systems of environmental hydraulics.
9. Potamology: Water flow, cobble movement, formation of fluvial beds, river management works.
10. Introduction to groundwater pollution, sources, physical and chemical properties of groundwater pollutants, Mass transport, advection, diffusion, Dispersion, adsorption, degradation
11. Advection dispersion equation
12. Applications, Non aqueous liquids
13. Groundwater pollution prevention and remediation

Laboratories

- Environmental Hydraulics
- Environmental Hydrology
- Water Quality control

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face deliveries. Laboratory exercises in Physical Chemistry

<table>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>• Use of ICT (power point) in Teaching
• Use of ICT (power point) in Laboratory Training
• Use of ICT in Communication with students (Learning process support through the electronic platform e-class).</td></tr>
<tr><td>TEACHING METHODS
The manner and methods of teaching are described in detail. Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.
The student's study hours for each learning activity are given as well as the hours of non directed study according to the principles of the ECTS</td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures</td><td>39</td></tr>
<tr><td>Laboratory</td><td>26</td></tr>
<tr><td>Writing short reports of laboratory exercises</td><td>13</td></tr>
<tr><td>Final Exams</td><td>3</td></tr>
<tr><td>Study hours and preparation for the laboratory exercises and the final examination</td><td>44</td></tr>
<tr><td>Course total</td><td>125</td></tr>
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<tr><td>STUDENT PERFORMANCE EVALUATION

Description of the evaluation procedure
Language of evaluation, methods of evaluation, summative or conclusive, multiple
choice questionnaires, short-answer questions,
open-ended questions, problem solving, written
work, essay/report, oral examination, public
presentation, laboratory work, clinical examination of patient, art interpretation,
other
Specifically-defined evaluation criteria are
given, and if and where they are accessible to
students.
1</td><td>1. The laboratories participate by 30% in the final grade. In order to be examined in theory, the student must have completed all the laboratories and have been successfully examined in them.
2. The main assessment criteria focus on understanding and correlating the knowledge that students gain from the course with other knowledge. Particular emphasis is placed on whether they have developed the ability to apply this knowledge to crop selection and to assess the impact of these changes on the environment. Emphasis is also placed on demonstrating critical ability and justifying the choices they make in each problem.
3. Evaluation is dynamic. It mainly involves problem solving. is done orally or in writing or with a combination of the two, with or without pre-examination on the basic principles of the course, with or without exculpatory advances and with other test or inventive methods, depending on the composition of the dynamics and the needs of the audience.
4. The above are done in the Greek language. For foreign language students (eg Erasmus students) conducted in English</td></tr>
</table>

(5) RECOMMENDED LITERATURE

Suggested bibliography:

- Βιβλίο [94688988]: Υδρολογία και Υδραυλική, Μυρωνίδης Δημήτριος Λεπτομέρειες
- Βιβλίο [18549069]: Υδρογεωλογία περιβάλλοντος. Υπόγεια νερά και περιβάλλον, Βουδούρης Κώστας Σ. Λεπτομέρειες
- Βιβλίο [17171]: Γενική υδρογεωλογία, Σούλιος Γεώργιος Χ. Λεπτομέρειες

-Complementary bibliography:

- F.W. Schwartz and Zhang (2003), “Fundamentals of Ground Water”, John Wiley and Sons, Inc., New York
- Domenico P.A. and F.W. Schwartz, (1990), “Physical and Chemical Hydrogeology”, John Wiley and Sons, Inc., New York