COURSE OUTLINE

1. GENERAL

SCHOOL	Environment and Agricultural Engineering		
ACADEMIC UNIT	Natural Resources Management and Agricultural Engineering		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	179	**SEMESTER**	6th
COURSE TITLE	Open and closed conduit hydraulics		

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**
Theory	3	3
Laboratory	2	2
TOTAL:	5	5

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	general background
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES (In English)
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 course offers deeper understanding of Hydraulics, open and closed conduit flow are explained, and all related control structures are described and analyzed.

It is constantly orientated in environmental and agriculture applications, aiming to encourage the spirit of eco-friendly water management.

Upon successful completion of the course the student will be able to:

• Measure the basic parameters in flow demonstrations.
• Study the flow in pipes and open channels.
• Design elements of hydraulic networks: channels, control structures, pumping stations, pipelines, drip irrigation lines and other.

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

- Search, analysis and synthesis of data and information with the use of the required technologies
- Independent Work
- Production of new research ideas
- Respect for the natural environment

3. SYLLABUS

Turbulent flow in closed conduits - roughness. Energy losses. Generalized law of Darcy-Weisbach, Empirical equations for linear losses. Hazen -Williams and Manning equations. Minor losses. Analysis of parallel pipeline systems and in series. Branching pipes, Cross method for network analysis.

Hydraulics of closed pipes with multiple outputs. Hydraulic analysis methods for discrete and continuous discharge profile. Generalized friction factor "F". Pipelines with gradients. Applications in lateral pipe irrigation systems.

Key elements of unsteady flow in closed conduits - Water hammer. Optimal design of closed pipes simple systems closed pipes with pump.

Steady flow in open channels. Specific energy, critical flow, Froude number. Uniform flow. Smoothly varying flow. Free surface profiles. Analysis - calculation methods. Abruptly changing flow. Hydraulic jump. Hydraulic structures. Introduction to unsteady flow in open channels. Rapidly and slowly changing unsteady flow. Applications in irrigation. Canals, strips, basins and channels. Hydraulics of natural open channels.

4. TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
Face-to-face, Distance learning, etc.</td><td colspan="2">The teaching methodology employed in the classroom and in the laboratory</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td colspan="2">Flow demonstration structures
Measurement instruments
Specialized software
e-class platform</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 colspan="2"><table><tr><th>Activity</th><th>Semester workload (hours)</th></tr><tr><td>Lectures</td><td>39</td></tr><tr><td>Exercises that focus on design application methodologies and laboratory measurements</td><td>26</td></tr><tr><td>Team project</td><td>20</td></tr><tr><td>Individual projects</td><td>10</td></tr><tr><td>Theory study</td><td>30</td></tr><tr><td>TOTAL</td><td>125</td></tr></table></td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION</td><td colspan="2">I. Final written theory examination (50%) comprising:</td></tr>
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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.*	- Multiple choice questions - Open questions - Problem solving - Theory elements II. Laboratory Grade (50%) -Written final examination (30%) - Team project delivery and presentation (20%)

5. ATTACHED BIBLIOGRAPHY

- Open-Channel Hydraulics, VenTe Chow, McGraw-Hill Kogakusha, LTD
- Handbook of Applied Hydraulics, C.V Davis Editor in Chief, K. E. Sorensen, Co-Editor, Mc Graw-Hill Book Company.