COURSE OUTLINE

(1) GENERAL

SCHOOL	ENGINEERING SCHOOL		
DEPARTMENT	CIVIL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDER GRADUATE		
COURSE CODE	2303521	SEMESTER	3[d]
COURSE TITLE	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
Lectures	2	5
Laboratory Exercises	2	
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*	Special Background Course
PREREQUISITE COURSES:	YES (PHYSICS I & II)
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek (official)
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO
COURSE WEBSITE (URL)	http://civil.teipir.gr/web/index.php?page=alias-55

(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*

Upon completion of the course, students will be able to:

1. In-depth knowledge and critical understanding of theory and laws of Fluid Mechanics with emphasis on Hydraulics.
2. Knowledge and familiarity in units conversion, dimensions, physical properties of fluids, hydrostatic applications, etc.
3. Knowledge and skills in order to design flow field systems based on hydraulic losses.
4. Knowledge and composition skills, in solving and computation applications in the scientific field of hydraulic pipes and open channels.
5. Capacities to assessing different proposals in order to solve complex issues concerning the fluids flow and energy in hydraulic pipes and open channels.
6. To describe and recognize the physical quantities and parameters that involved in problems related to Hydraulics.
7. To apply the principles of Fluid Mechanics and Hydraulics, as well as the appropriate equations in order to calculate the energy conversions of fluids in problems related to Hydraulics.
8. To combines the theoretical knowledge and the laboratory experience in order to use experimental devices for experimental calculations of some parameters involved to Hydraulics.
9. To combines, to design and to develop any troubleshooting process in the area of Hydraulics.
10. To be able to explain the "behavior" of fluids under different flow conditions, in closed (hydraulic pipes) and open channels.
11. To calculate, evaluate and compare the energy losses in the flow of fluids in hydraulic pipes and open channels.

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	*Project planning and management*
Adapting to new situations	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Team work	*Criticism and self-criticism*
Working in an international environment	*Production of free, creative and inductive thinking*
Working in an interdisciplinary environment	*……*
Production of new research ideas	*Others…*
	…….

More specifically, students will be able to:

1. Search, analysis and synthesis of data and information using and applying the required technologies
2. Decision Making
3. Individual project

Teamwork

(3) Course Content

Theory The core modules of the course include: 1. Units Systems and size Dimensions, Dimensional Analysis. 2. Physical Properties of fluids. Density, viscosity, kinematic viscosity, surface tension, compressibility, gas laws. 3. Hydrostatic Pressure, Pressure intensity-basic equation of hydrostatic, hydrostatic forces on surfaces. 4. Kinematics of Fluids. Flow lines and trajectories, total derivative time, equations of fluids motions (Euler's equations), Bernoulli's equation, energy height, piezometric height. 5. Permanent one dimensional incompressible flow in closed pipes. Reynolds number, laminar and turbulent flow in closed pipes. 6. Hydraulic load. Moody chart. Linear energy losses. Local energy losses. Overall hydraulic losses. 7. Steady flow in open channels. Features of flow in open channels. 8. Basic flow equations in open channels. Chezy equation. Manning-Strickler equation. 9. Tanks. The problem of the three tanks. 10. Hydraulic jump. General characteristics of hydraulic jump. **Laboratory** The workshop includes the following laboratory exercises: 1. Calculation of errors in the process of experimental measurements and during the calculation of derived magnitudes 2. Experimental measurement of liquids density and specific gravity 3. Capillary-capillary elevation 4. Experimental measurement of fluids viscosity 5. Experimental calculation of pressure center on a flat vertical surface 6. Venturi duct 7. Experimental calculation of the critical Reynolds number 8. Experimental calculation of losses in the fluid flow conduit 9. Flow through nozzle with sharp edges 10. Open channel flow. Experimental determination of flow speed and roughness coefficient

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Lectures and exercises, face-to-face.	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Teaching using ICT, Laboratory Education using ICT and experimental devices, Communication and Electronic Submission	
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.*	*Activity*	*Semester workload*
	Lectures	26
	Laboratory Exercises	26
	Preparation for writing laboratory exercises and individual homework	26
	Personal study	47

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	**Total Course** | **125**
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.*	**Theory:** • Final Written Examination: 80% • Three at least interim exams (advance): 20% **Laboratory:** • Weekly laboratory work-exercise: 40% • Final written semester examination: 60%

(5) ATTACHED BIBLIOGRAPHY

1. Streeter V.L. (1966). Fluid Mechanics. 4th edition, McGraw - hill.
2. Davis C.V. and Sorensen V.E. (1969). Handbook of applied Hydraulics. International Student Edition, McGraw – Hill.
3. Giles R.V. (1999). Theory and Problems of Fluid Mechanics and Hydraulics. McGraw – Hill, Schaum's Outline Series.
4. Koronakis P. (2001). Fluid Mechanics. ION publications, Athens, Greece (in Greek).
5. Moustris K. and Ntourou K. (2013). Laboratory Guide and Academic notes. TEI of Piraeus, Egaleo, Athens, Greece (in Greek).
6. Keramaris E. and Pechlivanidis G. (2008). Hydraulics II. TEI of Thessaloniki, Free online-web Hydraulics Academic notes, Available at: http://eclass.cie.teithe.gr/claroline/document/document.php
7. Moutsopoulos K. (2008). Applied Hydraulics-Short theory and exercises. University of Thessaloniki, Free online-web Hydraulics Academic notes, Available at: http://repository.edulll.gr/edulll/bitstream/10795/1296/22/1296_01.pdf
8. Papaevagelou G. (2009). Principals of Hydraulics. TEI of Serres, Free online-web Hydraulics Academic notes, Available at: http://blogs.sch.gr/geopapaevan/files/2009/08/shmeioseis_general_3.pdf