COURSE OUTLINE

(1) GENERAL

SCHOOL	**UNIVERSITY OF THESSALY**		
ACADEMIC UNIT	DEPARTMENT OF CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	ΥΔ0900	**SEMESTER**	8th
COURSE TITLE	EXPERIMENTAL 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**
	4	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, specialized general knowledge, skills development*	Specialized general knowledge, skills development
PREREQUISITE COURSES:	Fluid Mechanics Hydraulics
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.uth.gr/courses/CIV_U_357/

(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*

Specific Knowledge

Upon completing the course, the student will possess advanced knowledge that entails a critical understanding of theories and principles in:

- Hydraulic similarity
- Dimensional analysis
- Measurements, errors, and the processing of experimental measurement errors

Skills

Upon completing the course, the student will acquire advanced skills regarding:

- Experimental setups in hydraulic studies
- Measurement techniques in fluids
- Methods for processing errors in measurements

Competencies

Upon completing the course, the student will be able to:

- Organize and conduct experimental measurements
- Analyze experimental results
- Assess the reliability of experimental measurements

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…
	…….

- 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 on Labs
- Working in an interdisciplinary environment
- Project planning and management
- Production of free, creative and inductive thinking
- Respect for the natural environment
- Showing social, professional and ethical responsibility

(3) SYLLABUS

Week No. – Course contents

1 - Introduction. Dimensional analysis, Buckingham Π-theorem
2 - Nondimensional Navier-Stokes equations, characteristic dimensionless numbers
3 - Full (dynamic) and partial (kinematic or geometric) similarity. Reynolds and Froude similarity
4 - Theory and implementation of hydraulic laboratory models
5 - Measurement of density, kinematic viscosity and hydrostatic pressure of liquids. Static flow pressure measurement. Velocity measurements. Pilot tube. Discharge measurement in pipes and open channels
6 - Error analysis, experimental error estimates. Statistical analysis of experimental data.
7 - Turbulence theory, response of measuring devices, spectra and data acquisition in turbulent flows, Nyquist theorem, measurements
8 - Hot-wire anemometry. Optical techniques. Laser doppler anemometry, particle image velocimetry (PIV)
9 - Visit to hydraulics laboratory. Display of the use of measurement devices as well as experiments from Diploma and Masters Theses
10 - Experiment on energy losses in pipe flow
11 - Experiment on the development of boundary layer in pipes, via Pitot tube velocimetry
12 - Measurement of the velocity distribution along the axis and across a turbulent air jet
13 - Experiment in a 5m. long open channel. Free surface profile and hydraulic jump measurement. Use of sharp crested weir and sluice gate for flow control
14 - Experiment of the discharge time of a tank

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY ***Face-to-face, Distance learning, etc.***	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Power-point, notes, tutorials, laboratory experiments, and announcements in e-class.
TEACHING METHODS *The manner and methods of teaching are described in detail. Lectures, seminars, laboratory practice, fieldwork, study and analysis*	

Activity	*Semester workload*
Lectures	14*4=56 hours
Study	13*4=52 hours
Project	40 hours
Final examinations	2 hours

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*		
	Course total	**150**

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.*	**Language of Evaluation** Greek **Methods of evaluation** 50% - Final written examinations 50 % - Class project

(5) **ATTACHED BIBLIOGRAPHY**

-Suggested bibliography:

- Experimental hydraulics, Notes by P. Papanicolaou
- Handouts from Greek and international bibliography
- Bergeles, G, Papantonis, D και Tsangaris, S, 1998. Technical measurements of fluid 630 mechanics parameters. Symeon Editions, Athens. (In Greek)
- Bendat, JS, and Piersol, AG, 1971. Random data: Analysis and measurement procedures. Wiley.
- Drain, LE, 1980. The laser-Doppler technique. Wiley.
- Goldstein, RJ, Ed. 1996. Fluid mechanics measurements. Taylor and Francis.
- Japan society of mechanical engineers, (Ed.) 1988. Visualized flow. Pergamon.
- Perry, AE, 1982. Hot wire anemometry. Clarendon Press.
- Raffel, M, Willert, C, and Kompenhans, J, 1997. Particle image velocimetry. Springer.
- Sharp, JJ, 1981. Hydraulic modeling. Butterworths.

- Related academic journals:

- Experiments in Fluids
- Journal of Hydraulic Research
- Journal of Hydraulic Engineering,
- Journal of Hydraulics