5.2 CE0520 – Hydraulics

(1) GENERAL

SCHOOL	ENGINEERING SCHOOL		
ACADEMIC UNIT	CIVIL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**CE0520**	**SEMESTER**	**5**
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**
	4	4
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:	Fluid Mechanics (CE0430) English level B2 or higher is required for Erasmus incoming students
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek (English/Erasmus)
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://eclass.uniwa.gr/courses/CIV201/

(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 successful completion of the course, the student,

will have understood the principles governing Hydraulics,

will be able to calculate basic hydraulic quantities (pressure, flow rates, static and dynamic pressure, total hydraulic energy, energy losses due to viscous friction, etc.) in pipelines, installations and piping systems, ducts and 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…*

The course aims that the student acquires - practice the following general skills:

- Search for, analysis of, and synthesis of data and information, implementing appropriate technologies
- Decision-taking
- Independent work - Team work - Working in an international / interdisciplinary environment
- Respect natural environment - Social, professional and ethical responsibility
- Proact free, creative and inductive thinking

(3) SYLLABUS

Introductory review
• Conservation laws for mass, total hydraulic energy and linear momentum
• Definition of viscosity - Couette flow
Laminar flow orthogonal (between two parallel walls) and cylindrical (pipe flow)
Turbulent layer theory (in brief) - Laminar to turbulent transition length
Darcy-Weisbach friction coefficient
Darcy-Weisbach Semi-empirical expression - Moody diagram
• Applications in pipe flow under pressure (estimation of pressure losses, discharge, pipe diameter)
• Open-channel flow (homogeneous flow conditions)
• Pipe aging
Hazen-Williams semi-empirical expression with applications
Flow in pipe network
• Local energy losses
• Pipe flow network connecting tanks
• Pipe network with pumps and turbines
• Pipe networks in parallel
• Equivalent pipes in series
Open-channel flow.
• Introduction. Fundamental differences between pressure flow and free-surface flow. Flow types with water-surface (steady vs unsteady, homogeneous and varying flow, rapidly varying and gradually varying flow).
• St. Venant equations (conservation of mass and linear momentum). Bernoulli equation (conservation of hydraulic energy).
• Homogeneous flow. Principles and equations. Manning empirical equation. Standard methods for selection of cross-section. Estimation of optimum channel cross-section. Friction losses in free surface flows. Applications.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face in-class teaching. When needed, distance teaching (synchronous/asynchronous)
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of I.C.T. in Teaching and Student Communication

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

Activity	*Semester workload*
In Class (/Distance) Teaching	52
Literature Study	30
Exercises / Paradigms	20
Project assignment / Essay	18
Course total	**120**

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 (English/Erasmus)

Written examination, 2,5-hours

Problem solving, Multiple choice test, Questions and Answers, Written Essay / Project

The evaluation criteria are announced to the students well before the examination; weights per subject /exercise are explicitly indicated.

The examination results (including total / partial grading) are announced on the web. Students may require to have access to their tests, they may ask for clarifications on mistakes, grading etc.

(5) ATTACHED BIBLIOGRAPHY

Greek Bibliography:

1. Λιακόπουλος Αντ., Υδραυλική, 3η Έκδοση, Έκδοση: 3η/2020, ISBN: 978-960-418-775-1, Εκδ. ΕΚΔΟΣΕΙΣ Α. ΤΖΙΟΛΑ & ΥΙΟΙ Α.Ε., 2020, Κωδικός Βιβλίου στον Εύδοξο: 77107649
2. Τερζίδης Γεώργιος Α., Εφαρμοσμένη Υδραυλική, Έκδοση: 1η έκδ./1997,ISBN: 960-431-405-X, Εκδ. Ζήτη Πελαγία & Σια Ι.Κ.Ε., 1997, Κωδικός Βιβλίου στον Εύδοξο: 11029
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6. Παπαμιχαήλ Δ., Μπαμπατζιμόπουλος Χ., Εφαρμοσμένη Γεωργική Υδραυλική, Έκδοση: 1η έκδ./2014, ISBN: 978-960-456-415-6, Εκδ. Ζήτη Πελαγία & Σια Ι.Κ.Ε., 2014, Κωδικός Βιβλίου στον Εύδοξο: 41960118
7. Daugherty /Franzini /Finnemore, ΜΗΧΑΝΙΚΗ ΡΕΥΣΤΩΝ ΜΕ ΤΕΧΝΙΚΕΣ ΕΦΑΡΜΟΓΕΣ, Έκδοση: 1/2007, ISBN: 960330332-1, Εκδ. ΓΡΗΓΟΡΙΟΣ ΧΡΥΣΟΣΤΟΜΟΥ ΦΟΥΝΤΑΣ, 2007, Κωδικός Βιβλίου στον Εύδοξο: 4309

Foreign Bibliography:

1. Fluid Mechanics, M.C. Potter & D.C. Wiggert, Schaum's outline Series, McGraw-Hill, 2008.
2. Fluid Mechanics, White, McGraw-Hill, 4th Edition, 1998, ISBN-13: 978-0072281927
3. Practical Hydraulics, Melvyn Kay, Taylor & Fransis, 2nd edition, ISBN13: 978–0–203–96077–6
4. FLUID MECHANICS FOR PETROLEUM ENGINEERS, ELEMER BOBOK, Elsevier 1993, ISBN 0-444-98668-5