Course Outline

CE0430 - Fluid Mechanics

(1) Overview

Faculty	Engineering		
Department	Civil Engineering		
Level of Studies	First Cycle - 5 years - Diploma in Engineering		
Course Code	**CE0430**	**Semester**	4
Course Title	**Fluid Mechanics**		

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**	**ECTS**
Lectures	4	5
Laboratory Practice		
	4	**5**

Course Type *Select: general background, special background, specialised general knowledge, skills development*	Scientific Field Course / Special background (MEY)
Prerequisite knowledge (courses):	Rigid Body Mechanics (CE0120) Calculus & Linear Algebra (CE0110) English level B2 or higher is required for Erasmus incoming students
Language (teaching):	Greek
Is the Course offered to Eramsus /International Students	Yes
Course webpage (e-class/URL)	https://eclass.uniwa.gr/courses/CIV170/

(2) Module Aims – Learning Outcome

Learning Outcome

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.

- *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*

Upon successful completion of the course, the student,

will have understood the principles governing Hydrostatics,

will be able to calculate basic hydrostatic quantities (pressure, pressure vector, distribution of hydrostatic charges on flat and curved surfaces, calculation of recommended hydrostatic force and point of application - pressure center, buoyancy, stability, metacenter),

will have understood the 3 basic balances (mass, energy, linear momentum) as applied in continuous media and especially in liquids,

will have understood the similarities and differences in the behavior of solids, liquids and gases and in particular the basic flow behavior of liquids as a result of their main physical characteristics (density, viscosity) compared

to that of solids and gases,

will have understood the meaning of bulk / volumetric supply and its importance in evaluating performance and / or designing and dimensioning any hydraulic system or installation,

will have understood the meaning of the velocity field, the quantities that describe it (flow lines, complex vector derivatives, deviation, curl/swirl) as well as the different types of velocity fields,

will have understood the meaning of the flow tensor,

will have understood the flow behavior of ideal fluids (rheological equations),

will have understood the basic equation governing the motion of fluids (Navier-Stokes equation),

will have understood the phenomenology of flows and relevant classification according to the Reynolds number value (creeping, layered, transient, turbulent flows),

will have acquired the necessary background knowledge for the study of the supplementary course of Hydraulics but also specialization courses of the hydraulic direction of the study program

General Skills

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), the course aims to effect the following skills

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

Independent work - Team work - Working in an international / interdisciplinary environment

Decision-taking

Proact free, creative and inductive thinking

(3) Module Syllabus

1 Basic Information - Dimensions, Units, and Physical Quantities; Gases and Liquids; Pressure and Temperature; Properties of Fluids, Thermodynamic Properties and Relationships

2 Fluid Statics - Pressure Variation; Manometers; Forces on Plane and Curved Surfaces; Accelerating Containers

3 Fluids in Motion - Introduction; Fluid Motion; Lagrangian and Eulerian Descriptions (Pathlines, Streaklines, and Streamlines; Acceleration; Angular Velocity and Vorticity); Classification of Fluid Flows; Bernoulli's Equation

4 The Integral Equations - System-to-Control-Volume Transformation; Conservation of Mass; The Energy Equation; The Momentum Equation

5 Differential Equations - The Differential Continuity Equation; The Differential Momentum Equation; The Differential Energy Equation

6 Internal Flows - Entrance Flow; Laminar Flow in a Pipe (The Elemental Approach; Applying the Navier – Stokes Equations; Quantities of Interest); Laminar Flow Between Parallel Plates (The Elemental Approach; Applying the Navier – Stokes Equations; Quantities of Interest); Laminar Flow between Rotating Cylinders (The Elemental Approach; Applying the Navier – Stokes Equations; Quantities of Interest); Turbulent Flow in a Pipe (The Semi-Log Profile; The Power-Law Profile; Losses in Pipe Flow; Losses in Noncircular Conduits; Minor Losses; Hydraulic and Energy Grade Lines); Open Channel Flow

(4) Teaching and Learning Methodology – Assessment

Teaching method *Face to face in class, Distant learning, etc.*	Face-to-face in-class teaching. When needed, distance teaching (synchronous/asynchronous)
Use of ICT *Use of ICT in Teaching and Lab practice, communication with students, etc.*	Use of I.C.T. in Teaching and Student Communication
Teaching Breakdown *Lectures, seminars, lab practice, fieldwork, study and analysis of literature, tutorial workshops, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's hours of study per learning activity are accounted including the hours of nondirected study (according to ECTS principles).*	

Activity	***Study workload per semester***
In Class (/Distance) Teaching	52
Literature Study	45
Exercises / Paradigms	35
Project assignmenet / Essay	18
Total Activity	**150**

Student Performance Evaluation *Listing/description of the student's performance evaluation criteria / methods* *The evaluation criteria should be explicitly defined and communicated to the students*	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 / parial grading) are announced on the web. Students may require to have access to their tests, they may ask for clarifications on mistakes, grading etc. The examination is in Greek for resident students. Erasmus students are examined in English.

(5) Suggested Literature

1*. M. Potter and D.Wiggert, "Schaum's Outline of Fluid Mechanics", 2007, Spronger, DOI : 10.1036/0071487816, ISBN : 0071487816.

2*. H. Yamaguchi, "Engineering Fluid Mechanics", Eudoxus Code 73236844, Vol. 85, 2008, ISBN 9781402067426 Springer ebooks, http://dx.doi.org/10.1007/978-1-4020-6742-6

3*. G. Hauke, "An Introduction to Fluid Mechanics and Transport Phenomena", Eudoxus code 73228766, 2008 Springer, ISBN 9781402085376, http://dx.doi.org/10.1007/978-1-4020-8537-6