COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Science		
ACADEMIC UNIT	Physics		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**10EKO05**	**SEMESTER**	**4**
COURSE TITLE	**Fluid Dynamics**		

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 (theory and exercises)	5	7

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special Background
PREREQUISITE COURSES:	No (recommended Mechanics I)
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes, in the English language for Erasmus students
COURSE WEBSITE (URL)	https://eclass.uoa.gr/courses/PHYS210/

(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*

This course aims to introduce the student to basic concepts of Fluid Dynamics. It also gives him the opportunity to go beyond a qualitative presentation in the quantitative use of the basic theoretical tools for the further modeling of the relevant physical phenomena.

At the end of the course, each student will be able to:
1. Understand how the basic equations of Classical Mechanics lead to the Navier-Stokes equations and the basic conservation laws.
2. Use the Bernoulli integral to describe simple fluids, compressed or uncompressed.
3. Know the most basic waves and fluid instabilities.
4. Recognize the role of viscosity and describe the dynamics in the limit of large / small Reynolds numbers.
5. Apply the above to a variety of geophysical fluids in the atmosphere and the ocean, analyze and quantitatively quantify the results, recognizing the particular role of Earth rotation, stratification and turbulence.

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…
…….

The course aims at the following general competences

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Decision-making
Working independently
Analytical and synthetic thinking
Critical thinking
Time management
Creativity
Meeting Deadlines and Keeping Schedules
Problem solving

(3) SYLLABUS

- Introduction, kinematics and conservation laws, Euler and Navier-Stokes equations.
- Bernoulli equation, hydrostatics, gravity waves.
- Instability: General theory, Rayleigh-Taylor and Kelvin-Helmholtz instabilities.
- Introduction to turbulence, turbulent flows and the turbulent kinetic energy.
- Geophysical fluid dynamics: Coordinate systems and the effect of the Earth's rotation, scaling, vorticity conservation.
- Rotation effects in geophysical flows: Geostrophic balance, Ekman dynamics, barotropic waves in the presence of rotation, stratification effects in geophysical flows: Stratified geostrophic dynamics, internal waves

(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*	Yes Electronic communication with the students using ICT

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
Lectures	52
Exercises	13
Individual Study/ Study and Analysis of bibliography / Preparation	78
Writing reports/ essays	29
Exams	3
Course Total	**175**

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.

Final written exams in Greek
Homeworks with problems to solve

(5) ATTACHED BIBLIOGRAPHY

Suggested bibliography (given through the EYDOXUS platform):

- Βιβλίο [Κωδ. Ευδ. 86056036]: Δυναμική των Ρευστών, Βλαχάκης Νεκτάριος

Other:

- Σημειώσεις διδασκόντων https://eclass.uoa.gr/modules/document/?course=PHYS210
- Fluid Mechanics, Kundu, Cohen, Dowling
- Intoduction to Geophysical Fluid Dynamics, Cushman-Roisin, Beckers
- An introduction to fluid dynamics, Batchelor
- Fluid Mechanics, Landau, Lifshitz