COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Science		
ACADEMIC UNIT	Physics		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	10YK301	**SEMESTER**	8
COURSE TITLE	**ATMOSPHERIC 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)	4	6

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialization
PREREQUISITE COURSES:	No
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/PHYS313/

(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*

The course provides students with the knowledge to understand the basic concepts, principles and laws of fluid mechanics and thermodynamics related to atmospheric motion and thermodynamic processes. Especially, after the successful completion of the course, the student is able to:

- know the definitions and physical significance of the main meteorological parameters (e.g. pressure, density, temperature)
- know the spatial and temporal distribution and changes of these parameters
- understand the concepts, principles and theories related to the thermodynamic processes in the atmosphere (eg stability / instability, dynamic stability / instability)
- describe Newton's laws of motion, conservation of mass, momentum, spin and energy
- solve the basic equations (hydrostatic, ideal gas, etc.) of the atmosphere
- recognize the apparent and real forces affecting the movement of air masses
- understand the balance of these forces and the generation of winds
- resolve the equations of motion
- recognize spatial and temporal scales of atmospheric circulation
- determine the characteristics of the winds: geostrophic, gradient, cyclostrophic and thermal wind
- explain the difference between the streamlines of the wind field and the trajectories of the air masses
- explain the equation of continuity
- know the circulation theorem and the vorticity equation
- distinguish absolute, relative and potential vorticity
- know the divergence theorem and apply it
- distinguish small disturbances and recognize the waves of Kelvin-Helmholtz, Rayleigh-Taylor, Rossby
- distinguish various wave disturbances, such as internal -external gravity waves, sound and Lamb waves, planetary waves
- apply this knowledge to solving problems related to the content of the course
- evaluate the results of the problems

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…
…….

With its successful attendance and completion, the course aims to give the student the following skills:

Search for, analysis and synthesis of data and information, using the necessary technology
Working independently
Team work
Working in an interdisciplinary environment
Production of free, creative and inductive thinking
Analytical and synthetic thinking
Critical thinking
Problem solving

(3) SYLLABUS

- Basic concepts, forces, equations of motion, energy, mass conservation and simplified forms (incompressible, anelastic, Boussinesq), equation of state.
- Reference systems, coordinate systems, pressure and potential temperature as vertical coordinate, pressure gradient.
- Characteristic scales of atmospheric motions, scale analysis, simplified forms of basic equations, thermal wind, boundary layer and Ekman spiral.
- Vorticity, conservation of vorticity (absolute and relative), vorticity advection.
- Atmospheric stability (thermodynamic), dynamic stability/instability, small perturbations, Kelvin-Helmholtz, Rayleigh-Taylor and Rossby waves.
- Taylor-Goldstein equation, internal and external gravity waves, acoustic and Lamb waves, wave trapping in the atmosphere.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face teaching
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Yes The e-class system is used to provide notes, exercises, information, and communication with students. Computer-aided teaching support.
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	26
Exercises	26
Individual Study/ Study and Analysis of bibliography / Preparation	98
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.*	Final written examinations at the end of the semester, in Greek language. Four issues equivalent to each other. The themes concern both theory and questions of understanding - critical thinking, as well as problem solving.

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

1. "Ειδικά Κεφάλαια Ατμοσφαιρικής Φυσικής και Χημείας", Κ. Βαρώτσος, ΕΚΔΟΣΕΙΣ Σ. ΑΘΑΝΑΣΟΠΟΥΛΟΣ & ΣΙΑ Ο.Ε., 2014
2. "Μαθήματα Μετεωρολογίας και Κλιματολογίας", Α. Φλόκας, ΕΚΔΟΣΕΙΣ ΠΕΛΑΓΙΑ ΖΗΤΗ & ΣΙΑ ΟΕ, 1997

- Related academic journals:

1. "An introduction to Dynamic Meteorology", James R. Holton and Gregory J. Hakim, Academic Press, 2013
2. "Dynamical Meteorology – An Introductory Selection", B.W. Atkinson, Routledge, 1990