COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Science		
ACADEMIC UNIT	Physics		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**YK014**	**SEMESTER**	**2**
COURSE TITLE	**Ordinary Differential Equations and Linear Algebra**		

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*	*General Background*
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	*https://eclass.uoa.gr/courses/MATH586/*

(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 a rigorous, systematic and an in-depth study of the theory of Ordinary Differential Equations and its applications in physics problems.

With the completion of the course the student is able to:

- Apply the fundamental theorem of existence and uniqueness for initial value problems, and solve in closed form specific types of 1st order differential equations (separable differential equations, Bernoulli, Ricatti, exact 1st order differential equations).
- Perform the qualitative analysis of a differential equation (determination and characterization of equilibrium points, phase diagram, bifurcation points, and bifurcation diagram).
- Employ various techniques to solve 2nd order linear differential equations (method of undetermined coefficients, method of variation of parameters, reduction of order).
- Employ the power series method in order to solve 2nd order linear differential equations.
- Solve systems of 1st order linear differential equations.
- Perform the qualitative analysis of a 2nd order differential equation (determination and characterization of equilibrium points, stability, phase plane).

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

Working independently
Production of free, creative and inductive thinking
Analytical and synthetic thinking
Critical thinking
Problem solving

(3) SYLLABUS

- Autonomous scalar 1st order differential equations: well posedness of the initial value problem
- Autonomous scalar 1st order differential equations: equilibrium points, stability, and introduction to bifurcations.
- Linear 1st order differential equations in one- and two-dimensions, with constant or varying coefficients.
- Homogeneous and inhomogeneous linear 2nd order differential equations.
- Series solutions of linear 2nd order equations.
- Qualitative theory of differential equations on the plane. Local techniques and introduction to global techniques.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
Face-to-face, Distance learning, etc.</td><td>Face-to-face

Distance learning in exceptional situations</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>Yes

Electronic communication with the students using ICT (Information and Communications Technology),
eclass platform</td></tr>
<tr><td>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</td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Lectures</td><td>35</td></tr>
<tr><td>Exercises</td><td>17</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Individual Study/ Study and Analysis of bibliography / Preparation</td><td>98</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course Total</td><td>150</td></tr>
</table>
</td></tr>
<tr><td>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.</td><td>Final written exams in Greek

(oral examination when appropriate)</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

- Συνήθεις Διαφορικές Εξισώσεις, Ν. Αλικάκος, Γρ. Καλογερόπουλος, ΣΥΓΧΡΟΝΗ ΕΚΔΟΤΙΚΗ ΕΚΔΟΣΕΙΣ ΣΥΜΜΕΤΡΙΑ, 2003, Αθήνα

- Στοιχειώδεις Διαφορικές Εξισώσεις και Προβλήματα Συναριακών Τιμών, ,W. E. Boyce, R.C. Di Prima, Μετάφραση- επιμέλεια, Λ. Παπαλουκάς, ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΕΜΠ, 2015, Αθήνα

- ΜΙΑ ΕΙΣΑΓΩΓΗ ΣΤΗ ΓΡΑΜΜΙΚΗ ΑΛΓΕΒΡΑ, ΒΑΡΣΟΣ ΔΗΜΗΤΡΗΣ, ΔΕΡΙΖΙΩΤΗΣ ΔΗΜΗΤΡΗΣ, ΕΜΜΑΝΟΥΗΛ ΓΙΑΝΝΗΣ, ΜΑΛΙΑΚΑΣ ΜΗΧΑΛΗΣ, ΜΕΛΑΣ ΑΝΤΩΝΗΣ, ΤΑΛΕΛΛΗ ΟΛΥΜΠΙΑ, 2012, Εκδότης: "σοφία"

- Γραμμική άλγεβρα, Δονάτος Γεώργιος Σ., Αδάμ Μαρία Χ., 2008, Εκδότης: Γ. ΔΑΡΔΑΝΟΣ - Κ. ΔΑΡΔΑΝΟΣ Ο.Ε.